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PREFATORY ESSAY.

THE APPLICATION OF THE DOCTRINE OF EVOLUTION TO SOCIOLOGICAL THEORY AND PROBLEMS.

By Benjamin Kidd.

IN the Prefatory Essay to vol. xxvi. of the present edition of the *Encyclopædia Britannica,* Mr Edward Dicey, in reviewing recent political progress, has described the tendencies in thought and statecraft during the last quarter of the 19th century as, on the whole, most adequately summarized in the phrase "Conservative reaction." It is evident that a situation in the public life of a period to which such an expression can be correctly applied has a significance which extends beyond the conditions of current politics. Judging from analogies in history, a position of the kind in political life must be taken to imply that great alterations in the habits of thought and in the opinions of society are in progress beneath the surface of events. Such changes must arise from causes which are deep-seated, which are possibly carrying us forward to a new era of reconstruction, and which, therefore, fall to be considered in wide and general relations.

A new influence in the study of man.

During the second half of the 19th century the cause which most considerably influenced the tendencies of thought was the acceptance of the doctrine of organic evolution as based on the principle of natural selection. As it has come to be understood that it is not so much in the lower animal world as in human society that we have the highest, most complex, and most characteristic phase of the struggle for existence, a new influence, against which the older tendencies in knowledge have continued to struggle with diminishing success, has been felt in all the sciences dealing with man and the phenomena of his social progress. The leading problems in ethics, in politics, in economics, in religion, and in philosophy have been brought into direct relationship to principles universal in reach, which are seen to affect them vitally, but which were, nevertheless, not understood nor even to any general extent discussed before the closing decades of the 19th century. The first effect of the new ideas has been profoundly disintegrating. There has resulted an attitude of doubt, of hesitation, and of apparent reaction as the tendencies of the less organic views of older schools of thought have become visible. The process of change in progress is, in short, radical and far-reaching, and the first duty of the observer is, therefore, to endeavour to see it as a whole.

Although the hypothesis of evolution as applied to the cosmos, and even in a more special and local sense to forms of life, is not new, the effort to consider it in relation to man himself, and consequently in its bearings on sociological theories and problems, is of quite recent origin. To understand the nature of the characteristic difficulties which have presented themselves in this attempt, the conditions prevalent in Western thought when Charles Darwin published the *Origin of Species* in 1859 must be recalled.

For a hundred years before Darwin—that is to say, during the last half of the 18th century and the first half of the 19th century—the general mind had been to some extent familiarized with the conception of continuous development by many speculations which had begun to be supported by evidence. Kant's nebular hypothesis, after it had received scientific shape at the hands of Laplace and Sir W. Herschel, prepared the world for the reception of the theory of evolution as applied to the physical universe. In the biological sciences ideas of development and progressive modification of forms were also to be found in many quarters. In France by the middle of the 18th century Buffon had suggested that a succession of nearly related forms was to be traced amongst animals and plants, likeness of type being held by him to suggest the possibility of the varying forms being considered as having sprung originally from a single stock. Lamarck and Geoffroy Saint-Hilaire in the same country had arrived at a similar conclusion, the latter asserting that such divisions as fishes, amphibians, birds, and mammals were formed on one original type, and that modifications were still in progress. Lamarck in the *Philosophie Zoologique* had held, although in opposition to the dominant influence of Cuvier, that forms of existing life were descended from one or more original forms; the theory being also put forward by him that the action of the physical environment of the various forms in causing the increasing use or disuse of organs had tended to produce development in certain directions with divergence of type.

Earlier theories leading up to natural selection.

In Germany and England thought had been moving in the same direction. In the former country Kant's speculations as to the mode of development of the solar system had been supplemented by a view of evolution in the organic world which still forms a connecting link between the past and the modern view. The ideas of Goethe and Oken had tended to strengthen a belief in the theory of progressive development in life; and the work of embryologists like Wolff, Meckel, and von Baer had given a decided impetus to speculations founded on it. Meckel had remarked in 1811 that "there is no good physiologist who has not been struck incidentally by the observation that the original form of all organisms is one and the same," and von Baer in 1834 had asserted in still more decisive words that "only in a very childish view of nature could species be regarded as permanent and unchangeable types." In England to a certain class of inquirers a number of causes had long contributed not only to suggest the idea of continuous development, but to call attention to the character of the forces which might influence it. As early as 1798 Malthus, confining his attention to human society, had published his famous *Essay on the Principle of Population*, which was afterwards to suggest to Darwin the conception of natural selection. In geology a group of active minds had been working out the history of life upon the globe from the stratified rocks. The contributions of Murchison, Buckland, Mantell, Lyell, and others had helped to familiarize men's minds with the idea of development, both physical and biological, in the past history of the earth, Lyell, in particular, seeking to uphold the theory that all the geological features of the world were to be accounted for by the agency of exactly the same kind of changes as were taking place upon the earth in the present time.

In spite, however, of all these and other important indications, and of many pregnant suggestions made by observers like Owen, Wells, Matthew, and others, it must be considered that the conception of the continuous evolution of life from simpler forms had made surprisingly little impression. It had to contend against a set of conditions which it is important to understand, conditions that not only retarded its more direct developments, but prevented altogether its application to the higher problems of biology presented in human society.

Antagonism to the evolutionary principle.

In the first place, there was everywhere to be distinguished a strongly entrenched resistance to all attempts to apply the doctrine of evolution to man himself. The outlying conclusion upon which this resistance had generally elected to make its decisive stand was a very clear one. It was suggested in the first instance by the hitherto prevailing interpretation of the Hebrew account of creation contained in the first book of Genesis. But the principle which it involved was undoubtedly established in its hold on the more thoughtful minds simply by the absence of any convincing theory of the mechanism by which a process of evolution could be accepted as operating in life. It might be possible, it was reasoned, to accept divergences in forms of life within certain limits (variations). Nevertheless, it was said, species

must, at the same time, be held to be immutable. These it was considered represented acts of creation (special creations) at various times in the past history of the earth. Buffon's theory of organic evolution had been hardly more than suggestive. Lamarck had put forward a theory of the accumulation of the supposed inherited effects of the use and disuse of organs to account for divergence of types. But his view had not been accepted; and his conception of the transmutation of species was ridiculed in France by Cuvier, the most influential of the systematic naturalists, who remained to the end an advocate of the theory of constant cataclysms and recurring creations in the past history of life. Finally, it is on record, on the authority of Darwin, that down to the publication of the *Origin of Species* "all the most eminent living naturalists and geologists disbelieved in the mutability of species." It came to be afterwards asserted, he said, speaking of the position at the publication of the *Origin of Species*, that the subject was in the air, or that men's minds were prepared for it; but he continued, "I do not think that this is strictly true, for I occasionally sounded not a few naturalists, and never happened to come across a single one who seemed to doubt about the permanence of species. Even Lyell and Hooker, though they would listen with interest to me, never seemed to agree."

This was the position in thought when Darwin published the *Origin of Species*. It is necessary to keep it in view in considering the later applications of the theory of evolution to sociological problems. At first sight the *Origin of Species* attempted nothing in itself very remarkable.

Significance of the "Origin of Species."

It endeavoured to prove an assertion which, as has been said, had been many times put forward by naturalists in the past, namely, that species were not fixed groups. In estimating the nature of the work which he considered he had accomplished in the *Origin of Species*, Darwin said, "Hereafter we shall be compelled to acknowledge that the only distinction between species and well-marked varieties is, that the latter are known, or believed, to be connected at the present day by intermediate gradations, whereas species were formerly thus connected." That was all. Never, however, was a meaning of such far-reaching application hidden in a simpler form of words. It was by formulating in the conception of natural selection a theory of the mechanism by which he conceived the transmutation of species to be effected, and then, and especially, by supplying the necessary evidence in support of it, that Darwin advanced the doctrine of evolution beyond the position to which any of his predecessors had carried it.

The general mind from the beginning, and perhaps in some senses more fully than the workers in many of the departments of biological science, distinguished the significance of the new departure. It was not simply that a unifying principle exemplifying the mode of change in the organic world had been enunciated. What was perceived was that, by implication, the study of man himself had become a department of higher biology. All the phenomena of his development—physical, mental, and social—had now been brought within the application of the general causes which were thus asserted to have controlled the evolution of life from lower to higher forms from the beginning of sentient existence.

It will probably be seen much more clearly in the future than it is at present, how great were the difficulties which at the outset confronted the attempt to apply this theory of evolution to sociological problems. When the character of our civilization as a whole is considered; when the nature of the beliefs and of past interpretations of many doctrines intimately interwoven with its history is held in mind; when the fact that the acceptance of the theory of evolution has involved the conception of development as applied to men's fundamental convictions in such matters as ethics, politics, and religion, is taken into account;—it will be seen that an enormous and even an unprecedented change in the habits and modes of thinking of society has been involved. Every allowance must, therefore, be made for tendencies which have hitherto retarded the legitimate application of the conception of evolution to sociology. The wonder rather is that so great progress has already been made, and that, as Romanes has pointed out, we are already, as the result, living in the midst of a revolution in the general tendencies of knowledge which is without a parallel in the past history of mankind.

Looking at the conception of organic evolution as it was accepted in the period immediately following the publication of Darwin's *Origin of Species*, there are several matters which call for attention in considering the subsequent history of the attempt to apply the theory to sociological development.

When the distinctive Darwinian contribution to the doctrine of development is considered, it may be seen to consist essentially in a chain of evidence brought forward to support a simple theory of the mechanism of the evolutionary process. It was proved in the first place that every existing form of life tends to increase at such a rate as to outrun the conditions of its existence for the time being. There is to be found, said Darwin, "no exception to the rule that every organic being naturally increases at so high a rate, that, if not destroyed, the earth would soon be covered by the progeny of a single pair." In the second place, it was found that this faculty in life was coexistent with an inherent tendency in every form to variation within narrow limits. These variations extended to every part, organ, and function, and tended to be transmitted by inheritance. From these facts, now accepted practically without question, there was deduced the principle of natural selection. In Darwin's words, "As many more individuals of each species are born than can possibly survive; and as, consequently, there is a frequently recurring struggle for existence, it follows that any being, if it vary however slightly in any manner profitable to itself, under the complex and sometimes varying conditions of life, will have a better chance of surviving, and thus be *naturally selected.* From the strong principle of inheritance, any selected variety will tend to propagate its new and modified form." As Alfred Russel Wallace put it—the best equipped would have an advantage over their competitors in the struggle for existence, the fittest would survive. And they would tend to transmit in cumulative degree the qualities upon which that fitness depended.

First applications of the theory of evolution to human society.

The first era of the attempt to apply this conception of evolution by natural selection to society extends practically over nearly the whole of the second half of the 19th century; for Herbert Spencer, who had begun his system of social philosophy before the publication of the *Origin of Species,* incorporated in his general system the doctrine of natural selection, which he had himself in some degree foreshadowed in an essay published as early as 1852 in the *Westminster Review.* This first stage of the attempt has gradually brought into view a position of considerable interest in sociological theory, which, as its bearing becomes understood, is likely, it appears to the present writer, to exercise a not unimportant influence on the further development of the theory of organic evolution in general.

The characteristic action of Natural Selection in society.

It is evident that in considering the application of the principle of natural selection to human society there is a fact, encountered at the outset, which is so fundamental that it must be held to control all the phenomena of social evolution. It is nowadays a commonplace of knowledge, that the potential efficiency of society must always be taken to be greater than the sum total of the potential efficiency of all its members acting as individuals. This arises from the fact, to be observed every day in life, of the effect of organization, of division of labour, of specialization of work, and more particularly of the opportunity afforded in an organic type of society for the accumulation and transmission of that knowledge and experience from which power and efficiency in the struggle for existence in a large degree arise. There follows, however, from this fact, obvious enough once it is mentioned, an important inference. This is that in the evolution of society natural selection will, in its characteristic results, reach the individual not directly, but through society. That is to say, the interests of the individual *quâ* individual must cease to be a matter of first importance. It is by development in the individual of the qualities which will contribute most to the efficiency of society, that natural selection will in the long-run produce its distinctive results in human evolution. It is, in short, about this function of socialization, involving the increasing subordination of the individual, that the continued evolution of society by natural selection must be held to centre. Societies in which the individuals were able to resist the process would quickly reach the limits of their progress, and would have to give way in the struggle for existence before others in which the process of subordination continued. In the end it would be the social organizations in which the interests of the individual were most efficiently included in and rendered subservient to the interests of society considered collectively that, from their higher efficiency, would be naturally selected. In all the first attempts, therefore, to apply the doctrine of evolution to social development it was recognized that society must be considered in some sense as organic.

One of the earliest attempts to approach the study of social evolution from this standpoint was made

by Herbert Spencer in the middle of the 19th century. It was contained in an article published in the *Westminster Review* in January 1860, and was entitled "The Social Organism." This article is in many respects one of the most noteworthy documents in the literature of the last half of the 19th century. It is important for two principal reasons. In the first place, it offers the clue to the central principle round which Mr Spencer afterwards constructed his system of social philosophy, and round which the thought, and even the political development, of more than half a century have revolved. In the second place, it clearly expresses the nature of the fundamental difficulty underlying Mr Spencer's attempt to apply the doctrine of evolution to society. It affords, as we read it now, clear indication of a leading cause which made the last quarter of the 19th century a period of apparent reaction, but which, as the application of the doctrine of evolution is better understood, is not unlikely to render the ensuing period one of profound reconstruction in which the science of society may be carried considerably beyond the position reached by Mr Spencer.

Herbert Spencer's sociology.

Mr Spencer's object in the essay in question was suggested by the position which had been reached in the sciences dealing with life. He set out, therefore, by assuming that in the light of the recent great generalizations of biology it had become possible to apply the conception of the social organism much more effectively than was the case in the speculations of Plato and Hobbes. He proceeded accordingly to examine the analogy which he considered existed between the social organism and a living individual body. Mr Spencer in the result found societies to agree with individual organisms in four conspicuous peculiarities, which he enumerated as follows:—

1. "That commencing as small aggregations, they insensibly augment in mass: some of them eventually reaching ten thousand times what they originally were."
2. "That while at first so simple in structure as to be considered structureless, they assume, in the course of their growth, a continually-increasing complexity of structure."
3. "That though in their early, undeveloped states, there exists in them scarcely any mutual dependence of parts, their parts gradually acquire a mutual dependence; which becomes at last so great that the activity and life of each part is made possible only by the activity and life of the rest."
4. "That the life and development of a society is independent of, and far more prolonged than, the life and development of any of its component units; who severally are born, grow, work, reproduce, and die, while the body politic composed of them survives generation after generation, increasing in mass, completeness of structure, and functional activity."

In the examination of these analogies Mr Spencer, as might be expected, found in society, as in the individual organism, physiological division of labour; "differentiation upon differentiation taking place in the evolution of a civilized society," with the development of government, of control, of communication, and economic activities of all kinds.

Coming then to the differences between societies and individual organisms, Mr Spencer proceeded to enumerate these also under four heads The differences under the first three of these need not here be referred to, as they were in large measure explained away in the essay. But under head 4 a noteworthy distinction was made. Mr Spencer continued:—"The last and perhaps the most important distinction, is, that while in the body of an animal, only a special tissue is endowed with feeling; in a society, all the members are endowed with feeling. . . . While in individual bodies, the welfare of all other parts is rightly subservient to the welfare of the nervous system, whose pleasurable or painful activities make up the good or evil of life; in bodies politic, the same thing does not hold, or holds to but a very slight extent. It is well that the lives of all parts of an animal should be merged in the life of the whole; because the whole has a corporate consciousness capable of happiness or misery. But it is not so with a society; since its living units do not and cannot lose individual consciousness; and since the community as a whole has no corporate consciousness. *And this is an everlasting reason why the welfare of citizens cannot rightly be sacrificed to some supposed benefit of the State; but why, on the other hand, the State is to*

be maintained solely for the benefit of citizens. The corporate life here must be subservient to the lives of the parts; instead of the lives of the parts being subservient to the corporate life."

When the sentences which are here printed in italics are read carefully their importance will be perceived. They bring clearly into view the nature of the limitation within which Mr Spencer constructed his system of social philosophy. They afford also the clue to the characteristic conception of society which, although it has not been at any time without vigorous opposition, has been in the ascendant during the whole of the first stage of the attempt to apply the doctrine of evolution to society.

Spencer's limitation.

It has been said that in considering the principle of natural selection as in operation in society there is a principle to be taken into consideration at the outset which is so fundamental in character that it ultimately controls all the phenomena of social development. From the fact that the efficiency of society is always greater than the sum total of the efficiency of all its members acting as individuals, natural selection, it has been pointed out, must in its characteristic effects in human evolution reach the individual through society. It must, in short, in the end subordinate the individual and all his interests to the efficiency of society in this higher sense. But in the passage just quoted from Mr Spencer, as indeed in the whole of the article in question, two facts, it may be observed, call for attention. The "social organism" which he has in view is the State. And the State as he conceives it is subordinate to the individual, and not the individual to the State. In Mr Spencer's own words, "the corporate life here must be subservient to the lives of the parts; instead of the lives of the parts being subservient to the corporate life.

The difficulty with which Mr Spencer was here confronted may readily be perceived. If natural selection is conceived as operating on society, and, therefore, as tending to produce the highest efficiency out of the materials that comprise it, it must, as has been said, produce the subordination of the interests of its units to that higher efficiency of society which is greater than the sum total of the efficiencies of its component members. But one of only two conclusions could, therefore, result from Mr Spencer's position. In regarding the "social organism" as an organism in which the corporate life must be subservient to the lives of the parts, instead of the lives of the parts being subservient to the corporate life, it must be that the individual had succeeded in arresting the characteristic effects of natural selection on society. Or else, the result just mentioned being scarcely conceivable, natural selection, whether the individual be conscious of it or not, *must* be subordinating individual interests in society to a larger meaning in the evolutionary process. Society must, in short, be subject to principles which reach farther than Mr Spencer conceived; it must be organic in some different and wider sense than he imagined; and the analogy of the "social organism" as confined within the consciousness of ascendant interests in the political State must be considered to be a false one.

This may be said to present the crux of the position which slowly developed itself during the first stage of the attempt to apply the doctrine of evolution to society. The main problem with which the philosophy of the race has been on the whole always concerned, namely, that the individual in society is being subordinated to a process the principles of which extend beyond his political interests, and that this subordination must, nevertheless, be effected in terms of his own mind, had not been touched. Mr Spencer, notwithstanding the reach of the principle he was stating (see the article in these volumes on SOCIOLOGY), had not in practice got farther than the English Utilitarians, from Bentham to John Stuart Mill, in regarding the science of society as the science of the ascendant interests of the individuals comprised within the consciousness of the political State. As the 19th century reached its closing decade the gradually increasing perception of the difficulties of such a position is, therefore, to be distinguished in all directions,—in ethics, in economics, in politics, as well as in general philosophy. The conviction that it was impossible to formulate the principles of human development in the terms of any theory of the ascendancy of the interests of society as confined within the consciousness of Mr Spencer's "social organism," had indeed not ceased in the meantime to be ably and consistently expressed in various idealist and other schools of thought. But what now began to be clear was that the same conclusion must ultimately prevail in quarters where it was held

Dominant influence of English Utilitarians.

that there must be no implication to go a step beyond that firm ground of fact and experience demanded by the representatives of the characteristic development in English thought which had come down through Hume. Many of the theories and anticipations of the Utilitarian school in philosophy and politics were, in short, felt to have no permanent foundation, and their influence began to diminish. The extreme expression which the Utilitarian position had reached in phases of continental socialism, and in particular in the theories of Marx, in which the economic factor was asserted to be the ruling factor in history, were seen to be all involved in a like condemnation. The century, accordingly, approached its close in a period of apparent reaction. And the chill shadow of the waning credit of the over-confident ideas of the Utilitarian school which had ruled the development in thought and politics in its middle decades hung heavily over all the progressive parties which had inherited the traditions to which these ideas had given rise.

As the general theory of evolution had in the meantime continued to develop, other symptoms of interest bearing on the position which had been defined in sociological theory had become visible, and call for notice. The Darwinian doctrine of evolution as a working hypothesis rested on natural selection as the efficient cause of progress in the development of life. The theory of natural selection which Darwin had formulated had, however, been suggested to him, not so much by observations of the lower forms of life as by a study of human society. "Fifteen months after I had begun my systematic inquiry," says Darwin, "I happened to read for amusement Malthus *On Population*, and being well prepared to appreciate the struggle for existence which everywhere goes on from long-continued observation of the habits of animals and plants, it at once struck me that under these circumstances favourable variations would tend to be preserved, and unfavourable ones to be destroyed. The result of this would be the formation of new species. Here, then, I had at last got a theory by which to work." The co-formulator of the principle of natural selection, Alfred Russel Wallace, speaks of his independent experience in almost the same terms. "I was led to the theory itself," he said, "through Malthus—in my case it was his elaborate account of the action of 'preventive checks' in keeping down the population of savage races to a tolerably fixed but scanty number. This had strongly impressed me, and it suddenly flashed upon me that all animals are necessarily thus kept down—'the struggle for existence'—while *variations*, on which I was always thinking, must necessarily often be *beneficial*, and would then cause those varieties to increase while the injurious variations diminished."

Influence of Malthus.

A truth since in evidence in the development of the theory of organic evolution had here received exemplification, namely, that it is in human society that there is presented to the inquirer the principal basis for the study of the phenomena of life. Man is really the animal which has been observed most, the creature of whom immeasurably more is known than of any other form of existence. Many departments of knowledge and entire professions are exclusively devoted to the study of the phenomena of his life, both individual and social; and all history and literature are but the record of his actions and emotions in the struggle which he maintains against his fellows and against the world. It was, therefore, but a natural sequence of events that a unifying principle controlling the development of life should be suggested independently to two observers by a study of the struggle for existence in human society.

The bearing of this fact remained, however, to be seen. The Darwinian doctrine of natural selection which had been applied to life had been suggested, as has been said, by the theory of population propounded by Malthus, a theory closely associated in England with the political philosophy of the Utilitarians. It is accordingly of importance, in view of the developments which were to follow, to note certain features in which the doctrine of evolution, as it was presented by the early Darwinians, was related to the Utilitarian position as it was defined at the time in English thought, particularly in the writings of Bentham and James Mill. The characteristic position of the Utilitarians may be said to be that, even when all due allowance is made for many suggestive passages of wider implication in their writings, they practically conceived all the principles of the development of society to be related to the ascendant interests in the struggle for existence of the individuals comprised within the consciousness of the political State as they saw it around them. They endeavoured, therefore, as it were, to formulate the principles of human evolution from that cross-section of interests

The earlier view a restricted one.

and motives which they dissected into view on an examination of the principles of the State as thus conceived. In the first statement of the law of natural selection the correlative of this position is apparent. There is visible a tendency to endeavour to enunciate the laws of organic evolution, in general, from the principles brought into view by a similarly narrow cross-section of the evolutionary process. It was the operation of the evolutionary process in adapting the ascendant interests of the individual or the species to current environment that principally occupied attention.

Could this, however, include the method of the whole process? For instance, effective adaptation to existing environment might itself vary. It might, for instance, be adaptation to existing environment so complete that, as must have happened continually in case of extinct forms, it did not offer a sufficiently wide basis for change or development as the conditions of competition altered in the future. Or it might be, as between rival forms, adaptation to current environment which, while rendering the competitors equally efficient in the present, would also include qualities useless and even burdensome in relation to current environment, but contributing, though in varying degrees, to higher efficiency in the future. The evolutionary process would in time, as the future became the present, discriminate between these forms. Higher efficiency in the future would, of necessity, always include adaptation in the present, but the converse would not follow. With progress in the efficiency of life the evolutionary process would tend to become increasingly organic, so that it would be in the development of functions of life such as those associated with the production and organization of variation, the increasing equipment of offspring, and the propagation in numbers in excess of environment—in the operation of which the present was subordinate to the future—that it would tend to produce the most weighty results. Progress from lower to higher types would, in short, necessarily follow the line of variations in which present efficiency included more than adaptation to current environment. It would take place through forms which would bear the burthen of qualities contributing to higher efficiency in the future *in addition* to those concerned in adaptation to current environments.

The condition in which such a result could not be conceived as arising would, of course, be that in which it would have to be accepted that no qualities could exist in life except such as were related, or had been related by the principle of utility to current environment. This would be the case if the Lamarckian hypothesis were correct, and all development in life had to be conceived as the result of inherited effects of use or disuse of organs in direct response to environment. It would also be the case if the action of the Darwinian principle of natural selection had to be conceived as so stringent that no other qualities could co-exist with those related by the principle of utility to current environment.

Following the criticisms to which the Darwinian hypothesis in its return influence on the theory of society became subjected after Darwin's death, it may be observed, accordingly, to have centred in large degree round controversies related to these two leading matters. Darwin had retained to the end of his life a partial belief in the Lamarckian conception of evolution in the forms of life, as due to the transmission to descendants of the effects of use and disuse of organs in the individual (transmission of acquired qualities). "I am convinced," he said, "that natural selection has been the most important, but not the exclusive, means of modification." If the Lamarckian view were accepted as correct, it would, of course, confine the theory of development to the narrowest possible theory of Utilitarianism in relation to current environment. For all qualities would have to be ruled out of life except those produced in ancestors by past environment, plus those which environment might be producing in existing individuals. A central subject of dispute in the Weismann controversies has, however, been the sustained challenge, as regards the higher forms of life, of the doctrine of the transmission of acquired qualities (see HEREDITY), even to the limited extent that Darwin recognized it, accompanied by a considerable extension of the conception of the method in which the principle of natural selection operates in life.

Post-Darwinian developments.

The other controversy has centred round the view that the operation of natural selection tended to be so direct as to rule out, with great stringency, all qualities save those connected by the principle of utility with current environment. Mr Wallace has been one of the most consistent supporters of this view. But it has been challenged in turn by many observers, and the strong case against it is effectively

set out by Romanes (although without continuous insight into the significance of the principle for which he was contending), in his review of the post-Darwinian position in the second volume of *Darwin and after Darwin.*

As the doctrine of evolution now came to be applied more directly to human society, the effect of these positions became visible, and developments followed in rapid succession. Darwin had attempted no comprehensive or systematic study of human society. But in a few of the chapters of the *Descent of Man* he had discussed the qualities of the human mind, including the social and moral feelings, from the point of view of the doctrine of natural selection enunciated in the *Origin of Species.* The standpoint he took up was, as might be expected, practically that of the Utilitarian writers of the period on social subjects, from whom he quoted freely in support of his views. A certain note of hesitation and contradiction is, however, already to be distinguished in this return attempt to fit the facts of human society into the theory of natural selection as it had so far been developed. Thus at times Darwin appeared to think that natural selection could effect but comparatively little in advanced society. "With highly civilized nations," he says, "continued progress depends to a subordinate degree on natural selection." While he noted the obvious usefulness of the social and moral qualities in many cases, he at the same time felt constrained to remark upon their influence in others in arresting, as appeared to him, the action of natural selection in civilization. "We civilized men," he continues, "do our utmost to check the process of elimination (of the weak in body and mind); we build asylums for the imbeciles, the maimed, and the sick; we institute poor laws; and our medical men exert their utmost skill to save the life of every one to the last moment." The attempt is missing to connect the phenomena here brought into view with some wider principle of the evolutionary process which evidently must control them. This aspect of uncertainty is to be noticed in many statements. "It is impossible," he says again, "not to regret bitterly, but whether wisely is another question, the rate at which man tends to increase." In these and similar passages Darwin's attitude of mind is noticeable. An instinctive searching after a higher organic principle in relation to natural selection in society than is to be got out of the current Utilitarian doctrine may be said to be distinguishable.

The position was, however, undergoing rapid development. In the year 1889 Mr Wallace, in a statement of his conception of the doctrine of evolution in his book, *Darwinism,* brought more clearly into view the fundamental difficulty of the early Darwinian conception of natural selection as it began to be applied to society. In the last chapter of the book Mr Wallace maintained that there were in "man's intellectual and moral nature . . . certain definite portions . . . which could not have been developed by variation and natural selection alone." Certain faculties, amongst which he classed the mathematical, artistic, and metaphysical, the latter covering qualities with which he considered priests and philosophers to be concerned, were, he asserted, "altogether removed from utility in the struggle for life," and were, therefore, he thought, "wholly unexplained by the theory of natural selection." He, accordingly, proposed to consider man, in respect of these portions of his mind, as under the influence of some cause or causes wholly distinct from those which had shaped the development of life in its other characteristics.

Wallace's position.

The weakness of this position was immediately apparent. To remove man as regards qualities so directly associated with his social evolution from the influence of the law of natural selection was felt to be a step backwards. It is no injustice to Mr Wallace to say that the effect produced on the minds of the younger school of evolutionists was not so much to convince them that he was right, as to make them feel that the theory of natural selection which he had endeavoured to apply to human society was still in some radical respect incomplete. Mr Wallace's view was severely criticized in many quarters; but it followed, it may be pointed out, by strict logical necessity from his position, already mentioned, as to the supposed stringency of the action of the principle of natural selection in relation to current environment.

A tendency to arrive at a similar crux to that which Mr Wallace here encountered was also to be distinguished in the views of other of the early Darwinians. Huxley had been one of the first converts to a belief in the Darwinian conception of the principle of natural selection. But in the Romanes

lecture delivered in 1893 he had reached a position with regard to the operation of natural selection in human society logically little different from that in which Wallace found himself. In this lecture Huxley actually proceeded to place the ethical process in human society in opposition to the cosmic process, to which latter he considered the struggle for existence and the principle of natural selection belonged. "Social progress," he went on to say, "means a checking of the cosmic process at every step and the substitution for it of another, which may be called the ethical process; the end of which is not the survival of those who may happen to be the fittest, in respect of the whole of the conditions which obtain, but of those who are ethically the best." It was a fallacy, therefore, he thought, to consider "that because, on the whole, animals and plants have advanced in perfection of organization by means of the struggle for existence and the consequent 'survival of the fittest'; therefore men in society, men as ethical beings, must look to the same process to help them towards perfection." The weakness of such a position was scarcely less apparent than in the case of Mr Wallace. Here, also, the fact really in evidence was that the conception of natural selection that had been applied to society was, in some fundamental sense, insufficient.

Huxley's exclusion of the ethical from the cosmic process.

Many symptoms of a change in the conception of the conditions in which natural selection operated in human society were, however, becoming visible. It was evident that society must be organic in some wider sense than had hitherto been generally conceived, or than was possible in the "social organism" which Mr Spencer and the Utilitarians had imagined as centred round the ascendant interests in the struggle for existence of those comprising the political State. Regarding human development in history it did not seem in accordance with evident facts to imply that society was nothing more than political. Social progress was, as a rule, presented in history in association with great types or systems of social order organically related to certain conceptions and beliefs which had subordinated individual conduct and influenced political development over prolonged periods of time. At the present day the great majority of the race was included in a few great systems of the kind, and the fundamental ideas associated with these had influenced in every detail the moral conceptions, habits of life, standards of conduct, and all the principles of politics and of social development of the included peoples for hundreds and, in some cases, for thousands of years. Natural selection, in virtue of the result, was evidently discriminating between these systems, and, therefore, between the peoples which they included. It would probably continue to do so to an increasing degree in the future. Even amongst the most advanced peoples of the present day it was evident that the principles through which political forces were expressing themselves were not really, in the ultimate analysis, principles of the State or of the ascendant interests of those comprised within its consciousness. Western civilization, as a whole, was evidently organic in some wider sense than the life of any of the states included in it. In one sense, and in relation to developments which had influenced it most, it was to be considered as intimately associated with the life-history of a particular form of religious belief. Were, therefore, beliefs of this kind to be studied in respect of their organic relations to the struggle for existence? Were they after all characteristic phenomena of what must be the central function of the evolutionary process in its higher phases—the subordination, necessarily in terms of his own mind, of a reasoning creature to the meaning of an organic process in society, the principles of which extended far beyond the content not only of his individual, but of his political interests?

Developing views concerning the organic nature of human society.

The great difficulties referred to at the beginning as latent in the attempt to apply the doctrine of evolution to society were, however, now in evidence. The position of these beliefs, and the inflamed controversies through which they had come in developments which had taken place in the past had left an atmosphere little favourable at first to the work waiting to be done. Even the attitude of many claiming to represent the scientific spirit was often far removed from that which such a work required, as may often be observed in Huxley's polemical writings. The situation was in many respects unique in the history of thought, and the stage at which the old position begins to be influenced by a new concept is one of much interest.

The conditions in which the two tendencies meet, and the remarkable and conflicting ideas to which they give rise at first, are well exemplified in a passage in one of Mr Karl Pearson's free-thought essays

on the subject of Buddhism published in 1888. Writing as an opponent of religious predispositions, Mr Pearson, nevertheless, felt constrained to ask himself whether a social group possessing such a predisposition might not in the rivalry of existence be thereby placed in a position of advantage with regard to other groups having a less definite religion or no religion at all. "A predisposition, or prejudice having absolutely no rational basis, may," he continued, "have a social value and tend to preserve an individual or group of individuals in the struggle for existence. Do not we here catch a glimpse of how a nigh universal predisposition may exist without our being able to give it a rational basis? We can perhaps trace its historical growth, we may see how it took root, and the mode in which it has developed; but the utmost we can assert is, that its origin and permanence are due to the assistance it gives the human race in the struggle for life. What is true of such predispositions, and the resulting prejudices or beliefs in the mind of mankind as a whole, applies equally well to the customary beliefs of smaller sections of human society. Such beliefs may have absolutely no rational basis, may indeed be demonstrably false, but the race, the tribe, the society may in the long-run force them upon all or the majority of its members,—those who do not accept the belief being destroyed, expelled, or ostracized. The deeper knowledge, the clearer insight may show the individual that many beliefs are due only to racial predispositions; that they are intellectually false and productive of pain and misery to the individual. *He* may go so far as to renounce for himself all the Buddhist delusions, but can such renunciation become a general rule? May not the non-renouncing sections of humanity ultimately survive?"

The inquiry could not, of course, remain in this stage, though Mr Pearson carried it no farther, the position of antagonism from which he set out doubtless closing his mind to the application of the revolutionary concept which had here come into view. As the subject continued, however, to present itself in its wider bearings, it was evident that a very considerable and far-reaching change was at hand. The progress of knowledge had destroyed the self-centred Ptolemaic conception of a universe constructed to revolve round the world on which the observer stood, and to centre in himself. The doctrine of evolution was now, to all appearance, destined to accomplish a scarcely less significant, although in many respects an unexpected, transformation in its application to the science of society. Hitherto in all conceptions of the kind set forth in the passages quoted from Mr Spencer, it will be seen that the science of human development had been made to centre in the ascendant interests of those comprised within the consciousness of the political State. In most of the literature of the French Revolution, in the characteristic principles of the Utilitarian school of philosophy in England, as in the ideas of those phases of continental socialism in which the economic factor is regarded as the ruling factor in history, this conception of society had been fundamental. It may be said to have been in the ascendant during the 19th century. It was evident, however, that its intellectual basis had been undermined, and that the principles controlling the evolution of society must be considered from the standpoint of a much wider outlook.

Widening of the social conception.

The movement of the period in which we are living may, accordingly, be said to be towards what may be called a phenomenology of human evolution in its more organic relations. If the evolutionary process is to be considered as acting on man, through conceptions by which his individual and even political interests are subordinated over long periods of time to the principles of a larger process of life, there can be no doubt as to the direction that social development must take under the influence of natural selection. It must be the social systems which are founded on conceptions rendering society in the highest sense organic, that is to say, social systems which, while of necessity always remaining efficient in competition with other societies in the present, will most effectively subordinate current interests to a higher efficiency in the future, that will be naturally selected.

Looking at the civilization of our current Western era in this light, many of its salient features are seen to present themselves as those of a process of organic development extending over a long period of time, and proceeding in the last analysis from fundamental conceptions of the system of belief associated with it. In the earliest stages of human society the increased efficiency of co-operation over individual effort would be the first principle of development compelling under the influence of natural selection towards social organization. In a further stage in which the

Stages of social development.

efficiency of the social aggregate was centred round the personality of a great leader or military chief, its organic potentiality would be still higher, but liable to be resolved into its component elements on his death. As society grew still more organic and natural selection continued, society under the influence of ideas permanently subordinating the individual to military efficiency would have a great advantage over all others. Great social systems founded on the conception of exclusive citizenship having a religious significance regarded as proceeding from blood relationship to deified ancestors (Ancestor-Worship) would in this stage contain the germs of the highest military potentiality

Where, however, as throughout all this stage of social development, the highest law was always in the last resort a rule of force, and where, therefore, as in the civilizations of the ancient world, the subordination of the individual to the life of the State would be the inclusive ideal of all human effort, the full limits of the organic principle in society would in time be reached. The ultimate ideal of the State itself must, in such circumstances, be universal military conquest, and all social institutions would tend to become, as in the case of slavery, closed absolutisms organized round the conception of the ascendancy of men's desires in relation to the present.

In the next stage, therefore, the enormously higher organic potentiality of a type of society which, while preserving in competition with lower forms its defensive military efficiency in the present, would be influenced by conceptions that would project the sense of human responsibility outside the State and beyond the present, would be evident. In many of the religions of the East such conceptions were to be found in various stages of development. But no Eastern people has, down to the present time, been able to provide for them the permanent military *milieu* in history in which alone their potentiality in the evolutionary process could be realized. The significance, therefore, of the culmination of the military epoch in the ancient classic civilizations of the Western world which preceded the opening of the era in which we are living, and of the fact that the peoples of the same descent who were destined to carry on the civilization of the existing era represent the supreme military stock by natural selection not only of the entire world, but of the evolutionary process itself in human history, will be evident.

With the spread, accordingly, amongst peoples of this origin, and in such a *milieu* in history, of a new conviction of responsibility to principles extending beyond the consciousness of the political State, there would begin a further and more organic stage of the evolutionary process in society. The gradual dissolution in the era in which we are living of all the closed absolutisms within the State, in which human action and ideas had hitherto been confined, is apparently the characteristic phenomenon of this stage. Progress is towards such a free and tolerant, but intense and efficient conflict of forces as was not possible in the world before. It is, it would appear, in this light that we must regard the slow dissolution of the basis of ideas upon which slavery rested; the disintegration of the conceptions which supported the absolute position of the occupying classes in the State; the undermining of the ideas by which opinion was supported by the civil power of the State in the religious struggles of the Middle Ages; the growth of the conception that no power or opinion in the State can be considered as the representative of absolute truth; the consequent development of party government amongst the advanced peoples, with the acknowledgment of the right of every department of inquiry to carry results up to that utmost limit at which they are controlled only by the results obtained in other departments of activity with equal freedom; the growth of the conception, otherwise absurd, of the native equality of men; the resulting claim, otherwise similarly indefensible, of men to equal voting power irrespective of status or possessions in the State, which has been behind the movement towards political enfranchisement; and, finally, the development of that conviction which is behind the existing challenge to all absolute tendencies in economic conditions in the modern world—namely, that the distribution of wealth in a well-ordered State should aim at realizing political justice. These are all features, as the present writer has endeavoured to show (*Principles of Western Civilization*; see also the article in these volumes on SOCIOLOGY), of a developing process in modern history. They must be considered as all related to a controlling principle which has rendered the evolutionary process in society more organic than in any past stage—namely, the projection of the sense of human responsibility outside the limits of the creeds and interests which had in previous stages embodied it in the State.

The increasing intensity and efficiency of the social process amongst the included Western peoples has now, as current history shows, begun, under the influence of natural selection, to tell to an increasing degree in competition with other types of society It must be noticed, however, how the characteristic principle of the process from the beginning has been its projected efficiency. The peoples included in it have had to maintain themselves at every point in competition with other societies of lower future potentiality (as in the struggle extending over many centuries with Mahommedan civilization) by military efficiency. All the qualities to which future potentiality was related were not only useless for centuries of time, but, as in the conditions of the evolutionary process already referred to, they formed a burden that had to be borne in addition to efficiency in relation to current environment.

The characteristic principle of the process.

Here once more the suggestiveness of a study of human society in bringing into view the general principles of the evolutionary process in life has to be noted. The law of progress in life cannot, it would appear, be stated, as was imagined by the early Darwinians, simply in terms of qualities connected by utility with current environment. In human society the operation of the qualities which lead the advanced peoples to build hospitals and asylums for their weaker members carries us beyond that Utilitarianism in the present in connexion with which Darwin discussed it. It is, we see, controlled by that higher organic principle of responsibility to life, extending beyond the meaning of the State, with which the virility and superior efficiency of our civilization is identified, and through which natural selection in the end produces higher results, and on a far larger scale. Similarly, the conception of Mr Wallace that such faculties as those which include the qualities with which he saw priests and philosophers to be concerned could not be accounted for by the operation of natural selection, is seen to be incomplete. It proceeds naturally from Mr Wallace's position, already mentioned, as to the supposed stringency of the action of natural selection in relation to current environment. The qualities which cannot, on investigation, be connected by the principle of utility with existing environment are those correlated with the principle of projected efficiency, as the evolutionary process in society grows more and more organic, and the individual over long periods of time is subordinated to a process, the principles of which extend far beyond the content, not only of his individual, but of his political interests. So far, however, from such qualities having no relation to the principle of natural selection, they are, it will be seen, rather those through which natural selection is producing its largest and most efficient results in human society.

Utility in current environment insufficient; a higher controlling principle present.

Similarly, Huxley's conception that the ethical process in human society was to be placed in opposition to the cosmic process, and was to be regarded as tending to check the struggle for existence and the operation of natural selection must, it would seem, be taken to belong to that earlier stage of the application of the doctrine of evolution when the full reach of the process was not perceived, and when all qualities tended to be viewed in their relation to current environment. So far from it being possible to regard the ethical process as in opposition to the cosmic process, it must, it would appear, be taken that the ethical process *is* the cosmic process, and that it is through the principles and mechanism of the ethical process that the struggle for existence and natural selection are producing, on the largest scale, and in the most effective manner, their most characteristic results in the development of life.

The ethical process identical with the cosmic process.

The changes which the doctrine of evolution is thus beginning to effect in its applications to sociological theory are to all appearance only in their initial stages. In psychology and ethics they can hardly fail to be as important as they already promise to be in the domain of political philosophy. The survival in social and political philosophy of the Ptolemaic standpoint, as represented in the tendency to conceive the principles of the evolutionary process in society as centred in the ascendant interests in the struggle for existence of those comprised within the consciousness of the political State, has still its correlative in psychology and ethics. For instance, it has been hitherto impossible to fit into any theory of empirical psychology certain qualities which Kant found in the human mind. But the basis in the evolutionary process of many of the qualities

The tendencies of current development.

with which Kant was concerned, and which could not be accounted for in relation to experience, just as they could not be accounted for by Mr Wallace in relation to current environment, is now evident. For when the evolutionary process is considered in the wider and more organic relations that have here been discussed, it is clear that the peoples who represent the advanced sections of the race at the present day do so in virtue of qualities in the minds of those who preceded them which had no relationship to current environment. The peoples amongst them who are destined to inherit the future will similarly do so in virtue of qualities which have no Utilitarian relationship to existing environment. In the statement of the principles of the human mind the tendency hitherto in all empirical systems has necessarily been to endeavour to construct a theory of human society and of human progress from an introspective examination of the interests and emotions of the individual mind. But this tendency can hardly fail to be reversed with the continued application of the doctrine of evolution to society. It is the principles of the evolutionary process in society considered in its more organic aspects that must now be considered to be the controlling factor; and it is therefore to be expected that it will be from this wider standpoint that the study of the content of the individual mind itself will in future be approached.

ENCYCLOPÆDIA BRITANNICA.

(SUPPLEMENT.)

Glarus, one of the Swiss cantons, ranking officially as the seventh in order. It has a total area of 267 square miles. Of this 173 square miles are reckoned "productive," forests covering 41 square miles, vineyards but ·07, and land, arable or pasture, 132 square miles. Of the "unproductive" portion 13·9 square miles are occupied by glaciers. A fine carriage road over the Klausen Pass (to Uri) was opened in August 1899, while one is projected over the Praegel Pass (to Schwyz), now crossed by a good mule path. The slate quarries above Elm, at the head of the Sernf valley, were the scene of a great landslip in 1881, when 115 lives were lost. In 1896 there were in the canton of Glarus 10,906 cattle, 3971 pigs, 1237 sheep, and 7037 goats. The mountain pastures number eighty-seven, and are of an estimated capital value of about £250,000. The cotton industry is concentrated in the villages near the chief town. There are eighty factories, employing 10,000 persons, or 55 per cent. of the population. The canton is divided into twenty-eight communes, of which the most populous in 1900 (after the town of Glarus) were Ennenda (2473), Näfels (2527), Schwanden (2400), Netstal (1987), and Linthal (1896). The population of the canton was 33,825 in 1888, and in 1900 it was 32,349. Glarus is one of the few Swiss cantons in which the population is steadily diminishing. In 1899 there were 125 inhabitants per square mile. The canton is mainly Protestant (in 1900 there were only 8006 Roman Catholics) and German-speaking (in 1900, 370 Italians represented the largest non-German tongue in the canton). Glarus still preserves its primitive democratic assembly of all men over twenty years of age. The communes (forming eighteen electoral circles) elect for three years a sort of "standing committee" (*Landrath*), in the proportion of one member for every 500 inhabitants or fraction over 250, but the Landsgemeinde itself names for three years an executive of five members. Owing to the pure democracy in Glarus, no referendum, &c., is required, as that is exercised annually at the meeting of the Landsgemeinde. The present cantonal constitution dates from 1887. In 1897 the state revenue of Glarus was 1,056,959 francs (a rise of 56¼ per cent. since 1885), while the state expenditure was 1,026,375 francs (a rise of 48¼ per cent. since 1885). In 1897 the public debt was 4,210,500 francs. GLARUS, the capital of the canton, is 1578 feet above the sea-level. It is a clean, modern little town, with wide streets. Population (1888), 5357, of whom 1502 were Roman Catholics and only 100 non-German-speaking; (1900), 4896.

See BABLER. *Die Alpwirthschaft im Kant. Glarus.* Soleure, 1898.—HEER. *Geschichte d. Landes Glarus,* 2 vols. Glarus, 1898–99. (W. A. B. C.)

Glasgow, a royal burgh, city, and county of a city (1893), Scotland, on both banks of the river Clyde, 401½ miles north-west by north of London by rail, and 47½ west by south of Edinburgh.

Area and Population.—Under the Local Government Act (Scotland), 1889, the city was placed wholly in the county of Lanark. In 1891 the municipal boundary was extended to include six suburban burghs and a number of suburban districts, the area being increased from 6111 acres to 11,861 acres. The total area of the city and the coterminous burghs of Govan, Partick, and Kinning Park, which resisted annexation in 1891, is 15,659 acres. In 1893 the municipal burgh was constituted a county of a city. The population was in 1881, 511,415; 1891, prior to extension of boundary, 565,839; after extension, 658,198; 1901, 760,423, the increase since 1891 being nearly 16 per cent., compared with 14 in 1881–91. The birth-rate, 1896–98, was 33·6, against 33·9 in 1891–95, and 35·5 in 1886–90; in 1899 it was 33·0. The marriage-rate during the years 1896–98 was 9·7; in 1899 it was 10·2. Mainly through the vigorous administration of the Public Health Committee of the Corporation the death-rate has been reduced from 30 to 33, at which it stood less than half a century ago, to 21·6 in 1899. Of the population in 1891 the number of Gaelic-speaking persons was 17,925; 211,477 were natives of other parts of Scotland, 349,597 of the city itself, and 66,071 of

Ireland. Professional persons numbered 9540 men and 3937 women; commerce engaged the attention of 39,983 men and 3825 women; industry of 130,150 men and 60,230 women, of whom 15,275 men were concerned with machines and implements, 1898 men with ships, 9452 men and 19,979 women with textiles, and 29,964 men and 1695 women with minerals. Valuation of the city in 1878–79, £3,420,697; in 1899-1900, £4,780,000.

Constitution and Government.—Since 1885 the city has been divided for the purpose of representation in Parliament into seven divisions, each of which returns a member. Under the local Act of 1891 the corporation was increased from 50 to 77 members, with 15 magistrates, including the Lord Provost; and under the local Act of 1895 all the powers which the Town Council exercised as Police Commissioners, and trustees for parks, markets, water, &c., were consolidated and conferred upon the corporation as such. In 1898 the two parish councils of the city and barony, which administered the poor law over the greater part of the city north of the Clyde, were amalgamated as the Parish Council of Glasgow, with 31 members. As a county of a city Glasgow has a lieutenancy —successive Lord Provosts having hitherto been appointed Lords-Lieutenant—and a Court of Quarter Sessions, which is the appeal court from the magistrates as licensing authority.

The municipal government of Glasgow is notable for its efficiency in most departments, and the corporation has led the way in several enlargements of the municipal function. New City Chambers in George Square, Venetian in character, which cost about £600,000, were opened in 1889; and since then several additional blocks of buildings have had to be built, acquired, or leased, to house an ever-increasing staff of officials. Admirably equipped sanitary chambers were opened in 1897; they embrace a bacteriological and chemical laboratory. The first part of a scheme for intercepting and purifying the sewage of the city was completed in 1894. Powers were obtained in 1896 and 1898 to treat in the same way the whole sewage emptied into the Clyde and Kelvin by Glasgow, suburban burghs, and adjoining county districts, and it is certain that the estimated cost of £1,100,000 will be largely exceeded before the work is completed. Under an Act of 1895, Loch Katrine, from which the city draws most of its water, was raised 5 feet, and Loch Arklet, with a storage of 2,050,000,000 gallons, connected with it by tunnel; the two lochs together will ultimately have a capacity of about 12,000,000,000 gallons. The entire works between the loch and the city have been duplicated over a length of 23½ miles, and an additional reservoir, holding 694,000,000 gallons, has been built, adding 18 to the previous 12½ days' supply which is held in reserve. Hydraulic power has been supplied to manufacturers and others by the Water Committee since 1895. In 1899 the corporation had under its control five gasworks, with a productive capacity of 35,215,000 cubic feet of gas per day, which is sold to about 200,000 subscribers in and around the city at 2s. 6d. per thousand feet; and additional works, now being built at a cost of £1,000,000, will add 40,000,000 cubic feet to the daily output. The corporation began to supply electric light in 1893; 75 miles of distributing mains have been laid, and 2,824,350 units were sold to 2000 consumers in 1899. Part of the city is lit by electricity at a charge of £14 per lamp, and two large generating stations are at work, and a third is being built. But the greatest enterprise undertaken by the corporation in recent years is the working of the city tramways. Since the expiry of the lease of the company which used the lines up till 1894 the number of passengers carried has been more than doubled, and the revenue of the tramways department has reached nearly half a million sterling a year. Overhead electric traction is employed. The corporation acquired St Andrew's Halls in 1890, and has since purchased or built six public halls in different parts of the city, and contemplates the erection of more. A new infectious diseases hospital at Ruchill, consisting of 33 blocks of buildings, to accommodate 408 patients, was completed in 1900, supplementing the accommodation for 390 which already existed at Belvedere. Vast additions have been made to the parks and open spaces of Glasgow in recent years. Queen's Park was enlarged in 1894 by the enclosure of the grounds of Camphill (58 acres). The Cathkin Braes (49 acres) was presented in 1886, Bellahouston (176) was purchased in 1895, Ruchill (53) in 1891, Tollcross (82¾) in 1897, Springburn (53¼) in 1892, Richmond Park (44) in 1898, and Maxwell Park became the property of the corporation on the annexation of Pollokshields in 1891. The Botanic Gardens also became public property in 1891, and with subsequent additions now form a combined scientific institution and a public park of 40 acres. In addition there is a large number of open spaces, of which 11, covering a total area of 33,614 square yards, have been acquired since 1889.

A People's Palace, combining a conservatory and art gallery and museum, was erected on Glasgow Green in 1898, and a winter garden is being built in Springburn Park. New corporation art galleries have been erected in Kelvingrove Park at an estimated cost of £200,000, a considerable proportion of which was derived from the profits of the Exhibition held in 1887. Glasgow Bridge was rebuilt and widened in 1899 at a cost of £100,000. Rutherglen Bridge was rebuilt in 1896, and Dalmarnock Bridge in 1891. A new central station has been erected for the fire brigade, which has nine stations in the city and one sub-station. And a telephone exchange has been opened by the corporation under the Telegraphs Act of 1899.

Streets and Buildings.—Thirty-eight miles of new streets have been laid out since 1880. In the same period authority has been given for the erection of buildings of all kinds costing nearly £18,000,000, of which £6,000,000 were authorized to be spent in the three years 1896–99. The Improvements Act of 1866 was amended by an Act of 1881. Under it the Improvement Trustees (corporation) began in 1888 to build houses for the poor—sanitary dwellings at a rent of £4, 10s. for single-roomed houses and upwards. Then they began to erect lodging-houses for men and women, and ultimately became the owners of seven such houses, to which was added in 1896 a family home for the accommodation of whole families in certain circumstances. When the powers of the trust were practically exhausted in 1896 it was found that £1,955,550 had been spent in the 29 years in the purchase and improvement of land and buildings, and £231,500 in the erection of tenements and lodging-houses—total, £2,187,050; and on the other hand, ground had been sold for £1,072,000, and the trust owned heritable property valued at £692,000, showing a deficiency of £423,050. The assessment of the ratepayers for the purposes of the trust had brought in £593,000 in all, and it was estimated that the operations, beneficial to the city in a hundred ways, had cost the citizens about £24,000 a year for 29 years. Under a new Improvements Act obtained in 1897, £560,000 is at present being spent in dealing with other insanitary and congested areas in the centre of the city and on the south side of the river, and in acquiring not more than 25 acres of land, within or without the city, for the erection of dwellings for the poorest classes.

In 1891 the Mitchell Library was rehoused in Miller Street in a building formerly occupied by the Water Commissioners. The new post office was commenced in 1876 and completed in its present form in 1896, and already it has been found necessary to erect a new parcels department in another part of the city. Other public buildings dating since 1880 are the Inland Revenue Office (1885), Corn Exchange (partially rebuilt 1896), Athenæum (1888 and 1893), Theatre Royal (partially after fire in 1895), Y.M.C.A. Club (1897), and Bible Training Institute (1898), both pendicles of the Christian Institute (1879); Victoria Infirmary (1890), Fine Art Institute (1880), two wings of the High School (1887 and 1897), 69 public schools (since 1873), new School of Art (1899), Sick Children's Hospital (1882–87), Anderson's College Medical School (1887), Conservative Club (1894), Queen Street Station (1880), and a number of district railway stations. Gartloch Asylum was opened by the City Lunacy Board in 1896 in Cadder parish. The Central and St Enoch's stations are being enlarged, and the Royal Infirmary is about to be reconstructed at a cost of £100,000 as a memorial of Queen Victoria's Diamond Jubilee. Langside Battlefield Memorial was erected in 1887, and a Gladstone statue is to adorn George Square. Street architecture has greatly improved in Glasgow, but recently a strong tendency has been manifested to pile up gigantic business premises.

Communications.—The City and District Railway (circular), belonging to the North British Company, was opened in 1886. Cathcart District Railway (Caledonian) was completed in 1886, and made circular for the south side of the city and suburbs in 1894. In 1896 the Caledonian Railway Company opened the whole extent of a 6½-miles railway, which runs, underground for the most part, through the heart of the city from Maryhill to Dalmarnock. This (central) railway has two junctions in the city with the Lanarkshire and Dumbartonshire Railway, opened in the same year, and at the other extremity it throws off a branch to Tollcross, opened in 1897. Both the Caledonian and Glasgow and South-Western Companies are at present doubling the roads entering their principal stations. The Glasgow Subway—an underground cable passenger line, 6½ miles long, worked in two tunnels and crossing beneath the Clyde twice—was opened in 1896. For tramways, see above. Communication up and down and across the river is provided by small steamers run by the Clyde Trust, which carried 12,000,000 passengers in 1899; and it is now proposed to make cross-transit free in default of the provision of bridges across the harbour, which would hamper the shipping. There are two steam ferry boats or floating bridges for vehicular traffic, and there is a subway for foot and wheeled traffic at Stobcross.

Harbour.—Queen's Dock at Stobcross was completed in 1880. Prince's Dock, on the south side of the river, was opened in 1897. It is 72 acres in extent, divided into three basins and a canting basin; the quayage is 2⅛ miles long, and the entrance 156 feet wide. It is 20–28 feet deep at low water and 31–39 feet at high water, and is fully equipped with hydraulic and steam cranes, one of which lifts 130 tons. A second graving dock was opened in 1886, and a third in 1897. The three are respectively 551, 575, and 880 feet long, and the third has a width of 83 feet, and can be made at will into two docks of 417 and 457 feet long. The total area of the harbour is now 206 acres, and the length of the quays and wharves is more than 8¼ miles. The accommodation for mineral traffic has been increased by 64 per cent. since 1884, and the storage and quayage for timber was doubled in 1896. A new mineral dock is to be built by the Clyde Trust at Clydebank. Continuous work had been done at the deepening of the river. The dredging plant now owned by the Trust lifts two million cubic yards of material in the year, double the quantity lifted in 1884, and between 1885 and 1900 the depth of the channel was increased to a minimum of 22 feet, and vessels drawing 26 feet can go up or down on one tide. The debt of the Trust is nearly 5¾ millions, and the revenue, which was £291,000 in 1884, is now £439,000 a year.

The tonnage registered at the port in 1898 was 1667 vessels of 1,586,743 tons, and the movements of shipping were—1888, entered 9361 vessels of 2,885,672 tons, cleared 9400 of 2,998,835 tons; 1898, entered 11,091 vessels of 3,710,206 tons, cleared 11,476 of 3,964,108 tons. Imports were valued at £10,864,084 in 1888, and £12,788,374 in 1898; exports of the manufactures of the United Kingdom, £14,461,488, and of colonial goods, £523,865 in 1888, and £13,137,275 (United Kingdom) and £462,589 (foreign and colonial) in 1898. The principal article of import is flour, of which £2,158,465 worth was imported in 1898. Animals come next at £978,608; wood imports were valued at £905,190; wheat, £636,270; iron ore, £500,375; fruit, the trade in which has reached large dimensions in recent years, £425,465. The chief exports were in 1898 cotton manufactures, valued at £2,508,112; manufactured iron and steel, £1,797,395; machinery, £1,785,985; spirits, £1,038,320; cotton yarn, £837,226; linen fabrics, £719,060; coal, £576,327; jute yarn and goods, £409,039; woollen manufactures, £219,166. The customs revenue of the port rose from £969,339 in 1880 to £1,748,822 in 1898.

Industries.—There are 11 shipbuilding yards within the harbour of Glasgow, and 40 considerable shipbuilding firms operate in the river and firth. The Clyde output for 1899 was 41 sailing vessels of 14,618 tons, and 243 steamers of 476,456 tons—total tonnage, 491,074; the output in 1898 was 466,832; 1897, 340,037; 1896, 410,841; 1895, 360,152; 1894, 340,885; 1890, 349,995; 1880, 241,114. Marine engines of 478,503 i.h.p. were turned out in 1899; 510,805 in 1898; 373,195 in 1897; 295,620 in 1894. The manufacture of steel armour for battleships is the only industry of importance added to the activities of Glasgow of recent years, and it is probable that the making of ordnance will presently be associated with it. All trades connected with iron and steel have developed; textiles have not, mainly owing to the short supply of female labour. There are in the city 1977 factories and nearly 8000 workshops. There were in 1900 five cotton factories in operation, with a total of 325,000 spindles, and other industries are represented as follows:—Textile factories (including those devoted to cotton and five or six to carpet-weaving), 56; engineers and boilermakers, 186; iron foundries, 58; brass foundries, 60; chemical works, 20; white lead, 2; bichromate of potash, 1; paint and colour works, 30; confectioners, 20; biscuit makers, 9; tobacco factories, 15; clothing factories, 91; printers and bookbinders, 231; boot factories, 17; lace curtain factories, 4; printing and bleaching works, 61; cabinetmaking works, 61; flour-mills, 9; distilleries and breweries, 14; laundries, 19; saw-mills, 65; match-making works, 2; lead-smelting works, 1; indiarubber factories, 2; potteries, 8; aërated water works, 45.

University, Colleges, and Schools.—The university has now 31 professors and 32 lecturers, the latter almost all of recent institution. Queen Margaret College for women, established 1883, with an endowment of upwards of £25,000, was incorporated with the university in 1893, and is used for the teaching of women students, who are to a large extent segregated from the men

students. The foundations, scholarships, &c., of the university amount to about £14,000, and the number of matriculated students in 1898–99 was 1647, of whom 306 were women. A Muirhead College for women is in process of establishment. The Glasgow and West of Scotland Technical College was founded in 1886 by a combination of the non-medical part of Anderson's College, the College of Science and Arts, Allan Glen's Institution, and the Atkinson Institution, and is subsidized by Hutcheson's Trust, the City Educational Endowments Board, and the corporation. Anderson's College Medical School was incorporated in 1887, and St Mungo's College, with faculties of medicine and law, in 1889. There are two educational endowments boards, which apply a revenue of about £10,000 a year to the foundation of bursaries mainly. There are four high schools for boys and two for girls, besides two Roman Catholic academies for boys and one for girls, and the Glasgow School Board has among its schools 11 equipped with secondary departments or as science schools, and the Govan Board 6. Six School Boards—Glasgow, Govan, Maryhill, Springburn, Eastwood, and Cathcart—control the elementary education of Greater Glasgow (including Govan and Partick, with a total population in 1891 of about 780,000); the public schools number 97, and they had an average attendance of 93,968 in 1898–99.

Churches.—There are in Greater Glasgow 86 Established churches, 89 Free, 69 United Presbyterian (these and most of the Free churches now belonging to the United Free Church), 3 Original Secession, 1 Reformed Presbyterian, 2 Free Presbyterian, 26 Congregational Union, 2 Evangelical Union, 14 Baptist, 6 Wesleyan, 2 Swedenborgian, 2 Unitarian, 2 German Protestant congregations, 1 French Protestant, 2 Hebrew, 27 Scottish Episcopal (including missions), 1 English Episcopal, and 21 Roman Catholic. Four orders or congregations of Roman Catholics are represented in Glasgow—Jesuits, Passionists, Franciscans, and Marists—and there are 8 convents or conventual institutions.

AUTHORITIES.—J. CLELAND. *Annals of Glasgow.* Glasgow, 1816.—DUNCAN. *Literary History of Glasgow.* Glasgow, 1886.—*Registrum Episcopatus Glasgow* (Maitland Club), 1843.—PAGAN. *Sketch of the History of Glasgow.* Glasgow, 1847.—Sir J. D. MARWICK. *Extracts from the Burgh Records of Glasgow* (Burgh Records Society); *Charters relating to Glasgow.* Glasgow, 1891; *River Clyde and Harbour of Glasgow.* Glasgow, 1898.—*Glasgow Past and Present.* Glasgow, 1884.—*Munimenta Universitatis Glasgow* (Maitland Club), 1854.—J. STRANG. *Glasgow and its Clubs.* Glasgow, 1864.—REID ("SENEX"). *Old Glasgow.* Glasgow, 1864.—A. MACGEORGE. *Old Glasgow.* Glasgow, 1888.—DEAS. *The River Clyde.* Glasgow, 1881.—GALE. *Loch Katrine Waterworks.* Glasgow, 1883.—MASON. *Public and Private Libraries of Glasgow.* Glasgow, 1885.—J. NICOL. *Vital, Social, and Economic Statistics of Glasgow.* 1881.—J. B. RUSSELL. *Life in One Room.* Glasgow, 1888; *Ticketed Houses.* Glasgow, 1889.—T. SOMERVILLE. *George Square.* Glasgow, 1891.—J. A. KILPATRICK. *Literary Landmarks of Glasgow.* Glasgow, 1898.—J. K. M'DOWALL. *People's History of Glasgow.* Glasgow, 1899.—Sir J. BELL and J. PATON. *Glasgow: Its Municipal Organization and Administration.* Glasgow, 1896.—Sir D. RICHMOND. *Notes on Municipal Work.* Glasgow, 1899.—J. M. LANG. *Glasgow and the Barony.* Glasgow, 1895; *Old Glasgow.* Glasgow, 1896.—J. H. MUIR. *Glasgow in 1901.*

(W. WA.)

Glass.—Glass is an amorphous solid substance, formed by the action of heat, and consisting of mixtures of silicates, borates, and phosphates. It may be transparent, translucent, or opaque. Former definitions have been rendered obsolete by recent researches, and the present definition may meet with a similar fate, although a comparison of the analyses of English and foreign staple glasses (soda-lime, potash-lime, and potash-lead glasses) shows that the composition of these glasses is practically constant. The attempts to represent the different varieties of glass as definite chemical compounds have not been attended with success. The knowledge of the chemistry of glass has been considerably widened by the experiments carried out by Dr Schott at the Jena glassworks with reference to the manufacture of new kinds of optical glass. The commercial success and extensive development of these works have demonstrated the value of pure science to manufactures. In spite of the example set by Messrs Chance, who secured the services of M. Bontemps and Dr Hopkinson, and encouraged their researches, there has been no marked scientific development in English glass manufacture in recent years. It is doubtful how far State aid can permanently benefit an industry, but it is certain that no institution for aiding scientific industry exists in England comparable to the Imperial Technical and Physical Institute of Charlottenburg; and Dr Abbe and Dr Schott, the founders of the Jena glassworks, acknowledge their indebtedness to the Prussian Education Bureau and to the Diet for liberal and repeated subsidies, which enabled them to carry out costly investigations on a commercial scale.

In the preparation of the varieties of colourless glass in general use few new materials have been introduced. Sulphate of soda is now universally used for plate and sheet glass, and carbonate of barium has been substituted for red lead in several manufactories of pressed glass.

For rendering the ordinary potash-lead and soda-lime glasses opalescent or opaque, arsenic trioxide, tin oxide, cryolite, and a mixture of felspar and fluor-spar have been employed. (See MOSAIC.)

In preparing coloured glasses the chemical nature of the glasses must be considered. Some of the colour-giving metallic oxides develop one tint when mixed with a soda-lime glass, and a quite different tint when mixed with a potash-lead glass. With the latter the oxide of nickel gives a rich purple colour, with the former a reddish brown. The "charcoal" yellow, which so frequently occurs in the mosaic windows of the 13th century, can only be developed with a soda-lime glass. The yellow colour due to silver oxide can only be obtained by applying it to the surface of glass in the form of a pigment and subjecting the glass to a moderate heat in a kiln.

The use of gas furnaces for *melting glass* has become general. In the new form of Siemens furnace, additional economy of fuel is effected by building the gas producer as part of the furnace, and as the gas regenerators can be omitted the cost of construction is reduced.

In dealing with manufactured glass it will be convenient to adopt the following classification:—

I. Optical Glass. II. Blown Glass. III. Glass pressed or blown mechanically.

Table Glass. Tube. Sheet and Crown Glass.

Coloured Glass for Windows.

Plate Glass. Pressed Glass. Glass blown by compressed air.

I. OPTICAL GLASS.

The story of the manufacture of optical glass closed in the ninth edition of this *Encyclopædia* with the purchase in 1867 by the French Government of a pair of crown and flint discs, 29 inches in diameter, manufactured by Chance Bros. of Birmingham. To understand the subsequent development of the manufacture it is necessary to recall the work of Fraunhofer. Fraunhofer originated the idea of examining the influence exerted by the chemical constituents of glasses on their optical qualities.

Moreover, by his system of spectroscopic examination, he was the first to denote the optical properties of glasses in exact figures—to measure accurately the refractive index and dispersion, and to demonstrate the disproportionate increase of dispersion in crown and flint glass. Following in Fraunhofer's steps, and with the same object, namely, the elimination of the secondary spectrum, the Rev. W. V. Harcourt and G. G. Stokes carried out a prolonged series of experiments in glass-making, and examined the optical qualities of glasses in which phosphoric anhydride took the place of silica. Similar experiments were also conducted by Dr J. Hopkinson. In 1881 Professor Abbe and Dr Schott commenced their researches. The task they set themselves was to study the influence on refractive index and dispersion of every chemical element which could be combined to form an amorphous glass; to these researches, which were at first carried on on the scale of laboratory experiments, the Jena glassworks owe their origin. The example set by Abbe and Schott was closely followed by Messrs Chance of Birmingham and the late M. Mantois of Paris. The problem requiring solution was the removal of the secondary spectrum in combinations of crown and flint glass by the production of crown and flint glass of such quality that when examined spectroscopically the increase of dispersion in the two glasses is proportional in all parts of the spectrum. With reference to this problem, Dr Schott says: "When, in 1881, we began our experiments we had very satisfactory results by using glasses containing borates and phosphates. The great hopes we formed of these were, however, disappointed, in so far as these glasses did not prove durable enough for all purposes, and therefore their manufacture had to be discarded to a certain extent." The following examples show the progress that has been made towards obtaining a perfect combination (the numbers denote the relative partial dispersion in different parts of the spectrum):—

		A′ to D	D to F	F to G
Early combination of Jena glasses	Light Flint	0·615	0·713	0·600
	Hard Crown	0·643	0·703	0·566
Recent combination of Jena glasses	Flint . .	0·635	0·705	0·573
	Crown .	0 644	0·707	0·568

Another problem especially affecting the manufacture of photographic objectives is the production of glasses possessing greater variation between refractive index and medium dispersion, so as to afford a choice of several glasses of the same refraction but of different dispersion. The following are examples. D represents refractive index; G′–D medium dispersion:—

	D	G′–D
Crown glass with high dispersion .	1·5289	0·01374
Baryta Flint glass	1·6235	0·02107
Baryta Crown glass, densest . .	1·6112	0·01363

The following are analyses of some of the more interesting of the Jena glasses:—

	SiO_2	Na_2O	K_2O	Al_2O_3	MgO	PbO	ZnO	BaO	B_2O_3	P_2O_5
Light Baryta Flint .	65·6	1·23	6·47	..	..	1·03	12·2	9·97	3·27	..
Baryta Silicate Crown .	71·4	3·53	7·78	..	..	..	4·50	9·52	3·13	..
Light Phosphate Crown	..	...	14·8	11·3	11·6	...	..	..	4·98	56·6
Borate Flint . . .	..	4·12	..	10·0	..	6·87	12·6	..	66·3	..

At the present time M. Mantois's successor publishes a list of 110 different optical glasses, and the list of the Jena works contains 76. Messrs Chance's list for 1900 is as follows:—

ORDINARY CROWNS AND FLINTS.

Kind of Glass.	Refractive Index for D	Medium Dispersion C–F	$V=\frac{n-1}{\Delta n}$	Partial Dispersion. C–D	D–F	F–G′	Specific Gravity.
Hard Crown . . .	1·5175	0·00856	60·5	0·00252	0·00604	0·00484	2·48
Soft Crown. . .	1·5152	0·00906	56·9	0·00264	0·00642	0·00517	2·55
Extra Light Flint . .	1·5316	0·01085	49·0	0·00313	0·00772	0·00630	2·78
" . .	1·5333	0·01099	48·5	0·00322	0·00777	0·00640	2·80
Light Flint. . . .	1·5472	0·01196	45·8	0·00348	0·00848	0·00707	2·93
"	1 5610	0·01299	43·2	0·00372	0·00927	0·00770	3·06
"	1·5760	0·01404	41·0	0·00402	0·01002	0·00840	3·22
Dense Flint . . .	1·6124	0·01650	37·0	0·00474	0·01176	0·01030	3·57
" . . .	1·6214	0·01722	36·1	0·00491	0·01231	0·01046	3·64
" . . .	1·6225	0·01729	36·0	0·00493	0·01236	0·01054	3·66
Extra Dense Flint . .	1·6469	0·01917	33·7	0·00541	0·01376	0·01170	3·88
Double Extra Dense Flint	1·7129	0·02384	29·9	0·00670	0·01714	0·01661	4·40

SPECIAL GLASSES.

Kind of Glass.	Refractive Index for D	Medium Dispersion C–F	$V=\frac{n-1}{\Delta n}$	Partial Dispersion. C–D	D–F	F–G′	Specific Gravity.
Boro-Silicate Crown . .	1·5093	0·00788	64·6	0·00236	0·00552	0·00449	2·45
Baryta Crown . . .	1·5660	0·01006	56·3	0·00297	0·00709	0·00576	3·17
Densest Baryta Crown .	1 6099	0·01100	55·5	0·00321	0·00779	0·00629	3·58
Baryta Light Flint . .	1·5452	0·01020	53·5	0·00298	0·00722	0·00582	2·94
" . .	1·5840	0·01248	46·8	0·00362	0·00886	0·00735	3·29

M. Mantois, the maker of the 40-inch lenses for the Yerkes telescope, and the 49-inch lenses for the great telescope of the Paris Exhibition of 1900, gives the following description of the manufacture of glass discs for large lenses:—

The aim (he says) of the manufacturer is to produce large blocks of glass absolutely homogeneous and physically clear, entirely free from those transparent threads, cords, and striæ which are almost invariably found in ordinary glass. The furnaces employed are small, being constructed for a single crucible. The crucibles hold from 10 to 18 cwt. of glass, and are similar in shape to those used for flint glass, except that the mouth is elongated so as to project beyond the wall of the furnace. A crucible is built into a furnace, whilst cold, and the only part which remains visible is the projecting mouth. The temperature is raised slowly, and when the furnace is at a bright red heat the first charge of the raw material is shovelled into the crucible through the mouth. Successive charges are gradually added, until the crucible is full. About ten hours after the last charge has been added the furnace is driven to its highest temperature in order to disengage and expel from the glass all bubbles of air and gas. After the so-called "plaining" or refining process has lasted some twenty hours, a specimen of the molten glass is drawn from the crucible and examined with a microscopic lens to see if any bubbles remain. After several specimens have been examined and the molten glass is pronounced to be "plain," the temperature of the furnace is slightly lowered, the stopper and clay are removed from the mouth of the crucible, and the surface of the glass is skimmed to remove all floating impurities. After the glass has been skimmed the "stirring" process is commenced. In molten glass the constituents, silicates, borates, and phosphates have a tendency to separate, and either to sink or rise in the crucible according to their density. To break up the threads, cords, or striæ produced by this separation, to maintain the intimate mixture of the constituents, and to render the mass of the glass perfectly homogeneous, constant and prolonged stirring is absolutely necessary. The stirring apparatus is exceedingly simple. A cylinder of fireclay, closed at one end, which has been raised to a white heat, is gradually lowered into the molten glass. The bent end of a long iron bar is inserted in the mouth of the cylinder, the weight of the bar is supported by a chain, and a long wooden handle is attached to the end of the bar farthest from the furnace. The bar is so poised that a man by moving the handle can direct the cylinder into any part of the crucible, and keep the whole mass of glass in a state of gentle agitation. The work is exceedingly trying, especially during the first few hours, whilst the furnace is almost at its highest temperature. The workmen are dressed in asbestos-cloth, and relieve each other at short intervals. The process requires constant supervision, as different glasses require different manipulation; moreover, if bubbles are formed by the stirring, the work must immediately be stopped, the cylinder removed, the crucible closed, and the heat of the furnace increased. If no bubbles are formed the stirring is continued for from ten to fifteen hours, whilst the temperature of the furnace is allowed steadily to diminish. As the temperature diminishes the glass becomes more viscous, until the clay cylinder can only be moved

with difficulty. As there is no longer any danger of the constituents of the glass separating, and of "cords" being formed, the cylinder is drawn carefully to the mouth of the crucible and removed, and the fire is allowed to die down. After an interval of five or six hours, during which the glass has cooled rapidly, the cooling is checked by hermetically closing the crucible and furnace. This is done to prevent the glass from becoming "case-hardened," like so-called "toughened" glass. The crucible remains untouched for a period, varying from six days to six weeks, according to the size of the discs required and the nature of the glass. When the furnace is opened the crucible is drawn out, and the walls of the crucible are broken away from the glass. (In the manufacture of large lenses a crucible can only be used for one melting.) The mass of glass is usually found to be broken into several irregularly-shaped pieces. Each piece is examined microscopically, and by transmitting through the glass a beam of concentrated light, which shows up every imperfection. In spite of prolonged stirring and every precaution, parts of the glass are invariably found defective. These defects are due partly to irregularity of cooling, the exterior layers of the glass having naturally cooled more rapidly than the interior, and partly to the disturbance caused by the removal of the clay cylinder. It is rare that more than half of the contents of a crucible is perfectly clear and homogeneous. After the examination, the defective parts are chipped away with a hammer, or ground away by a revolving iron disc fed with emery and water. In order to convert the selected pieces, which are often irregular in form, into discs of regular form, each piece is placed in a mould made of fireclay and subjected to heat, sufficient to cause the glass to take the shape of the mould, but insufficient to produce complete fusion. The moulding process must be conducted with the greatest care, as a slight excess of heat may render useless all the labour previously expended. After the glass has taken the form of the mould the fire is allowed to die out, and the kiln in which the process has been conducted is hermetically closed. By the first moulding the irregular fragments of glass are converted into discs with parallel faces; by a second moulding, and by using moulds possessing various degrees of curvature, the discs are caused to assume roughly the form of lenses. Before the last process of moulding, part of the edge or surface of each disc is polished and the glass once more examined for defects.

II. Blown Glass.

Table-Glass and Vases.—The following is the composition of the varieties of glass used:—

	S_1O_2	K_2O	PbO	Na_2O	CaO	MgO	Fe_2O_3 and Al_2O_3
Potash-lead (Flint) glass	53·17	13·88	32·95	..	..	..	..
Soda-lime (Venetian) glass	73·40	..	..	18·58	5·06	..	2·48
Potash-lime (Bohemian) glass	71·6	15·0	..	..	10·0	1·2	2·2

Regenerative gas furnaces are being gradually adopted. In many works, however, the old-fashioned coal or coke furnaces, fitted in some cases with mechanical feeders, are still in use. For potash-lead glass covered crucibles are used, holding from ½ to ¾ ton of molten glass. Open, basin-shaped crucibles are used for leadless glasses. Potash-lead glass, although readily fusible, is so viscous and tenacious of gas and air bubbles, that, with the appliances now in use, the raw materials cannot be converted into clear workable glass in less than from fifty to sixty hours. The distinctive qualities of potash-lead glass are its ductility when heated and its brilliancy and colourlessness when cold. Owing, however, to its brilliancy, it is not so well adapted to display niceties of form as a leadless glass, which may be far from faultless with regard to clearness and colour. All table-glass worthy of the name is blown glass. Every vase, wine-glass, or decanter has commenced its existence in the form of a bubble at the end of a blowing-iron, and owes its form to simple tools guided by delicate touch and trained eyesight. The revival in recent years of the craft of glass-blowing in England must be attributed to William Morris and T. G. Jackson, R.A. They, at any rate, seem to have been the first to grasp the idea that a wine-glass is not merely a bowl, a stem, and a foot, but that, whilst retaining simplicity of form, it may nevertheless possess decorative effect. They, moreover, suggested the introduction for the manufacture of table glass of a material similar in texture to that used by the Venetians, both colourless and tinted (see Plate).

In 1870 the colours available and used for English table-glass were ruby, canary-yellow, emerald-green, dark peacock-green, light peacock-blue, dark purple-blue, and a dark purple. About that year the "Jackson" table-glass was made in a light, dull green glass, similar to that used in stained glass as "white," containing a wealth of bubbles and interesting irregularities. Owing to these so-called defects the glass only appealed to a very select circle. The dull green, commonly known as "pale green," was followed successively by amber, white opal, blue opal, straw opal, sea-green, horn colour, and various pale tints of soda-lime glass, ranging from yellow to blue. Experiments have also been tried with a violet-coloured glass, a violet opal, a transparent black, and with glasses shading from red to blue, red to amber, and blue to green. Touches of colour have been added to vessels in course of manufacture by means of seals of molten glass, applied like sealing-wax; or by causing vessels to wrap themselves round with threads or coils of coloured glass. By the application of a pointed iron hook, while the glass is still ductile, the parallel coils can be distorted into bends, loops, or zigzags (Figs. 3, 4).

The surface of vessels may be rendered lustrous by rolling the hot glass on metallic leaf, or iridescent, by the deposition of metallic tin, or by the corrosion caused by the chemical action of acid fumes. Gilding and enamel decoration are applied to vessels when cold, and fixed by heat. Cutting and engraving are produced by pressing the surface of vessels against the edge of wheels revolving on horizontal spindles. "Cutting" wheels range from 18 inches to 3 inches in diameter, and are made of iron for grinding, stone for smoothing, and wood for polishing. "Engraving" wheels are small, ranging from 1 inch to ¼ inch, and are made of copper. It is the fashion to run down "cutting" as a form of decoration. As, however,

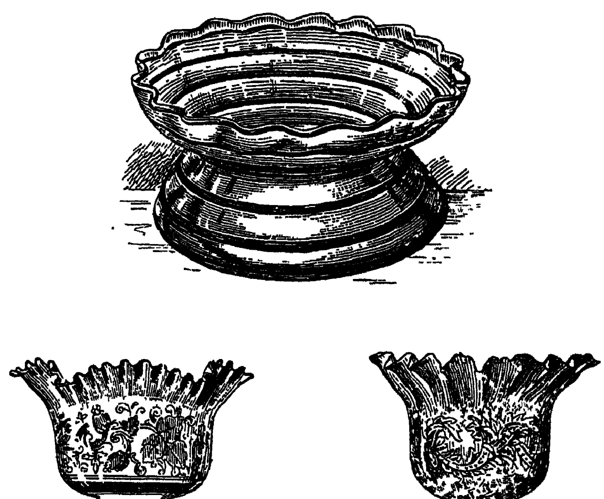

Fig. 1.—Glass mechanically "crimped."

"cutting" brings out one of the intrinsic beauties of potash-lead glass, namely, its remarkable power of reflecting and refracting light, the reason that it is decried must be on the ground of misapplication, rather than unfitness. The fault probably lies in cutting too deeply and too lavishly. When a vessel is smothered with cutting, form disappears in sparkle. The true use of engraving is to add interest to vessels by means of coats-of-arms, monograms, inscriptions, and graceful outlines. The improper, but too common, use of engraving is to hide defective material.

The influence exerted by public taste upon glass-blowing has not always been conducive to the best interests of the craft. Some instances are sufficiently curious to deserve notice. Large numbers of shades for gas, oil, and electric light, as well as bowls for flower-vases, were rendered decorative by allowing the edges of the mouths, while still ductile, to arrange themselves in natural folds. The discriminating public thought these natural folds to be too irregular, and certain manufacturers promptly introduced a machine, closely resembling a guillotine, which crimped the folds with mathematical precision (Fig. 1). This curious distrust of natural irregularity has had the effect of, to a great extent, spoiling opal glass. The beauty of opal glass consists in the wanton irregularity of its shading, no two pieces being precisely similar (Fig. 2). The public asked for regularity, and have been supplied with an insipid milk-and-water material, which is called opal. "Threading" has suffered much in the same way. By the old method of hand-threading the spaces between the threads or coils of coloured glass are always more or less irregular. A lathe has been introduced which not only winds the glass thread with exasperating exactitude, but renders it possible to cover a vessel with threading from top to bottom. Iridescence, when first introduced, was applied delicately to vases of suitable form; it was, however, before long applied to utensils of every description, and the effect, so far from suggesting the actual lightness and brightness of a bubble, is often rather more suggestive of the putrescence of a stagnant pool. Reticence and restraint in decoration have few advocates, and there is a constant demand for any kind of novelty, provided it is highly coloured and exuberantly trimmed. The unfortunate feature of the misuse of processes of decoration is not so much that it offends good taste, but that it brings into disrepute processes which, when properly used, are capable of producing beautiful effects.

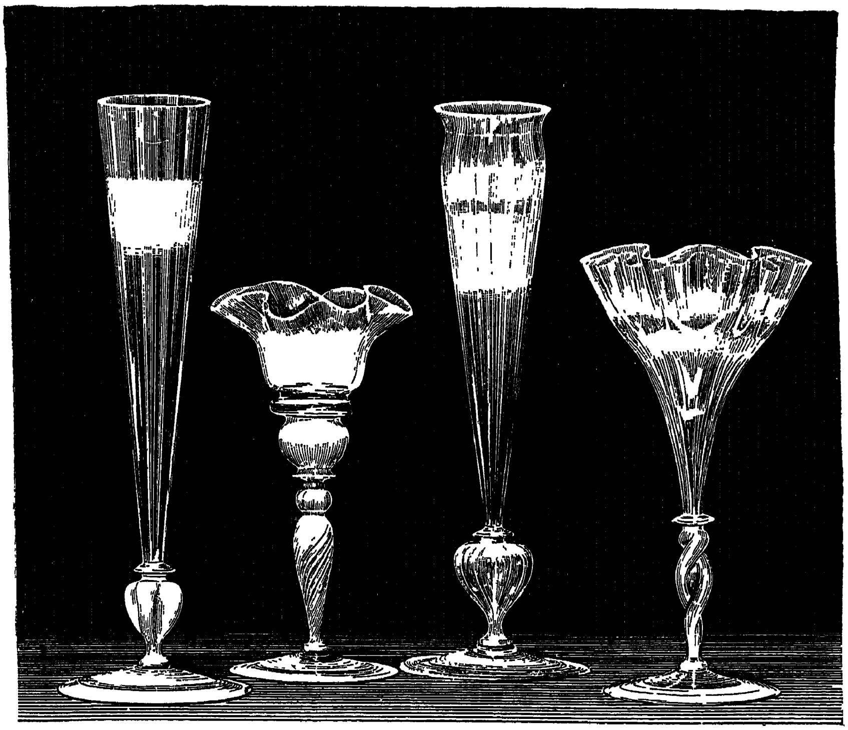

FIG. 2.—Opal Vases: figure on the right has naturally folded edges.

In the Paris Exhibition of 1900 surface decoration was the prominent feature of all the exhibits of table-glass. The carved or "cameo" glass, introduced by Thomas Webb of Stourbridge in 1878, had been copied with varying success by glass-makers of all nations. Frequently the surface had been dulled by acid so as to produce a "satin" finish. M. Émile Gallé and Daum Frères of Nancy exhibited

FIG. 3.—Whitefriars Glass.

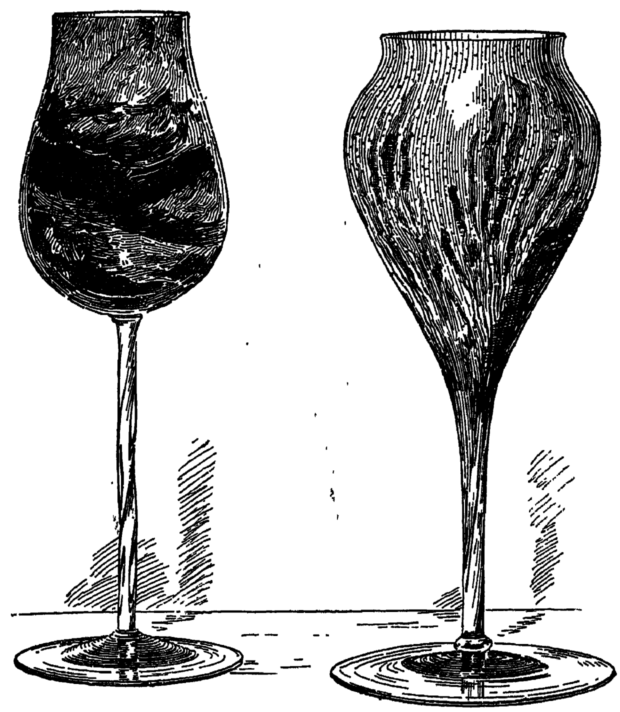

FIG. 4.—Whitefriars Glass.

specimens of this form of decoration possessing considerable beauty. The so-called "Favrile" glass of Messrs Tiffany of New York owes its effect entirely to surface colour and lustre (Fig. 6). The vases of Karl Koepping of Berlin are so graceful and so fragile that they appear to

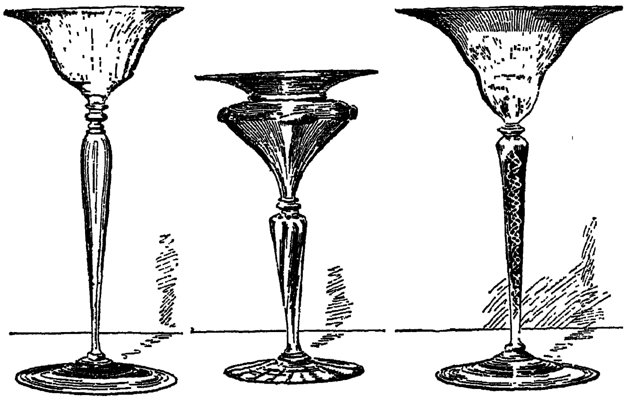

FIG. 5.—Whitefriars Glass.

be creations of the lamp-worker rather than of the glass-blower (see PLATE). Through the absence of exhibits of British table-glass it was impossible to determine the position it occupies in relation to that of other nations.

The existence of the craft of glass-blowing is threatened by three dangers. 1. There is the difficulty of attracting recruits. Boys are rightly forbidden to commence work at the furnace until they are fourteen. Commencing at this age, only those who are exceptionally quick attain the dexterity which is essential to a first-class workman. 2. To meet the demand for regularity and excessive lightness in table-glass, many of the simpler articles are now blown in moulds. The training which the fashioning of simpler forms by hand affords is thus lost. 3. The demand for cheap table-glass has encouraged the use of "pressed glass" and the introduction of automatic blowing machines from the United States.

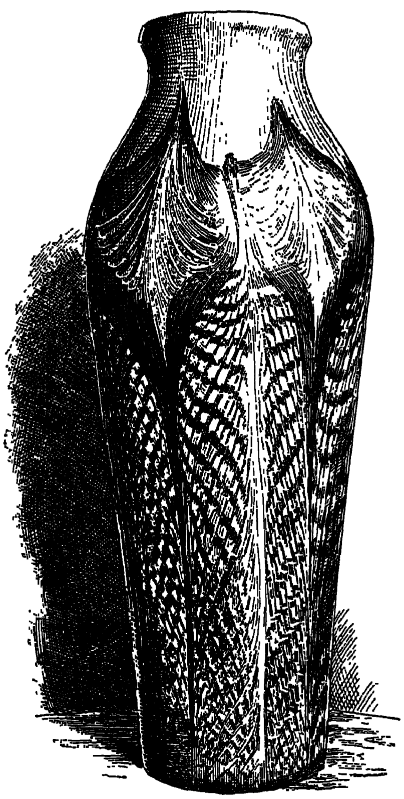

Fig. 6.—Tiffany Glass Vase.

Tube.—In modern thermometry instruments of extreme accuracy are required, and researches have been made, especially in Germany and France, to ascertain the causes of variability in mercurial thermometers, and how such variability is to be removed or reduced. In all mercurial thermometers there is a slight depression of the ice-point after exposure to high temperatures; it is also not uncommon to find that the readings of two thermometers between the ice- and boiling-points fail to agree at any intermediate temperature, although the ice- and boiling-points of both have been determined together with perfect accuracy, and the intervening spaces have been equally divided. It has been proved that these variations depend to a great extent on the chemical nature of the glass of which the thermometer is made. Special glasses have therefore been produced, by M. Tonnelot in France and at the Jena glassworks in Germany, expressly for the manufacture of thermometers for chemical and physical measurements.

The following are the analyses :—

	SiO_2	Na_2O	K_2O	CaO	Al_2O_3	Fe_2O_3	B_2O_3	ZnO	SO_3	Depression of Ice-point
Tonnelot's "Verre dur."	71·45	11·17	0·30	14·52	12·6	0·20	..	..	0·74	0·07
Jena glass—										
xvi–iii . .	67·5	14 0	..	7·0	2·5	..	2·0	7·0	..	0·05
59–iii . . .	72 0	11·0	..	..	5·0	.	12·0	..	..	0·02

Since the discovery of the Röntgen rays, experiments have been made to ascertain the effects of the different constituents of glass on the transparency of glass to X-rays. The oxides of lead, barium, zinc, and antimony are found perceptibly to retard the rays. The Jena glassworks manufacture two glasses for making X-ray tubes :—

	SiO_2	B_2O_3	Al_2O_3	Na_2O
I. . .	71·0	14·0	5·0	10·0
II. . .	39·6	30·0	20·0	10·0

Sheet Glass.—The following are analyses of sheet glass :—

	SiO_2	CaO	Na_2O	$Al_2O_3 + Fe_2O_3$
English . .	72·00	13·00	13·00	2·0
French . .	71·90	13·60	13·10	1·40

The materials used are sand, chalk or limestone, sulphate of soda; a small quantity of powdered anthracite or charcoal is added.

Regenerative gas-furnaces with tanks are generally used. The tanks are provided with one, two, or three floating bridges, and there are floating fireclay rings, within which the molten glass is kept clear by skimming, and from the centre of which the molten glass is gathered for working. Owing to the high temperature attainable with gas furnaces, and the greater purity of the materials used, the scum of "glass-gall" or "sandiver," which in old times rose to the surface, and was a constant source of trouble, is almost unknown. In many manufactories a separate furnace is used as a source for the heat required in manipulation. This arrangement prevents loss of heat from the melting furnace, and enables the temperature to be more regularly maintained. A well-regulated temperature improves the quality of the glass, and is sufficient compensation for the extra expenditure on fuel. The regular working of the melting furnace adds greatly to the convenience of the workmen, as they can work throughout the week in regular eight-hours shifts.

The use of compressed air for blowing the sheet-glass cylinders has been introduced, but has not been generally adopted.

Coloured Glass for Windows.—The production of coloured glass for "mosaic" windows has become a separate branch of glass-making. Charles Winston, after prolonged study of the coloured windows of the 13th, 14th, and 15th centuries, convinced himself that no approach to the colour effect of these windows could be made with glass which is thin and even in section, homogeneous in texture, and made and coloured with highly refined materials. To obtain the effect it was necessary to reproduce as far as possible the conditions under which the early craftsmen

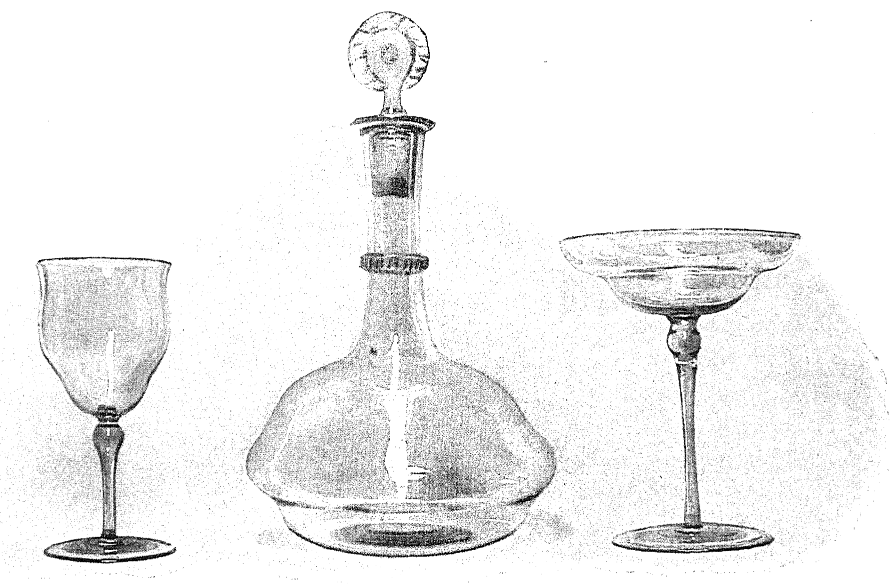

Table Glass. Designed by T. G. Jackson (in 1870).

Table Glass. Designed by William Morris (about 1872).

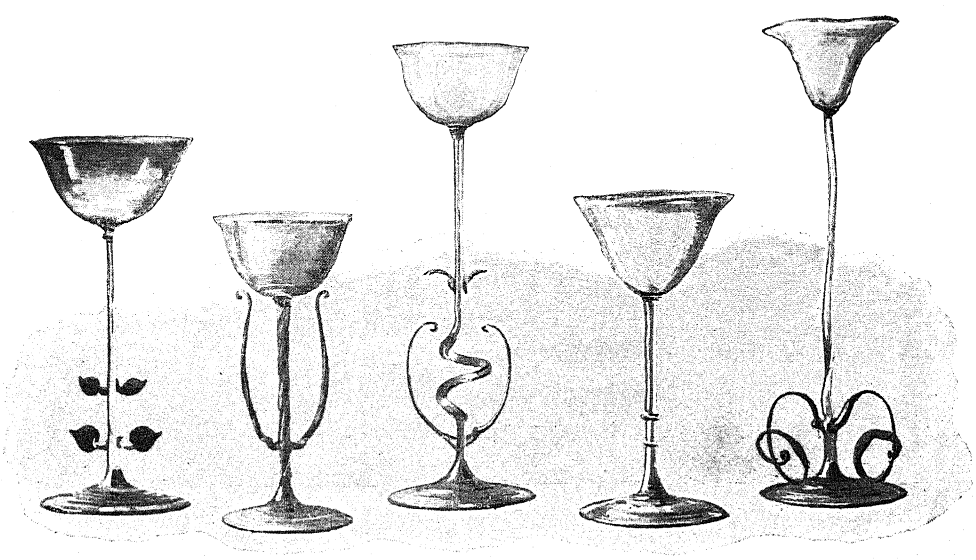

Table Glass. Designed by Koepping of Berlin (1900).

worked, and to create scientifically glass which is impure in colour, irregular in section, and non-homogeneous in texture. The glass is made in cylinders and in "crowns" or circles. The cylinders measure about 14 inches in length by 8 inches in diameter, and vary in thickness from one-eighth to three-eighths of an inch. The "crowns" are about 15 inches in diameter, and vary in thickness from one-eighth to half an inch, the centre being the thickest. The glass, thus made, gives all the life and variety that the artist can legitimately require, and coloured glasses are made which are certainly not unequal to the old. Mr E. J. Prior has introduced an ingenious method of making small oblong and square sheets of coloured glass, which are thick in the centre and taper towards the edges, and which have one surface slightly roughened and one brilliantly polished. Molten glass is blown into an oblong iron mould about 12 inches in depth and 6 inches in width. A hollow rectangular bottle is formed, the base and sides of which are converted into sheets. The outer surface of these sheets is slightly roughened by contact with the iron mould. Small slabs or sheets with an irregular section are also made by pressing molten glass on to flat moulds marked with slight irregularities. Large sheets of irregularly corrugated glass are made by a rolling machine. The molten glass passes between two rollers, one of which is engraved with sinuous indentations. This rolled and mechanically undulated glass, especially when it is opalescent and streaked with colour, is at the present time popular on the Continent and in the United States. Many of the coloured windows at the Paris Exhibition of 1900 were made of this glass, and contained representations by means of streaks of colour of sunset and sunrise, as well as of fruits, flowers, and trees. There were occasional happy effects of colour, but the style and material are too suggestive of confectionery.

III. Glass Mechanically Pressed or Blown.

Plate Glass.—The following are analyses of plate glass :—

	SiO_2	CaO	Na_2O	Al_2O_3	Fe_2O_3
French . .	71·80	15·70	11·10	1·26	0·14
English . .	70·64	16·27	11·47	0·70	0·49

The materials used are sand, limestone, sulphate of soda; a small quantity of powdered anthracite or charcoal is added. Regenerative gas furnaces are almost universally employed. The same crucibles are used both for melting and casting; they hold from 1 to 1½ tons of molten glass, and weigh from 7 to 9 cwt. Contact with the molten glass causes the tables to expand, and the expansion of the tables gives to the glass plates a curved section. This curvature is reduced by building the casting tables of many comparatively small slabs of iron, instead of two or three, as was formerly the custom.

Pressed Glass.—The following is an analysis of a specimen of English "pressed" glass :—

	SiO_2	Na_2O	CaO	BaO	Al_2O_3	Fe_2O_3
English .	70·68	18·38	5·45	4·17	0·33	0·20

The materials used at Gateshead are sand, sulphate of soda, nitrate of soda, lime-spar, and carbonate of barium. The use of red-lead has been discontinued. At Pittsburg, United States, the materials are sand, soda-ash, nitrate of soda, and lime (crushed and burnt). At Gateshead the old-fashioned coal furnaces are still used. The moulds are made of cast iron. Oil furnaces with steam-blast are used for polishing the goods after they have been pressed The presses are generally worked by hand. Steam power, however, has been applied to some of the heavier ones. The secretary of the National Glassworks at Pittsburg writes: "Most of the work done in America in table-ware, tumblers, &c., is produced by hand-presses, as it is necessary for the operator to know by touch whether the plunger has pressed the glass to the proper point in the mould. Natural gas has been very largely used for the past ten years in the manufacture of glass. Continuous tank furnaces are used for the commoner grades of pressed glass."

Glass Bottles partly Pressed and partly Blown by Compressed Air.—The following is an analysis of a specimen of light green English "bottle" glass :—

	SiO_2	Al_2O_3	Fe_2O_3	CaO_2	Na_2O
English . .	69·15	2·38	0·69	15·38	12·17

The materials used are sand, Derbyshire limestone, chalk, sulphate, and carbonate of soda. Gas regenerative tank furnaces are generally used. Ashley's patent bottle-making machine combines the process of pressing with a

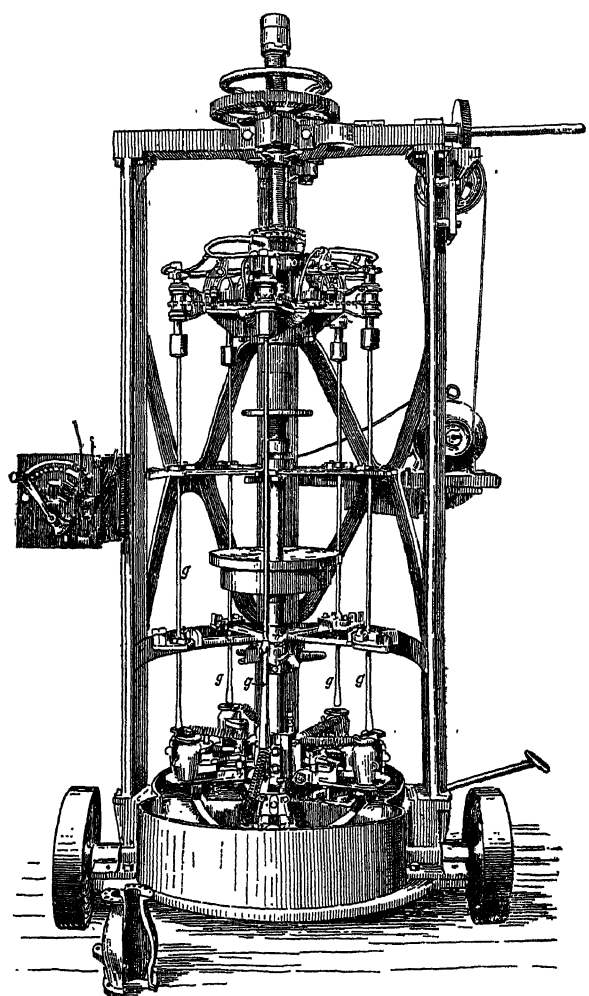

Fig. 7.—Owens's Glass-blowing Machine.
g. g. g. blowing-irons.

plunger, with that of blowing by compressed air. The neck of the bottle is first formed by the plunger, and the body is subsequently blown out by compressed air admitted through the plunger. A sufficient weight of molten glass to form a bottle is gathered and put

in a funnel placed over and giving access to a mould which shapes the outside of the neck. A plunger is forced upwards into the glass contained in the neck-mould and forms the neck. The funnel is removed, and the plunger, neck-mould, and mass of molten glass attached to the neck are inverted. A bottle mould rises and envelops the mass of molten glass. Compressed air is admitted through the plunger in the neck, forces the molten glass to take the form of the bottle mould, and completes the bottle. A single machine can be made to produce nine gross of bottles in a day.

Glass Blown by Compressed Air.—Works have been built at West Bromwich for the manufacture of tumblers, chimneys, bottles, and electric lamp bulbs by means of the automatic glass-blowing machine (Fig. 7) patented by Michael Owens of Toledo, U.S.A. These machines take the place of human glass-blowers. The only manual operations are: (1) Gathering the molten glass at the end of a blowing-iron; (2) placing the blowing-iron in the machine so that, whilst the mouth-piece is in contact with an air-jet, the mass of molten glass hangs within the sections of an open mould; (3) removing the blowing-iron with the finished article attached. Each machine consists of a revolving table carrying five or six moulds. The moulds are opened and closed by "cams" actuated by compressed air. As soon as a blowing-iron is in contact with an air-jet, the sections of the mould close upon the molten glass and the compressed air forces the glass to take the form of the mould. A large pipe carrying compressed air runs round the works, and the blowing machines are connected with the pipe by flexible tubes. It is claimed that these machines can turn out seven tumblers or five lamp chimneys per minute.

AUTHORITIES.—D. H. HOVESTADT. *Jenaer Glas.* Jena, 1900.—J. HENRIVAUX. *Le Verre et Le Cristal.* Paris, 1887.—CHANCE, HARRIS, and POWELL. *Principles of Glass Making.* London, 1883.—MORITZ V. ROHR. *Theorie und Geschichte der photographischen Objektive.* Berlin, 1899.—C. E. GUILLAUME. *Traité Pratique de la Thermométrie de Précision.* Paris, 1889.—LOUIS COFFIGNAL, *Verres et Emaux.* Paris, 1900.

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(H. J. P.)

Glass, Stained.—The art of what is called glass painting—though in reality a combination of glazing and painting goes to the making of a stained glass window—may be claimed as mediæval. It arose and was developed in connexion with Gothic architecture; painted glass, indeed, culminated in the 16th century, but the art throve only so long as artists of the Renaissance worked on the mosaic principle of the Middle Ages. Step by step with their departure from the consideration of a window as primarily stained glass, and their reliance upon painting only, the art declined. Its reawakening in England was part of the Gothic revival; and the Gothic revival determined the direction which modern glass should take. Early Victorian work was tentative, interesting, not for its artistic merit, but as marking the steps of recovery—witness the work of Willement, in the choir of the Temple Church; of Ward and Nixon, in the south transept of Westminster Abbey; and of Wailes, in the House of Lords. The cartoons for this last were drawn by Oliphant from sketches by Pugin, who in his day exercised considerable influence over the art, and by John Powell (Hardman & Co.), an able artist, who was content to walk, even after his master's death, reverently in his footsteps. Charles Winston, again, whose *Hints on Glass Painting* was the first real contribution towards the understanding of Gothic glass, and who, by the aid of Powell's (of Whitefriars), succeeded in getting glass very like the old in texture and colour, was more learned in ancient instances than appreciative of modern design. So from the beginning of its recovery glass fell into the hands of men less in sympathy with art than with archæology. The artists foremost in the Gothic revival (Butterfield, Street, Burges, &c.) were infected with the same spirit; and, as they had the placing of commissions for windows, they controlled the policy of glass painters. Thus designers, whatever their originality, were constrained to work in a manner contrary to their individual bias, and to fill churches with mock-mediæval windows, the interest in which died with the illusion about a Gothic revival. But they knew their trade, and when an artist like John Clayton (Clayton & Bell), master of a whole school of later glass painters, took a window into his hands (St Augustine's, Kilburn; Truro Cathedral; King's College Chapel, Cambridge) the result was a work of art from which we may gather what such men might have done had they been left to follow the bent of their own genius. It is necessary to refer to this, because it is popularly supposed that whatever is best in recent glass is due to the Romantic movement. The charms of Burne-Jones's design and of Morris's colour place the windows done by them among the triumphs of modern decorative art. But Morris was neither foremost in the reaction, nor quite such a master of the material he was working in as he showed himself in other crafts. Other artists to be mentioned in connexion with glass design are—Clement Heaton, Bayne, Westlake, and Henry Holiday.

Foreign work, as compared with modern English, shows a less just appreciation of glass. In Germany, King Louis of Bavaria enlisted Cornelius and Kaulbach as designers for it (Aix-la-Chapelle, Cologne, Glasgow). In France the Bourbons employed Ingres, Delacroix, Vernet, and Flandrin (Dreux). But though the windows they designed were painted with the skill characteristic of Munich and Sèvres, the glass, according as it was left bare or laden with paint, was either crude or dull, lacking the character of glass. In Belgium happier results were obtained, Capronnier's window at Brussels being not unworthy of the series by Van Orley, which it supplements; but foreign artists failed at the best to appreciate the quality of glass; they put better draughtsmanship into their windows than English designers, and painted them better, but they missed the glory of translucent colour.

In America, John La Farge, finding English material not dense enough, produced pot-metal more heavily charged with coloured oxides, and more wilfully streaked, mottled, and otherwise quasi-accidentally varied than European manufacture—opalescent, too, and more like agate or onyx than jewels. It was also an American idea to make glass in lumps and chip it into flakes, to corrugate it, to blow it into shapes, or to pull molten glass out of shape—to make, in fact, material safely to be trusted only in the hands of an artist of reserve. La Farge and L. Tiffany have turned it to beautiful account; but even they have put it to more pictorial purpose than it can properly fulfil. The design to which it obviously lends itself is a form of ornament severe even to the verge of the barbaric.

Mere painting, whether on pieces of pot-metal afterwards to be leaded together, or upon single sheets of plate, has been carried as far as it can go. In the one case there is always the discrepancy between delicate painting and

harsh lead lines; in the other, there is so little of the real quality of glass in the result, that there is no excuse for the production of so fragile a picture, lacking, as it must, the qualities peculiar to painting proper, as may be seen in the wonderful but most unsatisfactory series of pictures painted at Sèvres for the chapel at Dreux (sheets of plate each 4 by $2\frac{1}{2}$ feet).

Of late years each country has been learning from the others, and the newest effort is very much in one direction. It seems to be agreed that a window begins with glazing, that the all-needful thing is beautiful glass, and that painting may be reduced to a minimum, may even (owing to new developments in the making of glass) be dispensed with altogether.

The present tendency seems to be not merely in the direction of mosaic, but of carrying the glazier's art further than has been done before, rendering even figure subjects and landscapes in leaded glass. The limitations of mere glazing are obvious—only a very partial view, for example, of the human face can be expressed in this fashion—but a way out of the difficulty was shown at Paris (1900) by M. Tournel, who fused coloured tesseræ on to larger pieces of colourless glass, with a flux of powdered glass between them. There would be no advantage in building up whole windows in this way, but for the rendering of the flesh, &c., in a window for the most part leaded, this use of tesseræ, and even of small-shaped pieces fused on to white, seems to supply just what is wanted.

A freer hand is given to the glass painter to-day, partly because his work is no longer exclusively ecclesiastical. Domestic glass being now a very important industry, the practices of men employed upon it seriously affect the methods of those engaged upon church work. Moreover, the recognition of the artistic position of craftsmen in general makes it possible for an artist to devote himself to glass without sinking to the rank of a mechanic; and artists begin to realize the scope glass offers to them. Design is all-important. And design is adequate in proportion as it has nothing to lose and everything to gain by translation into glass. It must necessarily take into account the capacities of the material, asking of it only what it can do, and bringing out the qualities in which it excels—the purity, the brilliancy, the translucency, the beauty of colour in which it is supreme. (L. F. D.)

Glastonbury, a municipal borough and market-town in the eastern parliamentary division of Somersetshire, England, 5 miles south-west of Wells by rail. The church of St Benedict and St John's Church tower have been restored. In 1892 the remains of a prehistoric marsh village, consisting of sixty mounds within a space of five acres, were discovered close by the town. The relics found there and in other localities in the neighbourhood have been deposited in the Antiquarian Museum, begun in 1887. There are a Roman Catholic college for missionaries, a Roman Catholic chapel, and various Nonconformist chapels. There are manufactures of sheepskin rugs and leather gloves and shoes. Area, 5000 acres. Population (1881), 3719; (1901), 4016.

Glatz, a fortified town of Prussia, province of Silesia, on the Neisse, 58 miles by rail south-south-west from Breslau. Breweries and machinery factories have been added to its industries. A bronze statue of the Emperor William I. was unveiled in 1898. The fortifications of the town were razed in 1891. Population (1885), 13,588; (1900), 14,918.

Glauchau, a town of Germany, on the Mulde, 17 miles by rail west of Chemnitz, in the circle of Zwickau, kingdom of Saxony. It has important manufactures of woollens and half-woollens, 9 weaving mills, over 20 dye, cloth-dressing, yarn-washing, and print works, 2 spinning mills, several pattern-designing works, and a weaving-implement factory. Population (1890), 23,405; (1900), 25,674.

Gleichen, two groups of castles in Germany. (1) A group of three, situated each on an isolated hill in Thuringia, between Gotha and Erfurt. Of the three only one is inhabited, namely, Wachsenburg (1358 feet above sea-level), belonging to the duke of Saxe-Coburg-Gotha, and containing collections of weapons, pictures, &c. It is said to have been founded about 935, and was sold to the landgrave of Thuringia in 1368. The other two, Gleichen (1221 feet) and Mühlberg (1309 feet), are ruins. Both were unsuccessfully besieged by the Emperor Henry IV. in 1088. The former is best known from the romantic legend of the count of Gleichen, a Crusader, who was allowed to live with two wives at the same time (see Musæus, *Volksmärchen*, "Melechsala"). The castle of Mühlberg existed as early as 704. (2) The other group of two castles, Neu-Gleichen and Alt-Gleichen, both in ruins, crown two isolated hills (1394 and 1404 feet respectively) about 2 miles south-east from Göttingen.

Glenelg, a South Australian watering-place, $6\frac{1}{2}$ miles south-south-west of Adelaide, on Holdfast Bay. It is a popular summer resort, connected by two railway lines with Adelaide. In the vicinity is the "Old Gum Tree," under which South Australia was proclaimed British territory by Governor Hindmarsh in 1836. Population (1901), 3949.

Glens Falls, a village of Warren county, New York, U.S.A., in 43° 18′ N. and 73° 39′ W., on the Hudson river and on the Delaware and Hudson Railway, at an altitude of 343 feet. It has fine water power in the falls, which is utilized in lumber, shingle, and lath mills, paper mills, and iron and steel works. In the immediate neighbourhood are many lime-kilns. Population (1880), 4900; (1890), 9509; (1900), 12,613, of whom 1762 were foreign-born.

Glogau, a fortified town of Prussia, province of Silesia, on the Oder, 59 miles north-west from Breslau by the railway to Frankfort-on-the-Oder. A new quarter has grown up on the south-east of the old fortified *enceinte*. Population (1885), 20,027; (1900), 22,136.

Glossop, a municipal borough and market-town in the High Peak parliamentary division of Derbyshire, England, 58 miles north-north-west of Derby by rail. Recent erections are the free library, the public baths, a technical school (1900), and Wood's Hospital. Howard Park was formed in 1887. Area of borough, 3033 acres. Population (1881), 19,574; (1901), 21,526.

Gloucester, a city and seaport of Essex county, Massachusetts, U.S.A., in latitude 42° 36′ N. and 70° 39′ W., on Cape Ann, and a branch of the Boston and Maine Railway. It includes, besides the community of Gloucester, several small places, Annisquam, Bayview, Lanesville, East and West Gloucester, and Riverdale. The city includes an area of 34 square miles; most of this is uneven, and the bordering coast is rocky. Gloucester has an excellent harbour and some commerce, but the principal business is fishing. In this industry it is the most important place in the United States, and most of the adult males are engaged in it. There were employed in it, in 1895, 380 vessels, 2442 boats, and 5500 men. The product was valued at $3,212,985. An industry of secondary importance is the quarrying of the granite with which the city is underlaid. The manufactures are not extensive. In 1895 the capital invested was $3,003,256, employing 1980 hands, with a product valued at $5,590,366. Of this, by far the largest item was canned and preserved fish.

The coast is very picturesque, and it has become a favourite seaside resort, especially for artists, who prefer the point on the east side of the harbour, in the village of East Gloucester. Population (1880), 19,329; (1890), 24,651; (1900), 26,121, of whom 8768 were foreign-born. The death-rate in 1900 was 14·9.

Gloucester, a city of Camden county, New Jersey, U.S.A., in 39° 53′ N. and 75° 07′ W., on the eastern side of the Delaware river, opposite Philadelphia. It is connected with Philadelphia by ferry, and has two railways, the Atlantic City and the West Jersey and Seashore. Population (1880), 5347; (1890), 6564; (1900), 6840, of whom 1094 were foreign-born.

Gloucester, a city, county of itself, municipal and parliamentary borough, port, and county town of Gloucestershire, England, in the Tewkesbury parliamentary division of the county, on the left bank of the river Severn, 33 miles north-east of Bristol by rail. Alternately with Worcester and Hereford, a triennial musical festival is held here. In recent years the Shire Hall has been enlarged at a cost of £11,750; the Guildhall built at a cost of £31,500; the corn exchange enlarged and converted into the post office; a free library built, and a county council dairy school established. Between the years 1873 and 1890 the sum of £13,000 was expended on the restoration of the cathedral. In 1897 funds, estimated at £10,000, were collected for further expenditure, and the north and west alleys of the cloisters were thoroughly repaired. Gloucester, declared a port in 1882, is reached from the Severn by a ship canal (the Berkeley) 16½ miles in length. The registered shipping in 1898 consisted of 154 vessels of 7563 tons. In that year 4445 vessels entered the port with 510,874 tons, and 4478 vessels cleared with 493,856 tons. A harbour board was formed in 1890 to maintain, regulate, and light a harbour in the Severn estuary. Since 1885 the city has returned only one member to Parliament. Area, 1437 acres. Population (1881), 36,513; (1901), 47,943.

Gloucestershire, a west midland county of England, bounded on the S.E. by Wiltshire, on the S. by Somersetshire, on the W. by Monmouthshire, on the N.W. by Herefordshire, on the N. by Worcestershire and Warwickshire, and on the E. by Oxfordshire.

Area and Population.—The area of the ancient county is 795,734 acres or 1243 square miles, with a population in 1881 of 572,341, and in 1891 of 599,947, of whom 281,012 were males and 318,935 females, the number of persons per square mile being 483, and of acres to a person 1·32. The area of the administrative county, as given in the census returns of 1891, was 796,731 acres, with a population in 1891 of 645,574; but in 1896 considerable additions were made to its area by the transference from Warwickshire of the part of the parish of Batsford in Warwickshire, and by the transference from Wiltshire of the parishes of Kemble, Poole Keynes, and Somerford Keynes. The area of the registration county in 1891 was 714,763 acres, with a population of 548,886, of which 360,705 were urban and 188,181 rural. Within the registration area the increase of population between 1881 and 1891 was 4·52 per cent. The excess of births over deaths between 1881 and 1891 was 64,020, and the increase of the resident population was 23,717. In 1901 the population of the ancient county was 634,666. The following table gives the numbers of marriages, births, and deaths, with the number of illegitimate births, for 1880, 1890, and 1898:—

Year.	Marriages.	Births.	Deaths.	Illegitimate Births.	
				Males.	Females.
1880	4113	16,485	9938	423	392
1890	4315	15,723	9760	328	311
1898	4436	14,880	9116	276	275

The number of marriages in 1899 was 5034; of births, 17,809; and of deaths, 11,178.

The following table gives the marriage-, birth-, and death-rate per 1000 of the population, with the percentage of illegitimate births, for a series of years:—

	1870–79.	1880.	1880–89.	1890.	1888–97.	1898
Marriage-rate	17·2	15·7	15·3	15·8	15·4	15·7
Birth-rate	32·6	31·5	30·1	27·6	27·8	26·4
Death-rate	20·4	19·0	17·9	17·8	17·4	16·1
Percentage of Illegitimacy	4·8	4·9	4·8	3·9	4·0	3·7

In 1891 there were in the county 435 natives of Scotland, 735 natives of Ireland, and 392 foreigners.

Constitution and Government.—The ancient county comprises five parliamentary divisions, and it also includes the parliamentary borough of Gloucester, returning one member, part of the borough of Cheltenham, returning one member, and the greater part of the borough of Bristol, which returns four members. The administrative county contains four municipal boroughs: the city of Bristol (328,842), Cheltenham (49,439), Gloucester (47,943), and Tewkesbury (5419). Bristol and Gloucester are county boroughs. The following are the urban districts: Awre (1096), Charlton Kings (3806), Cirencester (7536), Coleford (2541), Horfield (1435), Kingswood (11,961), Nailsworth (3028), Newnham (1184), Stow-on-the-Wold (1386), Stroud (9188), Tetbury (1989), and Westbury-on-Severn (1866). The Forest of Dean is for forestry purposes under the jurisdiction of the Crown, and the hundred of the duchy of Lancaster is for some purposes under the jurisdiction of the duchy of Lancaster. Gloucestershire is in the Oxford circuit, and assizes are held at Gloucester. The boroughs of Bristol, Gloucester, and Tewkesbury have separate commissions of the peace and separate courts of quarter sessions. The ancient county—which is chiefly in the diocese of Gloucester—contains 397 ecclesiastical parishes and districts, with parts of ten others.

Education.—Cheltenham is the seat of a famous grammar school. There are a residential training college (Church of England) for schoolmasters, another at Bristol (Diocesan), and two training colleges (Church of England and Ladies' College) for schoolmistresses. There are at Bristol a district institution for deaf and dumb, a school board deaf school, and an asylum and school of industry for the blind. The number of elementary schools on 31st August 1899 was 541, of which 116 were board and 425 voluntary schools, the latter including 375 national Church of England schools, 11 Wesleyan, 11 Roman Catholic, and 28 "British and other." The average attendance at board schools was 41,321, and at voluntary schools 61,653. The total school board receipts for the year ending 29th September 1899 were over £212,666. The income under the Agricultural Rates Act was over £1925.

Agriculture.—Nearly seven-eighths of the total area of the county is under cultivation, and of this nearly four-sevenths is in permanent pasture, both cattle and sheep being largely raised. A feature of the county is its apple and pear orchards, chiefly for the manufacture of cider and perry, which are attached to nearly every farm, and cover altogether more than 19,000 acres. Nearly 60,000 acres are under wood. The acreage under wheat nearly equals the combined acreages under barley and oats; and turnips, &c., occupy about three-fourths of the green crop acreage, potatoes occupying only about a twelfth. About 1500 acres are under small fruit. The following table gives the larger main divisions of the cultivated area at intervals from 1880:—

Year.	Total Area under Cultivation.	Corn Crops.	Green Crops.	Clover.	Permanent Pasture.	Fallow.
1880	653,828	160,852	60,152	89,067	324,908	18,823
1885	659,011	146,659	60,610	98,064	341,239	12,408
1890	659,336	135,949	54,435	89,869	369,023	9,116
1895	656,488	120,603	50,293	88,068	387,092	8,611
1900	661,441	121,495	47,035	89,214	398,718	4,431

The following table gives particulars regarding the principal live stock for the same years:—

Year.	Total Horses.	Total Cattle.	Cows or Heifers in Milk or in Calf.	Sheep.	Pigs.
1880	25,779	112,292	36,230	354,621	52,171
1885	26,455	129,926	43,506	393,149	68,353
1890	27,268	121,336	41,640	375,712	81,094
1895	27 737	109,786	38,307	347,011	83,619
1900	27,530	124,708	39,068	364,785	67,438

Industries and Trade.—According to the annual report for 1898 of the chief inspector of factories (1900), the total number of persons employed in factories and workshops in 1897 was 60,427,

as compared with 59,678 in 1896. Of these 5830 were employed in textile factories, the majority of whom (3539) were engaged in the woollen manufacture carried on at Bisley, Eastington, Edge, Ebley, Minchinhampton, Nailsworth, North Nibley, Stonehouse, Stroud, and Wotton-under-Edge; the cotton industry employed 1355. The number employed in non-textile factories was 43,173, there being an increase between 1895 and 1896 of 10·2 per cent., and between 1896 and 1897 of 0·1. Of these 8538 were employed in clothing industries, 7097 in the manufacture of machine appliances, conveyances, and tools, 5752 in food industries, 4370 in the manufacture of paper, &c., and 1497 in furniture-making, &c.; pottery and glass are also manufactured. Workshops employed 11,424, of whom 6486 were employed in clothing industries and 1316 in those of furniture, &c. For the export and import maritime trade see under BRISTOL and GLOUCESTER, city. The total number of persons employed in mines and quarries in 1899 was 8775. In the same year 254,173 tons of clay were raised, 171,270 tons of limestone, and 123,534 tons of sandstone. Strontium sulphate is dug from shallow pits in the red marl in Gloucestershire and Somersetshire, the total quantity obtained in the two counties in 1899 being 12,629 tons, valued at £6314. The following table gives the coal and ironstone produced in 1890 and 1899:—

	1890.		1899.	
	Tons.	Value.	Tons.	Value.
Coal . .	1,419 616	£716,100	1,528,014	£789,474
Ironstone .	65,611	26,244	26,101	12,516

AUTHORITIES.—Among recent works are *Legends, Tales, and Songs in the Dialect of the Peasantry of Gloucestershire.* London, 1876.—ROBERTSON. *Glossary of Dialect and Archaic Words of Gloucester.* London, 1890. — WITCHELL. *Fauna and Flora of Gloucestershire.* Stroud, 1892.—BAZELEY and HYETT. *Bibliographers' Manual of Gloucestershire.* 3 vols. London, 1895–97. See also *Transactions of the Bristol and Gloucestershire Archæological Society.* (T. F. H.)

Gloversville, a city of Fulton county, New York, U.S.A., in 43° 03′ N. and 74° 22′ W., on a small branch of the Mohawk river, and on the Fonda, Johnstown, and Gloversville Railway; altitude 1000 feet. Gloversville derives its name from its principal industry, the glove manufacture, for which it is the chief centre in the United States. It was incorporated as a village in 1851, and received a city charter in 1890. Population (1880), 7133; (1890), 13,864; (1900), 18,349, of whom 2542 were foreign-born and 216 were negroes. The death-rate in 1900 was 11·8.

Glückstadt, a seaport town of Prussia, province of Schleswig-Holstein, on the right bank of the Elbe, 33 miles north-west from Hamburg by rail. The town hall, built in 1642, was entirely rebuilt in 1873. Here are a school of seamanship, and railway workshops, shipbuilding, &c. The port is free. Population (1885), 5483; (1900), 6586.

Gmünd, a town of Würtemberg, Germany, on the river Rems, 32 miles by rail east of Stuttgart. It is a seat of the jewellery and silversmiths' industries, of wood-carving and turning, and cotton-weaving, and has a trade in fruit and hops. There are an industrial art museum and several benevolent institutions. Population (1885), 15,321; (1900), 18,673.

Gmunden, the chief town of the Salzkammergut, in Upper Austria, and the principal depôt of the State Salt Monopoly, situated at the efflux of the Traun river, from the lake of the same name. It is much frequented as a health and summer resort, and has a variety of lake-, brine-, vegetable-, and pine-cone baths, a hydropathic establishment, inhalation chambers, whey cure, &c. Its principal resource, in addition to the salt industry, is the entertainment of its thousands of visitors. Population (1890), 6476; (1900), 7126.

Gneist, Heinrich Rudolf Hermann Friedrich von (1816–1895), German jurist and politician, was born at Berlin on the 13th of August 1816, the son of a judge attached to the "Kammergericht" (Court of Appeal) in that city. After receiving his school education at the Gymnasium at Eisleben in Prussian Saxony, he entered the University of Berlin in 1833 as a student of jurisprudence, and became a pupil of the famous Roman law teacher von Savigny. Proceeding to the degree of *doctor juris* in 1838, young Gneist immediately established himself as a "privat-docent" in the faculty of Law. He had, however, already chosen the judicial branch of the legal profession as a career, and having while yet a student acted as "auscultator," was admitted "assessor" in 1841. He soon found leisure and opportunity to fulfil a much-cherished wish, and spent the next few years on a lengthened tour in Italy, France, and England. He utilized his "Wanderjahre" for the purposes of comparative study, and on his return in 1844 was appointed extraordinary professor of Roman law in Berlin University; and thus began a professorial connexion which ended only with his death. The first-fruits of his activity as a teacher were seen in his brilliant work, *Die formellen Verträge des heutigen römischen Obligationen-Rechtes* (Berlin, 1845). *Pari passu* with his academic labours, he continued his judicial career, and became in due course successively assistant judge of the Superior Court and of the Supreme Tribunal. But to a mind constituted such as his, the want of elasticity in the procedure of the courts was galling. "Brought up," he tells, in the preface to his *Englische Verfassungs-Geschichte*, "in the laborious and rigid school of Prussian judges, at a time when the duty of formulating the matter in litigation was entailed upon the judge who personally conducted the pleadings, I became acquainted both with the advantages possessed by the Prussian bureau system as also with its weak points." Feeling the necessity for fundamental reforms in legal procedure, he published, in 1849, his *Trial by Jury*, in which, after pointing out that the origin of that institution was common to both Germany and England, and showing in a masterly way the benefits which had accrued to the latter country through its more extended application, he pleaded for its freer admission in the tribunals of his own country. The period of "storm and stress" in 1848 afforded Gneist an opportunity for which he had yearned, and he threw himself with ardour into the constitutional struggles of Prussia. Although his candidature for election to the National Assembly of that year was unsuccessful, he felt that "the die was cast," and deciding for a political career, retired in 1850 from his judicial position. Entering the ranks of the National Liberal party, he began both in writing and speeches actively to champion their cause, now busying himself pre-eminently with the study of constitutional law and history. In 1853 appeared his *Adel und Ritterschaft in England*, and in 1857 the *Geschichte und heutige Gestalt der Aemter in England*, a pamphlet primarily written to combat the Prussian abuses of administration, but for which the author also claimed that it had not been without its effect in modifying certain views that had until then ruled in England itself. In 1858 Gneist was appointed ordinary professor of Roman law, and in the same year commenced his parliamentary career by his election for Stettin to the Abgeordnetenhaus (House of Deputies) of the Prussian Landtag, in which assembly he sat thenceforward uninterruptedly until 1893. Joining the Left, he at once became one of its leading spokesmen. His chief oratorical triumphs are associated with the early period of his membership of the House; two noteworthy occasions being his violent attack (September 1862) upon the Government budget in connexion with the reorganization of the Prussian army, and his defence (1864) of the Polish chiefs of the (then) Grand Duchy of Posen, who were accused of high treason. In 1857–63 was published *Das heutige*

Englische Verfassungs und Verwaltungsrecht, a work which, contrasting English and German constitutional law and administration, aimed at exercising political pressure upon the Government of the day. In 1868 Gneist became a member of the North German Parliament, and acted as a member of the commission for organizing the Federal army, and also of that for the settlement of ecclesiastical controversial questions. On the establishment of German unity, his mandate was renewed for the Reichstag, and in this he sat, an active and prominent member of the National Liberal party, until 1884. In the Kulturkampf he sided with the Government against the attacks of the Clericals, whom he bitterly denounced, and whose implacable enemy he ever showed himself. In 1879, together with his colleague, von Hänel, he violently attacked the motion for the prosecution of certain Socialist members, which as a result of the vigour of his opposition was almost unanimously rejected. He was parliamentary reporter for the committees on all great financial and administrative questions, and his profound acquaintance with constitutional law caused his advice to be frequently sought, not only in his own but also in other countries. In Prussia he largely influenced legislation, the reform of the judicial and penal systems and the new constitution of the Evangelical Church being largely his work. He was also consulted by the Japanese Government when a constitution was being introduced into that country. In 1875 he was appointed a member of the Supreme Administrative Court ("Oberverwaltungsgericht") of Prussia, but only held office for two years. In 1882 was published his *Englische Verfassungs-Geschichte* (trans., "History of the English Constitution," London, 1886), which may perhaps be described as his *magnum opus.* It placed the author at once on the level of such writers on English constitutional history as Hallam and Stubbs, and supplied English literature with a text-book almost unrivalled in point of historical research. In 1888 one of the first acts of the ill-fated Emperor Frederick, who had always, as Crown Prince, shown great admiration for him, was to ennoble Gneist, and attach him as instructor in constitutional law to his son, the Emperor William II., a charge of which he worthily acquitted himself. The last years of his life were full of energy, and, in the possession of all his faculties, he continued his wonted academic labours until a short time before his death, which occurred at Berlin on the 22nd of July 1895.

As a politician, Gneist's career cannot perhaps be said to have been entirely successful. In a country where parliamentary institutions are the living exponents of the popular will he might have risen to a foremost position in the State; as it was, the party to which he allied himself could never hope to become more than what it remained, a parliamentary faction, and the influence it for a time wielded in the counsels of the State waned as soon as the Social-Democratic party grew to be a force to be reckoned with. It is as a writer and a teacher that Gneist is best known to fame. He was a jurist of a special type. To him law was not mere theory, but living force; and this conception of its power animates all his schemes of practical reform. As a teacher he exercised a magnetic influence, not only by reason of the clearness and cogency of his exposition, but also because of the success with which he developed the talents and guided the aspirations of his pupils. He was a man of noble bearing, religious, and imbued with a stern sense of duty. He was proud of being a "Preussischer Junker" (a member of the Prussian squirearchy), and throughout his writings, despite their liberal tendencies, may be perceived the loyalty and affection with which he clung to monarchical institutions. A great admirer and a true friend of England, to which country he was attached by many personal ties, he surpassed all other Germans in his efforts to make her free institutions, in which he found his ideal, the common heritage of the two great nations of the Teutonic race.

Gneist was a prolific writer, especially on the subject he had made peculiarly his own, that of constitutional law and history, and among his works, other than those above named, may be mentioned the following: *Budget und Gesetz nach dem constitutionellen Staatsrecht Englands* (Berlin, 1867); *Freie Advocatur* (*ibid.*, 1867); *Der Rechtsstaat* (*ibid.*, 1872, and 2nd edition 1879); *Zur Verwaltungsreform in Preussen* (Leipzig, 1880); *Das englische Parlament* (Berlin, 1886); in English translation, *The English Parliament* (London, 1886, 3rd edition 1889); *Die Militär-Vorlage von 1892 und der Preussiche Verfassungsconflikt von 1862 bis 1866* (Berlin, 1893); *Die nationale Rechtsidee von den Standen und das Preussische Dreiklassenwahlsystem* (*ibid.*, 1895); *Die verfassungsmässige Stellung des Preussischen Gesammtministeriums* (*ibid.*, 1895). See GIERKE, *Rudolph von Gneist, Gedächtnissrede* (Berlin, 1895), an In Memoriam address delivered in Berlin. (P. A. A.)

Gnesen (Polish, *Gniezno*), a town and archiepiscopal see of Prussia, province of Posen, 31 miles north-east from Posen by the railway to Thorn. It has new (Renaissance) administrative offices (1898) and a monument to the Emperor Frederick III. (1895); and linen and woollen weaving, and distilleries. Population (1885), 15,757; (1900), 21,661.

Goa, a territorial possession of Portugal, in India, bearing the official title of State of India. It embraces the three districts of Goa, Damão, and Diu, and stretches 60 miles along the Indian Ocean between 14° 53′ and 15° 44′ N. lat. The mean annual temperature at Panjim is 79·7° F., and at Satari 78·8°. Palms take the first place amongst the flora, especially the following species: *Cocus nucifera, Areca catechu, Caryota urens, Phœnix silvestris, Borassus flabelliformis, Cucifera thebaica* (date-palm), and *Corypha umbraculifera.* Other noteworthy vegetable products are the mango, three species of bananas, the bamboo, breadfruit tree, *sissó* (*Dalbergia sissoides*), teak (*Tectona grandis*), cutch or catechu (*Acacia catechu*), and *maura* (*Bacia latifolia*). Iron exists in various parts of the territory, and is extracted at Embarbacem and Astagraar. Agriculture is the principal occupation, and rice the principal crop; next comes the cocoanut, both for the nuts and for the juice (*sura*). Other cultivated products are betel-nut and bananas. Salt is very extensively prepared, and gives employment to nearly 2000 persons, who produce 23,200 tons of salt annually. Large quantities of native spirits are distilled from the palms. The average annual value of the imports for the three years 1894–96 was £216,800, and of the exports £114,800. In 1900 the imports through Marmagáo were valued at £53,160 and the exports at £25,700; and in addition there was a transit trade valued at £422,000. Goa imports textiles, cattle, wine, tea, rice, drugs, corn, potatoes and other edible roots, butter, sugar, oils, and tobacco; and exports cocoanuts, spices, fish, cashew nuts, bamboos, poultry, and timber. Trade is carried on almost entirely with Bombay, Madras, Kathiawar, and Portugal. A line of railway (51 miles) runs from Marmagáo to Castle Rock (on the Western Ghats). The area of the territory is estimated at 1400 square miles, and the population is 494,836 (1894), as compared with 420,868 (1881). The territory is ruled by a governor-general, and forms a separate ecclesiastical province of Portugal. Its capital is Nova Goa or Panjim, where there are a lyceum, normal school, seminary, technical school, and experimental agricultural station. For 1900–1901 the estimated revenue was £229,100, and expenditure £228,700.

See E. VILLAÇA, *Relatorio e Propostas de Lei*, Lisbon, 1899; LOPES MENDES, *A India Portuguesa*, Lisbon, 1886; and E. DE VASCONCELLOS, *As Colonias Portuguesas*, Lisbon, 1896–97. (E. DE V.)

Goalpara, a town and district of British India, in the Brahmaputra Valley division of Assam. The town (population, 5500) overlooks the Brahmaputra. It has declined in importance since the district headquarters were removed to Dhubri in 1879, and it suffered severely from the earthquake of 12th June 1897. The DISTRICT comprises an area of 3954 square miles. Its population in 1881 was 446,232, and in 1891 was 452,304, giving an average density of 114 persons per square mile. Classified according to religion, Hindus numbered 209,925; Mahommedans, 124,455; hill tribes, 116,112; Christians, 1632, of whom 51 were Europeans; "others," 180. In 1901 the population was 462,083, showing an increase of 2 per cent. The land revenue was Rs.1,25,383, the incidence of assessment being one pie per acre on the permanently settled portion, and R.1–6 on the rest; the number of police was 256; the number of boys at school in 1896–97 was 5896, being 16·6 per cent. of the male population of school-going age; the registered death-rate in 1897 was 49·65 per thousand. Tea cultivation does not flourish anywhere in the district. In 1897 there were three gardens, with 410 acres under tea, yielding 140,798 ℔. DHUBRI (population, 5000), the administrative headquarters of the district, stands on the Brahmaputra where that river takes its great bend south. It is the termination of the emigration road from North Bengal and also of the river steamers that connect with the North Bengal railway. In 1897, 66,952 coolie immigrants passed through.

Gobi or Shamo, the name which was formerly given to the whole of the steppes (dry prairies) and the stony or sandy deserts in Central Asia, extending in the form of a large crescent from the Pamirs in the south-west to the eastern corner of Transbaikalia, or Lake Dalai, in the north-east. In the north-west they are bounded by the highlands of the Eastern Tian-Shan and North-western Mongolia and by the Kentei escarpment, while along their south-eastern border the Kuen-lun, the Altyn-tagh, and the Nian-shan mountains separate them from the still higher and still more dreary plateaus of Northern Tibet, the Nian-shan joining by means of a succession of not yet explored plateaus and mountains the great Khingan border-ridge which separates the Gobi from Manchuria. Taken in this sense, the Gobi may be regarded as the lower terrace of the high plateau of East Asia. The western portions, however, of this immense region, which are watered by the Tarim, and belong geographically to the basin of Lob Nor (*nor* meaning lake), and politically to East Turkestan, may be conveniently considered as a separate region, which is known in Central Asia as the Taklamakan desert, and by geographers as the Tarim basin. The Gobi would thus be that part of the lower terrace which lies to the east of the 92nd degree of E. longitude (Greenwich), and would naturally be divided into two parts, the Western Gobi and the Eastern Gobi. (See MONGOLIA.)

Goch, a town of Prussia, in the Rhine province, 8 miles by rail south of Cleves. It manufactures brushes, plush goods, and cigars, and has oil-mills. In the Middle Ages it was the seat of a large trade in linen. Population (1900), 9101.

Godalming, a municipal borough and market-town in the Guildford parliamentary division of Surrey, England, on the Wey, 4 miles S.S.W. of Guildford by rail. Amongst its more recent buildings are a Masonic hall, the Victoria Hall, a home for epileptic women, and the technical institute and school of science and art. A drainage system costing £50,000 has been completed. Charterhouse School, originally founded in 1611, was transferred from London to Godalming in 1872. It stands within grounds 92 acres in extent, about half a mile north of Godalming, and consists of spacious buildings in Gothic style, with a chapel, library, and hall, besides boarding-houses, masters' houses, and sanatoria. The school has 34 masters and about 570 pupils. Area of municipal borough, 708 acres. Population (1901), 8748.

Godard, Benjamin Louis Paul (1849–1895), French composer, was born in Paris, 18th August 1849. He studied at the Conservatoire, and competed for the Prix de Rome without success in 1866 and 1867. He began by publishing a number of songs, many of which are charming, such as "Je ne veux pas d'autres choses," "Ninon," "Chanson de Florian," also a quantity of piano pieces, some chamber music, including several violin sonatas, a trio for piano and strings, a quartet for strings, a violin concerto, and a second work of the same kind entitled "Concerto Romantique." Godard's chance arrived in the year 1878, when with his dramatic cantata, *Le Tasse*, he shared with M. Théodore Dubois the honour of winning the musical competition instituted by the city of Paris. From that time until his death Godard composed a surprisingly large number of works, including four operas, *Pedro de Zalamea*, produced at Antwerp in 1884; *Jocelyn*, given in Paris at the Théâtre du Château d'Eau, in 1888; *Dante*, played at the Opéra Comique two years later; and *La Vivandière*, left unfinished and partly scored by another hand. This last work was heard at the Opéra Comique in 1895, and has been played in England by the Carl Rosa Opera Company. His other works include the "Symphonie Légendaire," "Symphonie Gothique," "Diane," and various orchestral works. Godard's productivity was enormous, and his compositions are, for this reason only, decidedly unequal. He was at his best in works of smaller dimensions, and has left many exquisite songs. Among his more ambitious works the "Symphonie Légendaire" may be singled out as being one of the most distinctive. He had a decided individuality, and his premature death at Cannes on 10th January 1895 was a loss to French art. (A. HE)

Godavari, a district of British India, in the north-east of the Madras Presidency, with an area of 7857 square miles. The population in 1891 was 2,078,782, being 264 persons per square mile for the hill-tracts alone, 42 per square mile, but rising to 407, for the rest of the district; in 1901 the population was 2,303,495, showing an increase of 11 per cent. The land revenue and rates (1898) were Rs.68,48,232, the incidence of assessment per acre being Rs.3–11–4 in *ryotwari* and R.0–13–3 in *zamindari* lands; the number of police was 1416. In 1897–98, out of a total cultivated area of 1,028,646 acres, 616,564 were irrigated from Government canals. The country has always been able to provide a large surplus for export. The principal crops are rice, millet, other food grains, pulse, oil-seeds, tobacco, sugar, and cotton. The cigars known in England as Lunkas are partly made from tobacco grown on *lankas* or islands in the river Godavari. The administrative headquarters are now at Cocanada, the chief seaport; but Rajahmundry, at the head of the delta, is the old capital. A large and increasing trade is conducted at Cocanada and Coringa, rice being there shipped to the Maldives, Mauritius, and Ceylon. At both these places rice-cleaning mills have been established. In 1897–98 the total sea-borne trade of the district was valued at Rs.2,07,82,027, of which just half was with foreign countries. The district is traversed by the main line of the East Coast railway, with a branch to Cocanada; the iron girder bridge of forty-two spans over the Godavari

river near Rajahmundry was opened in 1900. There is a Government college at Rajahmundry, with a training college attached, and an aided college at Cocanada. In 1896–97 there were altogether 1538 schools, attended by 50,945 pupils. There are thirteen printing-presses, issuing three English and three vernacular periodicals, and several libraries, reading-rooms, and literary institutes. The registered death-rate in 1897 was 22·8 per thousand.

Godesberg, a village of Prussia, in the Rhine province, Germany, on the left bank of the Rhine, 4 miles by rail south from Bonn. It is a favourite summer resort, with numerous villas belonging to the manufacturers and merchants of Cologne, Elberfeld, Crefeld, and other towns. There are three churches, including the Roman Catholic, built in the Gothic style in 1862, a famous hydropathic (1859), chalybeate springs (1864–65), a fine park (1892), and on a basalt peak (246 feet above the town) the ruins of Godesberg castle, built by the Archbishop of Cologne in the 13th and 14th centuries, and destroyed by the Elector of Bavaria in 1583. Population (1900), 8927.

Godhra, a town of British India, administrative headquarters of the Panch Mahals district of Bombay, and also of the Rewa Kantha political agency; situated in 22° 46′ N. lat. and 73° 40′ E. long., 52 miles north-east of Baroda. Population, 14,000. It is on the line from Anand to Rutlam, and has a Telang high school, and a printing-press issuing a vernacular newspaper.

Göding, the chief town of a government district in Southern Moravia, on the right bank of the river March, at this point forming the frontier between Austria and Hungary, and becoming navigable. The old imperial castle is the centre of the Moravian family estates of the Austrian reigning house. The manufactures comprise tobacco, white-lead, starch, and cloth. Population, half Czech (1890), 8482; (1900), 10,231.

Godkin, Edwin Lawrence (1831–1902), American author, was born of English parents in Moyne, County Wicklow, Ireland, 2nd October 1831, and graduated at Queen's College, Belfast, in 1851. In the Crimean war, from 1854 to 1856, he was correspondent of the London *Daily News*. In 1856 he made the United States his home, and was admitted to the bar in 1859, but continued his journalistic work. In 1865—partly because of a scheme on the part of several friends of the lately freed Africans to establish a newspaper to promote the interests of the coloured population—he was enabled to carry out a cherished plan to edit an American political and critical weekly somewhat on the lines of the London *Spectator*; and the *Nation* was started in New York, with Mr Godkin as its leading spirit. In 1881, with Carl Schurz and Horace White, he acquired control of the New York *Evening Post* (daily), and the *Nation* was thenceforward made up of matter appearing in the *Post*. He retired on account of ill-health in 1899. His principal work was done in advocacy of political independence, free trade, and civil service reform, which he defended with a satirical pen. From his articles in the *Nation* and other periodicals he gathered several volumes, of which the chief are *Reflections and Comments 1865–95*, and *Unforeseen Tendencies of Democracy* (1898). He died at Brixham, England, on 21st May 1902.

Gödöllö, a market town of Hungary, 23 miles distant from Budapest, in the county of Pest-Pilis-Solt-Kis-Kun, with 5885 inhabitants in 1900. The king's summer castle, which formerly belonged to the princes Grassalkovich, was, along with the beautiful domain, presented by the Hungarian nation to King Francis Joseph I. after the coronation in 1867. In its park there are a great number of stags and wild boars. Gödöllö is a favourite summer resort of the inhabitants of Budapest. In its vicinity is the famous place of pilgrimage Mária-Besnyö, with a fine Franciscan cloister, wherein lived Fessler, the Hungarian historiographer.

Gokcha (*Gök-chai*; Armenian, *Sevanga*; ancient *Göhkaruni*), the largest lake of Transcaucasia, government Erivan, Russia, 40° 9′ to 40° 38′ N. and 45° 1′ to 45° 40′ E. Its altitude is 6340 feet; it is of triangular shape, and measures from north-west to south-east 45 miles, its greatest width being 27 miles and its maximum depth 57 fathoms. Two peninsulas divide it into two parts, united by a strait 5 miles wide. It lies on a high plateau, surrounded by 12,000 feet of high, barren mountains of volcanic origin, and receives twenty-eight mountain rivers, which mostly dry up in summer. Its outflow is the Zanga, left bank tributary of the Araks (*Araxes*); it never freezes, and its level undergoes periodical oscillations. It contains four species of *Salmonidæ*, and two of the *Cyprinidæ*, which are only met with in the drainage area of this lake.

Golcar, a township in the Colne Valley parliamentary division of the West Riding of Yorkshire, England, 3 miles W.S.W. of Huddersfield by rail. It stands on the Colne Valley canal. The chief industry is the manufacture of fancy woollen goods. Area of urban district, 1593 acres. Population (1881), 7653; (1901), 9260.

Gold.—The nature and history of this metal were fully dealt with in the ninth edition of the *Ency. Brit.*, and the quantities produced in various countries for years ranging from 1875 to 1879 were also given. For many years afterwards the annual production continued to decrease, the average production of the five years 1881–85 being the smallest since the Australian and Californian mines began to be worked in 1848–49. It was not until after 1885 that the annual output of the world began to expand. Of the total production in 1876 almost the whole was derived from the United States, Australasia, and Russia. Since then the proportion furnished by these countries has been greatly lowered by the appearance of South Africa, Canada, India, and China among the gold-producers. The increase of production has not been uniform, the greater part having occurred most notably since 1895. Among the regions not previously important as gold-producers which now contribute to the annual output, the most remarkable are the goldfields of South Africa (Transvaal), which were discovered in 1885. India likewise has been added to the list, its active production having begun at about the same time as that of South Africa. The average annual product of India for the period 1886 to 1899 inclusive was £698,208, and its present annual product averages from 450,000 to 500,000 ounces, or about £1,900,000, obtained almost wholly from the free-milling quartz veins of the Colar goldfields in Mysore, Southern India. Canada, too, has assumed an important rank, having contributed in 1900 £5,583,300. This great increase was due to the development of the goldfields of the North-Western Territory, especially British Columbia. From the district of Yukon (Klondike, &c.) £2,800,000 were obtained in 1899, wholly from alluvial workings, but the progress made since has been slower than was expected by sanguine people. It is, however, probable that the North-Western Territory will continue to yield gold in important quantities for

some time to come, though it is impossible to make any estimate of the future annual output.

The output of the United States increased from 1,678,612 ounces in 1881 to 3,829,897 ounces in 1900. The provisional estimate of the director of the United States Mint for 1901 was for a value of £16,043,800, against £15,864,000 in 1900. This increase was chiefly due to the exploitation of new goldfields. The fall in the price of silver stimulated the discovery and development of gold deposits, and many States formerly regarded as characteristically silver districts have become important as gold producers. Colorado is a case in point, its output having increased during the period under review from about £600,000 to £6,065,000 in 1900. Somewhat more than one-half of the Colorado gold is obtained from the Cripple Creek district. Other States also showed a largely augmented product. On the other hand, the output of California, which was producing over £3,000,000 per annum in 1876, has fallen off, the average annual output from 1876 to 1900 being £2,800,000. This decrease was largely caused by the practical suspension for many years of the hydraulic mining operations, in preparation for which millions of dollars had been expended in deep tunnels, flumes, &c., and the active continuance of which might have been expected to yield some £2,000,000 of gold annually. This interruption, due to the practical prohibition of the industry by the United States courts, on the ground that it was injuring, through the deposit of tailings, agricultural lands and navigable streams, was lessened, though not entirely removed, by compromises and regulations which permit, under certain restrictions, the renewed exploitation of the ancient river-beds by the hydraulic method. On the other hand, the progressive reduction of mining and metallurgical costs effected by improved transportation and machinery, and the use of high explosives, compressed air, electric-power transmission, &c., resulted in California (as elsewhere) in a notable revival of deep mining. This was especially the case on the "Mother Lode," where highly promising results were obtained. Not only is vein-material, formerly regarded as unremunerative, now extracted at a profit, but in many instances increased gold-values have been encountered below zones of relative barrenness, and operators have been encouraged to make costly preparations for really deep mining—more than 3000 feet below the surface. The gold product of California, therefore, may be fairly expected to maintain itself, and, indeed, to show an advance. Alaska first appeared in the list of gold-producing countries in 1880, and gradually increased its annual output until the year 1900, when it yielded 375,922 ounces. The Alaska gold is derived at present almost wholly from the large low-grade quartz mines of Douglas Island. But in 1899 another important district was discovered at Cape Nome, on the north-western coast. The result of a few months' working during that year was more than £500,000 of gold, and a very much larger annual output may reasonably be anticipated in the future. The gold occurs in alluvial deposits designated as gulch-, bar-, beach-, tundra-, and bench-placers. The tundra is a coastal plain, swampy, and covered with undergrowth and underlaid by gravel. The most interesting and, thus far, the most productive are the beach deposits, similar to those on the coast of Northern California. These occur in a strip of comparatively fine gravel and sand, 150 yards wide, extending along the shore. The gold is found in stratified layers, with "ruby" and black sand. The "ruby" sand consists chiefly of fine garnets and magnetites, with a few rose-quartz grains. As yet the relative importance of the other placers has not been determined. Further exploration of the interior will probably result in the discovery of additional gold districts. Mexico, from a gold production of £200,000 in 1891, advanced to about £1,881,800 in 1900. Of this increase, a considerable part was derived from gold-quartz mining, though much was also obtained as a by-product in the working of the ores of other metals. The product of Colombia, Venezuela, the Guianas, Brazil, Uruguay, Argentina, Chile, Bolivia, Peru, and Ecuador amounted in 1900 to £2,481,300, of which Colombia and the Guianas supplied more than one-half.

In 1876 Australasia produced £7,364,120, of which Victoria contributed £3,984,349. The annual output of Victoria declined until the year 1892, when it began to increase rapidly, but not to its former level, the value for 1900 having been £3,142,400. There has been an important increase in Queensland, which from £1,696,304 in 1876 advanced to £3,248,000 in 1899. There has been no increase and, indeed, no large fluctuation until quite recently in the output of New Zealand, which averaged £1,054,000 per annum from 1876 to 1898, but the production of the two years 1899 and 1900 rose to £1,472,600 and £1,394,520 respectively. By far the most important addition to the Australasian product has come from West Australia, which began its production in 1887—about the time of the inception of mining at Witwatersrand ("the Rand") in South Africa —and by continuous increase, which assumed large proportions towards the close of the 19th century, was 1,643,873 ounces, or £6,426,000, in 1899 and 1,580,949 ounces, or £6,179,000, in 1900. For 1901 the yield was returned at 1,869,459 ounces, subject to revision.

Undoubtedly the greatest of the gold discoveries made in the latter half of the 19th century was that of the Witwatersrand district in the Transvaal. By reason of its unusual geological character and great economic importance this district deserves a more extended description. The gold occurs in conglomerate beds, locally known as "banket." There are several series of parallel beds, interstratified with quartzite and schist, the most important being the "main reef" series. The gold in this conglomerate reef is partly of detrital origin and partly of the genetic character of ordinary vein-gold. The formation is noted for its regularity as regards both the thickness and the gold-tenor of the ore-bearing reefs, in which respect it is unparalleled in the geology of the auriferous formations. The gold carries, on an average, £2 per ton, and is worked by ordinary methods of gold-mining, stamp-milling, and cyaniding. In 1899, 5762 stamps were in operation, crushing 7,331,446 tons of ore, and yielding £15,134,000, equivalent to 25·5 per cent. of the world's production. Of this, 80 per cent. came from within 12 miles of Johannesburg. After September 1899 operations were suspended, almost entirely owing to the war, but on 2nd May 1901 they recommenced, and some progress had been made by January 1902 towards placing the industry in its former position. The total for the eight months ended 31st December 1901 was 238,991 ounces. So certain is the ore-bearing formation that engineers in estimating its auriferous contents feel justified in assuming, as a factor in their calculations, a vertical extension limited only by the lowest depths at which mining is feasible. On such a basis they arrived at more than £600,000,000 as the available gold contained in the Witwatersrand conglomerates. At the rate of exploitation in 1899 this amount would be extracted in about thirty years, but this period will, it is assumed, be diminished by increase in the magnitude of the exploitations. Deposits similar to the Witwatersrand banket occur in Zululand, and also on the Gold Coast of

Africa; but these localities have been worked to a small extent only. Considerable mining developments are being made in Rhodesia, the country lying north of the Transvaal, where gold occurs in well-defined quartz-veins, and there is unquestionable evidence of extensive ancient workings. The economic importance of the region generally has not been fully proved, mining by modern methods being still in its infancy there. Rhodesia produced 91,940 ounces in 1900 and 172,061 ounces in 1901, in spite of the South African war.

The gold production of Russia during the period under review was remarkably constant, averaging £4,899,262 per annum; the gold is derived chiefly from placer workings in Siberia. Gold discoveries have been made in Eastern and Southern Siberia, from which an important output may be expected. The completion of the trans-Siberian railway will stimulate mining.

The gold production of China was estimated for 1899 at £1,328,238 and for 1900 at £860,000, showing approximately the average annual production from 1883 to 1900 inclusive. Considerable increase will doubtless attend the development of the empire.

Table of the Quantities of Gold produced in the Undermentioned Countries in the Years named (*in ounces*).

Year.	Australasia.	Africa.	Canada.	India.	Mexico.	Russia.	United States.	Other Countries.	Total.
1881	1,475,161	...	52,483	...	41,545	1,181,853	1,678,612	547,326	4,976,980
1882	1,438,067	...	52,000	..	45,289	1,154,613	1,572,187	563,638	4,825,794
1883	1,333,849	...	46,150	...	46,229	1,132,219	1,451,250	849,805	4,859,502
1884	1,352,761	...	46,000	...	57,227	1,055,642	1,489,950	901,309	4,902,889
1885	1,309,804	...	53,987	...	46,941	1,225,738	1,538,325	827,789	5,002,584
1886	1,257,670	...	66,061	...	29,702	922,226	1,693,125	1,075,579	5,044,363
1887	1,290,202	[1] 28,754	59,884	15,403	39,861	971,656	1,596,375	1,059,355	5,061,490
1888	1,344,002	[1] 240,266	53,150	35,034	47,117	1,030,151	1,604,841	821,062	5,175,623
1889	1,540,607	[1] 366,023	62,658	78,649	33,862	1,154,076	1,587,000	788,370	5,611,245
1890	1,453,172	497,817	55,625	107,273	37,104	1,134,590	1,588,880	855,505	5,726,966
1891	1,518,690	729,268	45,022	131,776	48,375	1,168,764	1,604,840	1,040,856	6,287,591
1892	1,638,238	1,210,869	43,905	164,141	54,625	1,199,809	1,597,098	1,193,487	7,102,172
1893	1,711,892	1,478,477	44,853	[2] 207,152	63,144	1,345,224	1,739,323	1,182,520	7,772,585
1894	2,020,180	2,024,164	50,411	210,412	217,688	1,167,455	1,910,813	1,212,725	8,813,848
1895	2,170,505	2,277,640	92,440	257,830	290,250	1,397,767	2,254,760	1,073,313	9,814,505
1896	2,185,872	2,280,892	136,274	323,501	314,437	1,041,794	2,568,132	1,099,959	9,950,861
1897	2,690,278	3,034,679	294,582	390,595	362,812	1,124,511	2,774,935	1,027,506	11,699,898
1898	3,235,638	4,295,609	669,445	418,944	411,187	1,231,791	3,118,398	1,026,250	14,407,262
1899	4,105,526	4,195,961	1,031,563	456,020	450,000	1,072,333	3,437,210	1,001,736	15,750,349
1900	3,764,548	562 307	1,258,000	513,266	[3] 420,000	[3] 1,100,000	3,837,215	[3] 1,046,734	[4] 12,502,070

[1] The Chamber of Mines of the late South African Republic in its report for the year ended 30th December 1899 gives a table from which it appears that the total output of 1887, 1888, and 1889 was 642,804 ounces, of which 42,000 ounces represent "estimated unrecorded production" for those years. The figures given above show a total of 635,043 ounces, and it is unnecessary to alter them.

[2] Incomplete. [3] Estimated. [4] Partly estimated.

Metallurgy.—During the period 1875–1900 no radical changes were made in the amalgamation of gold ores, nor was there any great improvement in crushing the ores. By increased weight of stamps, and by the use of "self-feeders," the capacity of the batteries has been considerably enlarged. Where conditions are specially favourable, other classes of pulverizing machines are sometimes used. The cyanide process is the only radically new departure in gold metallurgy proper. It is mainly used in the treatment of battery-tailings, and has been found of advantage. It consists essentially in (1) the solution of the gold in cyanide of potassium; (2) the precipitation of the dissolved gold by means of zinc (M'Arthur Forrest process), or by electricity (Siemens and Halske, and other modifications); and (3) the fusion and casting into ingots of the precipitated gold. Gold ores, other than tailings, are occasionally cyanided in the raw state, or after the preliminary roasting. The process is applicable also to the recovery of gold from certain classes of auriferous pyrites. To render the process economically successful the gold must be in a fine state of division, and the ores must not carry too great a percentage of deleterious substances, the presence of which necessitates an excessive consumption of cyanide and of zinc. Preliminary roasting may extend the application of the process to the treatment of base ores. Cyaniding has in many cases superseded the chlorination process, though in America the latter is still often preferred where a preliminary roasting is required. About 33 per cent. of the gold produced in the Witwatersrand district is extracted by the cyanide process, to which the gold ores of that district are exceptionally adapted. When conducted on a large scale the entire metallurgical treatment of the Witwatersrand ores, *i.e.*, the crushing and amalgamation of the ore and the cyaniding of the tailings and slimes, costs about six shillings per ton, the cost of cyaniding being about two to four shillings per ton. From 90 to 95 per cent. of the assay value of the ore is recovered by these combined processes in the Witwatersrand district.

In the extraction of gold from concentrates by the chlorination process the use of sulphur dioxide or hydrogen sulphide as precipitants is more general now than formerly, these reagents being deemed preferable to ferrous sulphate when time is of importance. Barrel chlorination has to some extent taken the place of chlorination in vats. The chemical reactions are the same in both, but in the barrel process the agitation of the pulp by revolution, and the generation of chlorine by chemical action throughout the mass, facilitates and hastens the solution of the gold. The most noteworthy improvement in refining is the Wohlevill electrolytic process, which has been successfully employed in the two principal gold refineries of Germany. It is chiefly valuable in cases where the gold is alloyed with a small amount of platinum.

Though revolutionary inventions or improvements in the direct metallurgy of gold have been few, the cost of producing gold has been greatly reduced by causes which have affected other mining and metallurgical industries as well. Among these are to be mentioned the immense increase in the transmission and use of mechanical power, including devices for the handling of large quantities of material with a minimum of manual labour; the use of

high explosives in mining; and especially the immense extension of metallurgical enterprises, based on the reduction of lead or copper ores, in which both gold and silver are obtained practically as by-products. It often happens, for instance, in the United States that the miner of a gold-bearing ore desirable to smelters by reason of its other ingredients can realize 90 to 95 per cent. of its gold value without payment of any smelting charges for that metal. These commercial conditions often act as a competitive limit upon such processes as stamp-milling, amalgamation, chlorination, and cyaniding, the whole cost of which must be assessed upon the gold produced.

In working auriferous river-beds, dredges have been used with considerable success in certain parts of New Zealand and on the Pacific slope in America. The field for such operations is, of course, limited. The dredges used in California are almost exclusively of the endless-chain bucket or steam-shovel pattern. Some dredges have a capacity, under favourable conditions, of 2000 cubic yards of gravel daily, which they handle at a cost of from five to ten cents per cubic yard.

Industrial Consumption.—It is estimated by the director of the United States Mint (*Report upon the Production of the Precious Metals in the United States during the calendar Year* 1899, p. 50) that the world's industrial consumption of gold for the year 1898 amounted to about £15,000,000, of which about £10,750,000, or about 71 per cent., was taken by the United States, Germany, France, and Great Britain. (J. H. H*.)

Gold Coast.—The name "Gold Coast" denotes geographically that portion of the Guinea coast which extends from Asinie upon the west to the river Volta on the east, but it is now generally restricted to the political colony and protectorate of the Gold Coast, belonging to Great Britain. This extends from about 3 degrees west longitude to about 1·14 degrees east longitude, the length of the coast-line being about 350 miles. It is bounded on the west by the French colony of the Ivory Coast, and on the east by German Togoland. On the north the nominal boundary, as against the nominal boundary of the French Sudan, extends to the 11th degree of north latitude, but at the present time the actual extent of the colony and protectorate is very much more circumscribed. Inland the breadth of the protectorate, excluding Ashanti and the Northern Territories, varies considerably, but its breadth appears nowhere greatly to exceed 200 miles, and the average breadth is, for the most part, not much more than 50 miles. The total area, including all the hinterland allotted by European conventions, has been estimated at 74,500 square miles; excluding Ashanti and the Northern Territories, it is about 40,000 square miles, with a population of about 1½ million. The Northern Territories, up to November 1899, were separated from Togoland by a Neutral Zone. The territory thus described was then, however, apportioned between Great Britain and Germany. The river Daka was fixed as the boundary as far north as 9° N. lat., whence it was arranged that the frontier should be so delimited that Gambaga and the territories of Mamprusi fell to the Gold Coast, and Yendi and the territories of Chakosi to Togoland.

The Gold Coast proper possesses no harbours, and bars of sand block the mouths of the rivers. Of the towns, Axim is the port of the gold-mines of Wassau and the outlet of a large timber trade; Elmina has a population of over 11,000, Cape Coast Castle about 12,000, and Accra, the capital, about 20,000. Saltpond, between Cape Coast Castle and Accra, is worthy of notice as the principal centre of the palm oil industry.

For many years the Gold Coast played an important part in the struggle of the various nations for colonial supremacy. Portugal here took the lead, founding San Gorge la Mina (Elmina) in 1470. The English appeared upon the scene in the middle of the 16th century, and were soon followed by the French. More dangerous rivals arose in the shape of the Dutch, who from the end of the 16th century sought to oust the Portuguese from the Gold Coast, and in whose favour the Portuguese did finally withdraw in 1642, in return for the withdrawal on the part of the Dutch of claims to Brazil. Inasmuch as the Dutch did not interfere with the country outside their immediate posts, British and other European traders were able to establish settlements along the coast. The troubles with the powerful native kings of Ashanti, in which the British colony became involved when its importance as a slave-trading centre came to an end, and which latterly were largely due to the acquisition by the British of the territory held by other European Powers, finally culminated (as was shown in the ninth edition under ASHANTI) in the capture of Kumasi in 1874, an event which involved consequences unwished for by the home Government. It was followed by the defection of outlying provinces, some of which became absorbed in the British protectorate. Hostile chiefs were pursued by the Ashanti king into British territory, and a state of unrest was generally prevalent. Remedial measures proved impossible against the obstinacy of King Prempeh, and it became apparent that a state of things had been brought about which necessitated annexation (see below). Ashanti became British in 1896, and in 1899 the governor was able to report that, "taking it as a whole, the country seemed contented and prosperous, a pauper being unknown." An organized rebellion in the following year, which at one time seemed likely to involve very grave consequences, showed that there were still serious troubles to be surmounted before the Ashantis settled down under British rule.

Ashanti.

The Gold Coast is a Crown colony, with a governor, executive council, and legislative council. The executive council consists of five members; the legislative of the same, with the addition of the chief justice and three nominated unofficial members. The supreme court consists of a chief justice and three puisne judges. There are district commissioners, and in the protectorate native chiefs have a limited jurisdiction. There are also travelling commissioners for native affairs, a British resident for Ashanti, and a commissioner for the Northern Territories, as the territories behind the Gold Coast and north of Ashanti are now designated.

The Gold Coast constabulary includes both a military and civil police, the former being mainly recruited from the Hausas.

The following are the figures of the revenue and expenditure during 1896–1900 :—

Year.	Revenue.	Expenditure.
1896	£237,460	£282,277
1897	233,179	401,692
1898	258,822	377,976
1899	422,796	309,656
1900	383,283	272.203

The large deficits in 1897 and 1898 were mainly due to punitive expeditions, £147,587 of the expenditure in 1897 being entirely on account of the Ashanti campaign. The revenue is mainly raised by customs duties. There is still no standing public debt, but the colony is responsible for advances to the amount of £435,448, in great part for the Sekundi-Tarkwa railway.

The trade of the Gold Coast has latterly greatly increased, as the following table shows :—

Year.	Imports.	Exports.
1896	£778,009	£792,111
1897	784,188	857,793
1898	960,336	992,998
1899	1,152,478	1,111,738
1900	1,294,963	885,445

Rubber represents over 50 per cent. in value of the total exports, and palm oil and kernels nearly 20 per cent. Next in importance to these comes gold dust. Cotton goods are the principal import.

Of the potential wealth of the country there can be no question. "Rich in gold, in valuable timber, in soil which will produce almost any commodity of trade value," the great difficulty in the way of

its development is the difficulty of access to the interior. The colony west of Accra is in the forest belt of Africa, and the rivers, though numerous, abound in rocks and rapids. Although hitherto the output of gold has not been very great, it is believed that with the opening of a railway the gold industry is capable of great developments. The export of gold was valued at £86,186 in 1896, but at only £38,007 in 1900. There are said to be twenty miles of banket reef gold in Wassau, Ashanti, and Kwahu, very similar to that in the Transvaal. A railway, from Sekundi, on the coast, to the mining district of Tarkwa, has been constructed, and railway surveys have also been made in various directions. Rubber, which at present remains the staple product, is shipped from Cape Coast Castle, Accra, and Quitta. A large amount of rubber comes from Ashanti, and it is estimated that the output could be easily trebled were the transport rendered cheaper. Palm oil and palm kernels come mainly from the districts behind Saltpond, and from the districts of Aquassim and Crobol. Valuable timbers abound in the hinterland. There is a good road from Cape Coast Castle to Prahsu, and from Accra to Aburi, and a road has been constructed for about fifty miles in the Northern Territories. There are about 700 miles of telegraph open. But whatever the improvement in the means of transport, the unhealthiness of the climate must always be a retarding influence upon the development of the Gold Coast. There are at present only about 200 European inhabitants, and the number will probably not greatly increase.

The rainfall averages at Accra 30 inches in the year, but at other places the fall is much greater. There are two wet seasons, April to July, and October and November. From December to March the dry Harmattan wind blows.

Under the agency of the Basel, Wesleyan, and Roman Catholic missionary societies elementary education is spreading. There are Government schools at Accra, Cape Coast Castle, and Insuaim, and the total number of schools, assisted and not assisted, was, in 1898, 208. Very little has yet been done in the way of secondary education.

AUTHORITIES.—Col. A. B. ELLIS. *The Land of Fetish*, 1883; *The Tshi-speaking Peoples of the West Coast of Africa*, 1887; and a *History of the Gold Coast*, 1893.—FREEMAN. *Travels and Life in Ashanti and Jaman*, 1898.—MACDONALD. *The Gold Coast, Past and Present*, 1898.—*Parliamentary Papers*.—LUCAS. *Historical Geography of the British Colonies*, vol. iii. "West Africa," 2nd ed. 1900.—Major MOCKLER-FERRYMAN. *Imperial Africa*, vol. i., 1898. (H. E. EG.)

Ashanti Expeditions, 1895–1900.

The treaty arranged between the British authorities and the Ashantis after the expedition of 1873–74 (see *Ency. Brit.*, 9th ed., ii. 682) had remained practically a dead letter. The road from Kumasi to Cape Coast Castle had not been kept open to trade. The indemnity had only been paid in part. Human sacrifices continued. Under King Prempeh the Ashanti power became more and more a disturbing influence in the hinterland of the Gold Coast colony, and an obstacle to trade and civilization. It was impossible to permit the reign of murder within a short distance of the British frontier, and demands made for the complete fulfilment of the terms of the treaty produced no result. The king declined to treat with the governor of the Gold Coast, and despatched informal agents to England, whom the Secretary of State refused to receive. To put an end to the misgovernment and barbarities carried on at Kumasi, and to establish law, order, and security for trade, an expedition was at length decided upon. The force, placed under Colonel Sir Francis Scott, consisted of the 2nd West Yorkshire Regiment, a "special service corps," made up of detachments from various regiments in the United Kingdom, under specially selected officers; the 2nd West India Regiment, and the Gold Coast and Lagos Hausas. The composition of the special service corps was much criticized at the time; but as it was not called upon for fighting purposes, no inferences as to its efficiency are possible. The details of the expedition were carefully organized. Before the arrival of the staff and contingent from England the native forces were employed in improving the road from Cape Coast Castle to Prahsu (70 miles), and in establishing road stations to serve as standing camps for the troops. About 12,000 carriers were collected, the load allotted to each being 50 ℔. In addition, a force of native scouts, which ultimately reached a total of 860 men, was organized in eighteen companies and partly armed with Snider rifles to cover the advance of the main column and to improve the road. The king of Bekwai having asked for British protection, a small force was pressed forward and occupied this native town, about 25 miles from Kumasi, on 4th January 1896. The advance continued, and at Ordahsu a mission arrived from King Prempeh offering unconditional submission. On 17th January Kumasi was occupied, and Colonel Sir F. Scott received the king. Effective measures were taken to prevent his escape, and on the 20th Prempeh made submission to Mr Maxwell, the governor of Cape Coast, in native fashion. The king, with the queen mother and the principal chiefs, was then arrested and taken as a prisoner to Cape Coast Castle, where they were embarked on board H.M.S. *Racoon* for Elmina. The fetish buildings at Bantama were burned, and on 22nd January Bokro, a village 5 miles from Kumasi, and Maheer, the king's summer palace, were visited by the native scouts and found deserted. On the same day, leaving the Hausas at Kumasi, the expedition began the return march of 150 miles to Cape Coast Castle. The complete success of the expedition was due to the excellent organization of the supply and transport services, while the promptitude with which the operations were carried out probably accounts in great measure for the absence of resistance. Although no fighting occurred, a heavy strain was thrown upon all ranks, and fever claimed many victims, among whom was Prince Henry of Battenberg, who had volunteered for the post of military secretary to Colonel Sir F. Scott. (G. S. C.)

Expedition of 1895-96.

Expedition of 1900.

In 1900, after four years of peace, a serious rebellion broke out in Ashanti. The tribes involved were the Kumasis, Adansis, and Kokofus; the other tribes of the Ashanti confederation remained loyal. The rebels were, however, able to command a force reported to number 40,000. On 28th March the governor of the Gold Coast, Sir F. Hodgson, in a public palaver at Kumasi, announced that the Ashanti chiefs would have to pay the British Government 4000 ounces of gold yearly, and he reproached the chiefs with not having brought to him the Golden Stool—the emblem of sovereignty among the Ashantis—which the Kumasis had kept hidden since 1896. Three days afterwards the Kumasi warriors attacked a party of Hausas sent with the chief object of discovering the Golden Stool. (In the previous January a secret attempt to seize the Stool had failed.) The Kumasis, who were longing to wipe out the dishonour of having let Prempeh be deported without fighting, next threatened the fort of Kumasi. Mr Ramseyer and the other Basel missionaries, and Sir F. and Lady Hodgson, took refuge in the fort, and reinforcements were urgently asked for. On 18th April 100 Gold Coast constabulary arrived. On the 29th the Kumasis attacked in force, but were repulsed. The same day a party of 250 Lagos constabulary reached Kumasi. They had fought their way up, and came in with little ammunition. On 15th May Major Morris arrived from the British territory north of Ashanti, also with 250 men. The garrison now numbered 700. The 29 Europeans in the fort included four women. Outside the fort were gathered 3000 native refugees. Famine and disease soon began to tell their tale. Sir F. Hodgson sent out a message on 4th June (it reached the relieving force on 12th June), saying that they could only hold out to 11th June. However, it was not till 23rd June that the governor and all the Europeans save three, together with

600 Hausas of all ranks, sallied out of the fort. Avoiding the main road, held by the enemy in force, they attacked a weakly held stockade, and succeeded in cutting their way through, with a loss of two British officers mortally wounded, 39 Hausas killed, and double that number wounded or missing. The governor's party reached Cape Coast Castle safely on 10th July.

A force of 100 Hausas, with three white men (Captain Bishop, Mr Ralph, and Dr Hay), was left behind in Kumasi fort with rations to last three weeks. Meantime a relief expedition had been organized at the Gold Coast by Lieut.-Colonel Willcocks. This officer reached Cape Coast Castle from Nigeria on 26th May. The difficulties before him were appalling. Carriers could scarcely be obtained, there were no local food supplies, the rainy season was at its height, all the roads were deep mire, the bush was almost impenetrable, and the enemy were both brave and cunning, fighting behind concealed stockades. It was not until the 2nd of July that Colonel Willcocks was able to advance to Fumsu. On the next day he heard of the escape of the governor and of the straits of the garrison left at Kumasi. He determined to relieve the fort in time, and on the 9th of July reached Bekwai, the king of which place had remained loyal. Making his final dispositions, the colonel spread a report that on the 13th he would attack Kokofu, east of Bekwai, and this drew off several thousands of the enemy from Kumasi. After feinting to attack Kokofu, Colonel Willcocks suddenly marched west. There was smart fighting on the 14th, and at 4.30 P.M. on the 15th, after a march since daybreak through roads "in indescribably bad condition," the main rebel stockade was encountered. It was carried at the point of the bayonet by the Yoruba troops, who proved themselves fully equal to the Hausas. "The charge could not have been beaten in *élan* by any soldiers." Kumasi was entered the same evening, a bugler of the war-worn garrison of the fort sounding "the general salute" as the relieving column came in view. Most of the defenders were too weak to stand. Outside the fort nothing was to be seen but burnt-down houses and putrid bodies. The relieving force that marched into Kumasi consisted of 1000 fighting men (all West Africans), with 60 white men, two 75-millimetre guns, four seven-pounder guns, and six Maxims.

Kumasi relieved, there remained the task of crushing the rebellion. Colonel Willcocks's force was increased by Yaos from Central Africa and by Sikhs to a total of 3368 natives, with 134 British officers, and 35 British non-commissioned officers. In addition there were Ashanti levies. On the 30th of September the Kumasis were completely beaten at Obassa. Thereafter many of the rebel chiefs surrendered, and the only two remaining in the field were captured on 28th December. Thus 1901 opened with peace restored. The total number of casualties during the campaign (including those who died of disease) was 1007. Nine British officers were killed in action, 43 were wounded, and six died of disease. The commander, Lieut.-Colonel Willcocks, was promoted colonel, created a K.C.M.G., was mentioned in the King's speech at the opening of Parliament in 1901, and received the freedom of the City of London, with a sword of honour. Sir F. Hodgson was appointed Governor of Barbados, and Major Nathan took his place on the Gold Coast. By an Order in Council, dated 26th September 1901, Ashanti was formally annexed to the British dominions.

(F. R. C.)

Goldie, Sir George Dashwood Taubman (1846- ——), British colonial administrator, was born on 20th May 1846 at the Nunnery in the Isle of Man, being the youngest son of Lieut.-Colonel John Taubman Goldie-Taubman, Speaker of the House of Keys, by his second wife Caroline, daughter of John E. Hoveden of Hemingford, Cambridgeshire. Sir George resumed his paternal name, Goldie, by royal licence in 1887. He was educated at the Royal Military Academy, Woolwich, and for a few months held a commission in the Royal Engineers. He travelled in all parts of Africa, gaining an extensive knowledge of the continent, and first visited the country of the Niger in 1877. He was impressed by the advantage to be gained by uniting all British interests in that region, and in 1879 succeeded in promoting the United African Company. In 1881 a charter was sought from Government, the capital of the company was raised from £125,000 to £1,000,000, and it was renamed the National African Company. The French traders who established stations on the Lower Niger rendered it difficult to obtain any territorial rights in the country, but in 1884 they were bought out, prior to the meeting of the Berlin Conference, where Taubman was present as an expert on matters relating to the Niger. Through Joseph Thompson, the explorer of Masailand, treaties were made with over three hundred native chiefs, and in July 1886 a charter was at length granted, the National African Company becoming the Royal Niger Company, with Lord Aberdare as governor and Taubman as vice-governor. In 1887 Goldie was created K.C.M.G., and in 1897 he took part in the successful expedition of the company against the Mahommedan states of Nupé and Ilorin. In the following year the differences with France in regard to the frontier line became acute, and compelled the intervention of the British Government. It was evidently impossible for a commercial association to hold its own against the State-supported protectorates of France and Germany, and in consequence, on 1st January 1900, the Royal Niger Company transferred its territories to the British Government for the sum of £865,000. The ceded territory was styled the protectorate of Northern Nigeria, and placed under the governorship of Colonel Lugard. Goldie was created a privy councillor in 1898. He is honorary D.C.L. of Oxford University (1897) and honorary LL.D. of Cambridge (1897). He married in 1870 Matilda Catherine (died 1898), daughter of John William Elliott of Wakefield.

Goldingen (Lettish, *Kuldiga*), a district town of Russia, government of Courland, 40 miles S.E. of Windau, on Windau river. It has woollen mills, needle and match factories, as well as a gymnasium for boys of the Courland nobility, and a college for teachers. Population (1897), 9733.

Goldmark, Karl (1832- ——), Hungarian composer, was born at Keszthely-am-Plattensee, in Hungary, on 18th May 1832. His father, a poor cantor in the local Jewish synagogue, was unable to assist to any extent financially in the development of his son's talents. Yet in the household much music was made, and on a cheap violin and home-made flute, constructed by Goldmark himself from reeds cut from the river-bank, the future composer gave rein to his musical ideas. This was helped on by the village schoolmaster, by whose aid he was able to enter the music-school of the Oedenburger Verein. Here he remained but a short time, his success at a school concert finally determining his parents to allow him to devote himself entirely to music. In 1844, then, he went to Vienna, where Jansa took up his cause and eventually obtained for him admission to the conservatorium. For two years Goldmark worked under Jansa at the violin, and on the outbreak of the revolution, after studying all the orchestral instruments he obtained an engagement in

the orchestra at Raab. There, on the capitulation of Raab, he was to have been shot for a spy, and was only saved at the eleventh hour by the happy arrival of a former colleague. In 1850 Goldmark left Raab for Vienna, where from his friend Mittrich he obtained his first real knowledge of the classics. There, too, he devoted himself to composition, and in the course of a short time he produced a veritable mountain of music. In 1857, while suffering severely from the prevalent Mendelssohn fever, Goldmark, who was then engaged in the Karl-theater band, gave a concert of his own works with such success that his first quartet attracted very general attention. Then followed the "Sakuntala" and "Penthesilea" overtures, in which Goldmark showed how Wagner's influence had cured his aforesaid fever, and the delightful "Ländliche Hochzeit" symphony, which carried his fame abroad. His reputation was now made, and very largely increased by the production at Vienna in 1875 of his first and best opera, *Die Königin von Saba.* Over this opera Goldmark spent seven years. Its popularity is still almost as great as ever. It was followed in November 1886, also at Vienna, by *Merlin*, much of which has been rewritten since then. A third opera, a version of Dickens's *Cricket on the Hearth*, was given by the Royal Carl Rosa Company in London in 1900. Goldmark's chamber music has not made much lasting impression in England, but the overtures "Im Frühling," "Prometheus Bound," and "Sapho" were given fairly constantly some years ago. In the realms of absolute music Goldmark is often dull. A "programme" seems essential to him. In opera he is most certainly at his best, and as an orchestral colourist he ranks among the very highest.

Goldsboro, capital of Wayne county, North Carolina, U.S.A., on the Neuse river, at an altitude of 110 feet. It is on the Atlanta and North Carolina, the Atlantic Coast, and the Southern railways. Population, (1880), 3286; (1890), 4017; (1900), 5877, of whom 76 were foreign-born and 2520 negroes.

Goldschmidt, Madame. See Lind, Jenny.

Golf.—In 1880 the man who travelled about England with a set of golf clubs was an object of some astonishment, almost of alarm, to his fellow-travellers. In those days the commonest of questions in regard to the game was, "You have to be a fine rider, do you not, to play golf?" so confounded was it in the popular mind with the game of polo. At Blackheath a few Scotsmen resident in London had long played golf. In 1864 the Royal North Devon Club was formed at Westward Ho, and this was the first of the seaside links discovered and laid out for golf in England. In 1869 the Royal Liverpool Club established itself in possession of the second English course of this quality at Hoylake, in Cheshire. A golf club was formed in connexion with the London Scottish Volunteers corps, which had its house on the Putney end of Wimbledon Common on Putney Heath; and, after making so much of a start, the progress of the game was slow, though steady, for many years. A few more clubs were formed; the numbers of golfers grew; but it could not be said that the game was yet in any sense popular in England. All at once, for no very obvious reason, the qualities of the ancient Scottish game seemed to strike home, and from that moment its popularity has been wonderfully and increasingly great. The English links that have most risen in favour during recent years is the fine course of the St George's Golf Club, near Sandwich, on the coast of Kent. It is a course that has two chief merits—the primary one of excellence for golf, and the secondary one of accessibility. To the London golfer it was the first course of the first class that was reasonably accessible, and the fact made something like an epoch in English golf. A very considerable increase, it is true, in the number of English golfers and English golf clubs had taken place before the discovery for golfing purposes of the links at Sandwich. Already there was a chain of links all round the coast, besides numerous inland courses; but since 1890 their increase has been extraordinary, so that there are now not much fewer than 1000 golf clubs in Great Britain and Ireland. To compute the average membership of these clubs is very difficult. There is not a little overlapping, in the sense that a member of one club will often be a member of several others; but probably the average may be placed at something like 200 members for each club. The immense amount of golf-playing that this denotes, the large industry in the making of clubs and balls, in the upkeep of links, in the actual work of club-carrying by the caddies, and in the instruction given by the professional class, is obvious. Golf has taken a strong hold on the affections of the people in all parts of Ireland, and the fashion for golf in England has reacted strongly on Scotland itself, the ancient home of the game, where since 1880 golfers have probably increased in the ratio of twenty to one. Besides the industry that such a growth of the game denotes in the branches immediately connected with it, as mentioned above, there is to be taken into further account the visiting population that it brings to all lodging-houses and hotels within reach of a tolerable golf links, so that many a fishing village has risen into a moderate watering-place by virtue of no other attractions than those which are offered by its golf course. Therefore to the Briton golf has developed from something of which he had a vague idea—as of "curling"—to something in the nature of an important business, a business that can make towns and has a considerable effect on the receipts of railway companies.

Progress of the game.

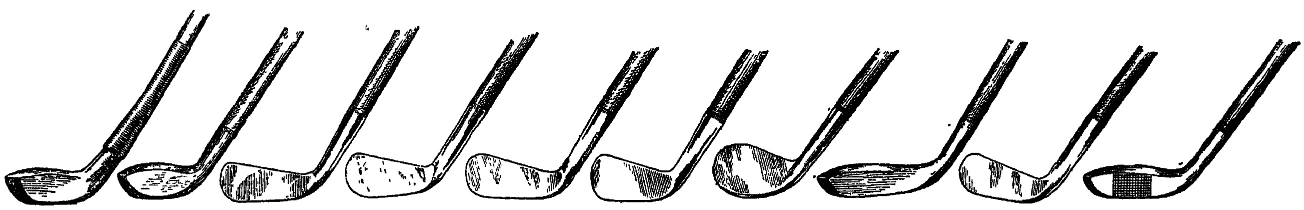
Moreover, ladies have learned to play golf. This is not stating the fact too widely nor too forcibly, for though it is true that before 1885 many played on the short links of St Andrews, North Berwick, Westward Ho, and elsewhere, still it was virtually unknown that they should play on the longer courses, which till then had been in the undisputed possession of the men. At many places women now have their separate links, at others they play on the same course as the men. But even where links are set apart for women, they are far different from the little courses that used to be assigned to them. They are links only a little less formidable in their bunkers, a little less varied in their features than those of men. The ladies have their annual Championship, which they play on the long links of the men, sometimes on one, sometimes on another, but always on courses of the first quality, demanding the finest display of golfing skill.

The claim that England has made to a golfing fellowship with Scotland has been conceded very strikingly by the admission of two English greens, those of Hoylake and of Sandwich, into the exclusive list of the links on which the Open Championship of the game is decided. Before England had so fully assimilated Scotland's game this great annual contest was waged at St Andrews, Musselburgh, and Prestwick in successive years. Now the ancient green of Musselburgh, somewhat worn out with length of hard and gallant service, and moreover, as a nine-holes course inadequately accommodating the numbers who compete in the Championships to-day, has been superseded by the course at Muirfield as a championship arena, and the greens of Sandwich and Hoylake, as just now stated, have been included in the list, which thus contains at present five greens in place of the old

three. The Amateur Championship also has been played on these two greens of England, as well as on the three that are honoured in Scotland as championship courses; but since this championship of the amateurs is of more modern institution than the Open Championship, and indeed owed its institution chiefly to the initiative of the English club at Hoylake, there is not in this circumstance the same marked proof that Scotland concedes to England share in the general golfing councils.

While golf had been making itself a force in the Southern kingdom, the professional element—men who had learned the game from childhood, had become past-masters, were capable of giving instruction, and also of making clubs and balls and looking after the greens on which golf was played—had at first been taken from the northern side of the Border. But when golf had been started long enough in England for the little boys who were at first employed as "caddies"—in carrying the players' clubs—to grow to sufficient strength to drive the ball as far as their masters, it was inevitable that out of the number who thus began to play in their boyhood some few should develop an exceptional talent for the game. This, in fact, actually happened, and English golfers, both of the amateur and the professional classes, have proved themselves so adept at Scotland's game, that the championships in either the Open or the Amateur competitions have been won more often by English than by Scottish players of late years. Probably in the United Kingdom to-day there are as many English as Scottish professional golf players, and their relative number is increasing.

Golf has also "caught on," to use the American expression, in the United States. To the American of 1890 golf was largely an unknown thing. Since then, however, golf has become a very much greater factor in the life of the upper and upper-middle classes in the United States than it ever has been in England or Scotland. Golf to the English and the Scots meant only one among several of the sports and pastimes that take the man and the woman of the upper and upper-middle classes into the country and the fresh air. To the American of like status golf came as the one thing to take him out of his towns and give him a reason for exercise in the country. Before golf came to amuse them there were only a very few of the rather Anglicized Americans who in the Eastern States found any active amusements at all out of doors. To-day golf has become an absorbing interest in the Eastern States of America, and indeed all over the Northern Continent, but it is in the Eastern States that it has made most difference in the life of the classes with whom it has become fashionable. The others, the Westerners and Southerners, found more excuses before the coming of golf for being in the open country air. It is in the Eastern States more especially that it has had so much influence in making the people live and exercise out of doors. In a truly democratic spirit the American woman golfer plays on a perfect equality with the American man. She does not compete in the men's championships; she has championships of her own; but she plays, without question, on the same links. There is no suggestion of relegating her, as a certain cynical writer in the Badminton volume on golf described it, to a waste corner, a kind of "Jews' Quarter," of the links. And the Americans have taken up golf in the spirit of a sumptuous and opulent people, spending money on magnificent club-houses beyond the finest dreams of the Englishman or the Scot.



Types of Golf Clubs.
1, Driver; 2, Brassy; 3, Cleek; 4, Driving Mashie; 5, Iron; 6, Mashie; 7, Niblick; 8, Wooden Putter; 9, Putter; 10, Baffing Spoon.

So much enthusiasm and so much golf in America have not failed to make their influence felt in the United Kingdom. Naturally and inevitably they have created a strong demand for professional instruction, both by example and by precept, and for professional advice and assistance in the laying-out and upkeep of the many new links that have been created in all parts of the States, sometimes out of the least promising material. By the offer of great prizes for exhibition matches, and of wages that are to the British rate on the scale of the dollar to the shilling, they have attracted many of the best Scottish and English professionals to pay them longer or shorter visits as the case may be, and thus a new opening has been created for the energies of the professional golfing class.

Changes in rules and play.

There have been some slight changes of detail and arrangement in the rules of the game. A new class of golfer has arisen, requiring a code of rules framed rather more exactly than the older code. The Scottish golfer, who was "teethed" on a golf club, as Mr Andrew Lang has described it, imbibed all the traditions of the game with his natural sustenance. Very few rules sufficed for him. But when the Englishman, and still more the American (less in touch with the traditions), began to play golf as a new game, then they began to ask for a code of rules that should be lucid and illuminating on every point—an ideal perhaps impossible to realize. It was found, at least, that the code put forward by the Royal and Ancient Club of St Andrews did not realize it adequately. Nevertheless the new golfers were very loyal indeed to the club that had ever of old held, by tacit consent, the position of fount of golfing legislation. The Royal and Ancient Club was appealed to by English golfers to step into the place, analogous to that of the Marylebone Cricket Club in cricket, that they were both willing and anxious to give it. It was a place that the club at St Andrews did not in the least wish to occupy, but the honour was thrust so insistently upon it, that there was no declining. The latest effort to meet the demands for some more satisfactory legislation on the thousand and one points that continually must arise for decision in course of playing a game of such variety as golf, consists of the appointment of a standing committee, called the "Rules of Golf Committee." Its members all belong to the Royal and Ancient Club; but since this club draws its membership from all parts of the United Kingdom, this restriction is quite consistent with a very general representation of the views of north, south, east, and west—

from Westward Ho and Sandwich to Dornoch, and all the many first-rate links of Ireland—on the committee. Ireland has, indeed, some of the best links in the kingdom, and yields to neither Scotland nor England in enthusiasm for the game. This committee, after a general revision of the rules into the form in which they now stand, considers every month, either by meeting or by correspondence, the questions that are sent up to it by clubs or by individuals; and the committee's answers to these questions have the force of law until they have come before the next general meeting of the Royal and Ancient Club at St Andrews, which may confirm or may reject them at will. The ladies of Great Britain manage otherwise. They have a Golfing Union which settles questions for them; but since this union itself accepts as binding the answers given by the Rules of Golf Committee, they really arrive at the same conclusions by a slightly different path. Nor does the American Union, governing the play of men and women alike in the States, really act differently. The Americans, naturally, reserve to themselves freedom to make their own rules, but in practice they conform to the legislation of Scotland, with the exception of a more drastic definition of the status of the amateur player, which seems to be required by the circumstances of the game in the States.

A slight modification has been effected in the implements of the game. The tendency of the modern wooden clubs is to be short in the head as compared with the clubs of, say, 1880 or 1885. The advantage claimed (probably with justice) for this shape is that it masses the weight behind the point on which the ball is struck (see Fig.). Better material, both in the wood of the clubs and in the gutta-percha of which the balls are made, is a consequence of the increased demand for these articles and the increased competition among their makers. Whereas, under the old conditions, a few workers at the few greens then in existence were enough to supply the golfing wants, now there is a very large industry in golf club and ball making, which not only employs workers in the local club-makers' shops all the kingdom over, but is an important branch of the commerce of the stores and of the big athletic outfitters.

With all this growth of interest in golf, it is only natural that more and more attention should have been directed to efforts at discovering its origin, but so far all in vain. One of the most ancient and most interesting of the pictures in which the game is portrayed is the tail-piece to an illuminated *Book of Hours*, made at Bruges at the beginning of the 16th century. The original is in the British Museum. The players, three in number, have but one club apiece. The heads of the clubs are steel or steel covered. They play with a ball each. That which gives this picture a peculiar interest over the many pictures of Dutch schools that portray the game in progress is that most of them show it on the ice, the putting being at a stake. In this *Book of Hours* they are putting at a hole in the turf, as in our modern golf. It is scarcely to be doubted that the game is of Dutch origin, and that it has been in favour since very early days. Farther than that our knowledge does not go. The early Dutchmen played golf, they painted golf, but they did not write it.

Literature of the game.

With our own devotees of golf the case has been very different, and the literature of the game has grown to some considerable bulk. For many years it was practically comprised in the fine work by Mr Clark, *Golf: A Royal and Ancient Game*, together with two handbooks on the game by Mr Chambers and by Mr Forgan respectively, and the *Golfiana Miscellanea* of Mr Stewart. A small book by the present writer, named *Hints on Golf*, was very shortly followed by a much more important work by the late Sir Walter Simpson, Bart., called *The Art of Golf*, a title which sufficiently explains itself. The Badminton Library book on *Golf* attempted to collect into one volume the most interesting historical facts known about the game, with *obiter dicta* and advice to learners, and, on similar didactic lines, books have been written by Mr H. C. S. Everard, Mr Garden Smith, and W. Park, the professional player. Mr H. J. Whigham, sometime amateur champion golfer of the United States, has given us a book about the game in that country. *The Book of Golf and Golfers*, compiled, with assistance, by the present writer, is in the first place a picture-gallery of famous golfers in their respective attitudes of play. Much interesting lore is contained in the *Golfing Annual*, which has now been published yearly for several years, and in the pages of *Golf*, which has now become *Golf Illustrated*, a weekly paper devoted to the game. Among works that have primarily a local interest, but yet contain much of historical value about the game, may be cited the *Golf Book of East Lothian*, by the Rev. John Kerr, and the *Chronicle of Blackheath Golfers*, by Mr W. E. Hughes.

Method of play.

By way of amplifying the rather dry definitions given in the rules, it may be said, for the benefit of the unlearned, that the game of golf consists in hitting the ball over a great extent of country, preferably of that sand-hill nature which is found by the sea-side, and finally hitting or "putting" it into a little hole of some four inches diameter cut in the turf. The place of the hole is commonly marked by a flag. Eighteen is the recognized number of these holes on a full course, and they are at varying distances apart, from one hundred yards up to anything between a quarter and half a mile. For the various strokes required to achieve the hitting of the ball over the great hills, and finally putting it into the small hole, a number of different "clubs" has been devised to suit the different positions in which the ball may be found and the different directions in which it is wished to propel it (see Fig.). At the start for each hole the ball may be placed on a favourable position (*e.g.*, "teed" on a small mound of sand) for striking it, but after that it may not be touched, except with the club, until it is hit into the next hole. A "full drive," as the farthest distance that the ball can be hit is called, is about two hundred yards in length, of which some three-quarters will be traversed in the air, and the rest by bounding or running over the ground. It is easily to be understood that when the ball is lying on the turf behind a tall sand-hill, or in a bunker, a differently-shaped club is required for raising it over such an obstacle from that which is needed when it is placed on the tee to start with; and again, that another club is needed to strike the ball out of a cup or out of heavy grass. It is this variety that gives the game its charm. Each player plays with his own ball, with no interference from his opponent, and the object of each is to hit the ball from the starting-point into each successive hole in the fewest strokes. The player who at the end of the round (*i.e.*, of the course of eighteen holes) has won the majority of the holes is the winner of the round; or the decision may be reached before the end of the round by one side gaining more holes than there remain to play. For instance, if one player be four holes to the good, and only three holes remain to be played, it is evident that the former must be the winner, for even if the latter win every remaining hole, he still must be one to the bad at the finish.

Championship.

The Amateur Championship is decided by a tournament in matches thus played, each defeated player retiring, and his opponent passing on into the next round. In the case of the Open Championship, and in most medal competitions, the scores are differently reckoned—each man's total score (irrespective of his relative merit at each hole) being reckoned at the finish against the total score of the other players in the competition. There is also a species of competition called "bogey" play, in which each man plays against a "bogey" score—a score fixed for each hole in the round before starting—and his position in the competition relatively to the other players is determined by the number of holes that he is to the good or to the bad of the "bogey" score at the end of the round. The player who is most holes to the good, or fewest holes to the bad, wins the competition. It may be mentioned incidentally that golf occupies the almost unique position of being the only sport in which even a single player can enjoy his game, his opponent in this event being "Colonel Bogey"—more often than not a redoubtable adversary.

The links which have been thought worthy, by reason of their geographical positions and their merits, of being the scenes on which the golf championships are fought out, are, as we have already said, three in Scotland—St Andrews, Prestwick, and Muirfield—and two in England—Hoylake and Sandwich. This brief list is very far from being complete as regards links of first-class quality in Great Britain. Besides the five named, there are in Scotland—Carnoustie, North Berwick, Cruden Bay, Nairn, Aberdeen, Dornoch, Troon, Machrihanish, South Uist, Islay, Gullane, Luffness, and many more. In England there are—Westward Ho, Bembridge, Littlestone, Deal, Great Yarmouth, Brancaster, Seaton

Carew, Formby, Lytham, Harlech, Burnham, among the seaside ones; while of the inland, some of them of very fine quality, we cannot even attempt a selection, so large is their number and so variously estimated their comparative merits. Ireland has Portrush, Newcastle, Portsalon, Dollymount, and many more of the first class; and there are excellent courses in the Isle of Man. In America many fine courses have been constructed. There is not a British colony of any standing that is without its golf course—Australia, India, South Africa, all have their golf championships, which are keenly contested. Canada has had courses at Quebec and Montreal for many years, and the Calcutta Golf Club, curiously enough, is the oldest established (next to the Blackheath Club), the next oldest being the club at Pau in the Basses-Pyrénées.

The Open Championship of golf was started in 1860 by the Prestwick Club giving a belt to be played for annually under the condition that it should become the property of any who could win it thrice in succession.

The following is the list of the champions:—

1860.	W. Park, Musselburgh	174—at Prestwick.
1861.	Tom Morris, sen., Prestwick	163—at Prestwick.
1862.	Tom Morris, sen., Prestwick	163—at Prestwick.
1863.	W. Park, Musselburgh	168—at Prestwick.
1864.	Tom Morris, sen., Prestwick	160—at Prestwick.
1865.	A. Strath, St Andrews	162—at Prestwick.
1866.	W. Park, Musselburgh	169—at Prestwick.
1867.	Tom Morris, sen., St Andrews	170—at Prestwick.
1868.	Tom Morris, jun., St Andrews	154—at Prestwick.
1869.	Tom Morris, jun., St Andrews	157—at Prestwick.
1870.	Tom Morris, jun., St Andrews	149—at Prestwick.

Tom Morris, junior, thus won the belt finally, according to the conditions. In 1871 there was no competition; but by 1872 the three clubs of St Andrews, Prestwick, and Musselburgh had subscribed for a cup which should be played for over the course of each subscribing club successively, but should never become the property of the winner. In later years the course at Muirfield was substituted for that at Musselburgh, and Hoylake and Sandwich were admitted into the list of championship courses. Up to 1891, inclusive, the play of two rounds, or thirty-six holes, determined the championship, but from 1892 onwards the result has been determined by the play of seventy-two holes.

After the interregnum of 1871, the following were the champions:—

1872.	Tom Morris, jun., St Andrews	166—at Prestwick.
1873.	Tom Kidd, St Andrews	179—at St Andrews.
1874.	Mungo Park, Musselburgh	159—at Musselburgh.
1875.	Willie Park, Musselburgh	166—at Prestwick.
1876.	Bob Martin, St Andrews	176—at St Andrews.
1877.	Jamie Anderson, St Andrews	160—at Musselburgh.
1878.	Jamie Anderson, St Andrews	157—at Prestwick.
1879.	Jamie Anderson, St Andrews	170—at St Andrews.
1880.	Bob Fergusson, Musselburgh	162—at Musselburgh.
1881.	Bob Fergusson, Musselburgh	170—at Prestwick.
1882.	Bob Fergusson, Musselburgh	171—at St Andrews.
1883.	W. Fernie, Dumfries	159—at Musselburgh.
1884.	Jack Simpson, Carnoustie	160—at Prestwick.
1885.	Bob Martin, St Andrews	171—at St Andrews.
1886.	D. Brown, Musselburgh	157—at Musselburgh.
1887.	Willie Park, jun., Musselburgh	161—at Prestwick.
1888.	Jack Burns, Warwick	171—at St Andrews.
1889.	Willie Park, jun., Musselburgh	155—at Musselburgh.
1890.	Mr John Ball, jun., Hoylake	164—at Prestwick.
1891.	Hugh Kirkaldy, St Andrews	166—at St Andrews.
1892.	Mr H. H. Hilton, Hoylake	305—at Muirfield.
1893.	W. Auchterlonie, St Andrews	322—at Prestwick.
1894.	J. H. Taylor, Winchester	326—at Sandwich.
1895.	J. H. Taylor, Winchester	322—at St Andrews.
1896.	H. Vardon, Scarborough	316—at Muirfield.
1897.	Mr H. H. Hilton, Hoylake	314—at Hoylake.
1898.	H. Vardon, Scarborough	307—at Prestwick.
1899.	H. Vardon, Scarborough	310—at Sandwich.
1900.	J. H. Taylor, Richmond	309—at St Andrews.
1901.	J. Braid, Romford	309—at Muirfield.

The Amateur Championship is of far more recent institution. Its winners have been:—

1886.	Mr Horace Hutchinson	at St Andrews.
1887.	Mr Horace Hutchinson	at Hoylake.
1888.	Mr John Ball	at Prestwick.
1889.	Mr J. E. Laidlay	at St Andrews.
1890.	Mr John Ball	at Hoylake.
1891.	Mr J. E. Laidlay	at St Andrews.
1892.	Mr John Ball	at Sandwich.
1893.	Mr P. Anderson	at Prestwick.
1894.	Mr John Ball	at Hoylake.
1895.	Mr L. Balfour-Melville	at St Andrews.
1896.	Mr F. G. Tait	at Sandwich.
1897.	Mr J. T. Allan	at Muirfield.
1898.	Mr John Ball	at Prestwick.
1899.	Mr F. G. Tait	at Hoylake.
1900.	Mr H. H. Hilton	at Sandwich.
1901.	Mr H. H. Hilton	at St Andrews.

Glossary of Technical Terms used in the Game.

Addressing the Ball.—Putting oneself in position to strike the ball.

All Square.—Term used to express that the score stands level, neither side being a hole up.

Baff.—To strike the ground with the club when playing, and so loft the ball unduly.

Baffy.—A short wooden club, with laid-back face, for lofting shots.

Bogey.—The number of strokes which a good average player should take to each hole. This imaginary player is usually known as "Colonel Bogey," and plays a fine game.

Brassy.—A wooden club with a brass sole (see Fig.).

Bulger.—A driver in which the face "bulges" into a convex shape. The head is shorter than in the older-fashioned driver.

Bunker.—A sand-pit.

Caddie.—The person who carries the club (from French *cadet*).

Cleek.—The iron-headed club that is capable of the farthest drive of any of the clubs with iron heads (see Fig.).

Dead.—A ball is said to be "dead" when so near the hole that the putting it in in the next stroke is a "dead" certainty. A ball is said to "fall dead" when it pitches with hardly any run.

Divot.—A piece of turf cut out in the act of playing, which, be it noted, should always be replaced before the player moves on.

Dormy.—One side is said to be "dormy" when it is as many holes to the good as remain to be played—so that it cannot be beaten.

Driver.—The longest driving club, used when the ball lies very well and a long shot is needed (see Fig.).

Foozle.—Any very badly missed or bungled stroke.

"Fore!"—A cry of warning to people in front.

Foursome.—A match in which four persons engage, two on each side playing alternately with the same ball.

Green.—(*a*) The links as a whole; (*b*) the "putting-greens" around the holes.

Grip.—(*a*) The part of the club-shaft which is held in the hands while playing; (*b*) the grasp itself—*e.g.*, "a firm grip," "a loose grip," are common expressions.

Half-Shot.—A shot played with something less than a full swing.

Halved.—A hole is "halved" when both sides have played it in the same number of strokes. A round is "halved" when each side has won and lost the same number of holes.

Hanging.—Said of a ball that lies on a slope inclining downwards in regard to the direction in which it is wished to drive.

Hazard.—A general term for bunker, whin, long grass, roads, and all kinds of bad ground.

Heel.—To hit the ball with a pulling movement, so as to send it too much to the left: in a sense, the opposite of *slice.*

Honour.—The privilege (which its holder is not at liberty to decline) of striking off first from the tee.

Iron.—An iron-headed club intermediate between the cleek and lofting mashie. There are driving irons and lofting irons according to the purposes for which they are intended (see Fig.).

Lie.—(*a*) The angle of the club-head with the shaft (*e.g.*, a "flat lie," "an upright lie"); (*b*) the position of the ball on the ground (*e.g.*, "a good lie," "a bad lie").

Like-as-we-Lie.—Said when both sides have played the same number of strokes.

Line.—The direction in which the hole towards which the player is progressing lies with reference to the present position of his ball.

Mashie.—An iron club with a short head (see Fig.). The *lofting mashie* has the blade much laid back, for playing a short lofting shot. The *driving mashie* (see Fig.) has the blade less laid back, and is used for longer, less lofted shots.

Match-Play.—Play in which the score is reckoned by holes won and lost.

Medal-Play.—Play in which the score is reckoned by the total of strokes taken on the round.

Niblick.—A short stiff club with a short, laid back, iron head, used for getting the ball out of a very bad lie (see Fig.).

Press.—To strive to hit harder than you can hit with accuracy.

Putt.—To play the short strokes near the hole.

Putter.—The club used for playing the short strokes near the hole. Some have a wooden head, some an iron head (see Fig.).

Rub-of-the-Green.—Any chance deflection that the ball receives as it goes along.

Run Up.—To send the ball low and close to the ground in approaching the hole—opposite to lofting it up.

Scratch Player.—Player who receives no odds in handicap competitions.

Slice.—To hit the ball with a cut across it, so that it flies curving to the right.

Stance.—(*a*) The place on which the player has to stand when playing—*e.g.*, "a bad stance," "a good stance," are common expressions; (*b*) the position relative to each other of the player's feet.

Stymie.—When one ball lies in a straight line between another and the hole the first is said to "stymie," or "to be a stymie to" the other—from an old Scottish word given by Jamieson to mean "the faintest form of anything." The idea probably was, the "stymie" only left you the "faintest form" of the hole to aim at.

Tee.—The little mound of sand on which the ball is generally placed for the first drive to each hole.

Teeing-Ground.—The place marked as the limit, outside of which it is not permitted to drive the ball off. This marked-out ground is also sometimes called "the tee."

Top.—To hit the ball above the centre, so that it does not rise much from the ground.

Wrist-Shot.—A shot less in length than a half-shot, but longer than a putt.

Rules of Golf.

1. *Definitions.*—(*a*) The game of golf is played by sides, each playing its own ball. A side consists either of one or of two players. If one player play against another, the match is called "a single." If two play against two, it is called "a foursome." A single player may play against two, when the match is called "a threesome," or three players may play against each other, each playing his own ball, when the match is called "a three-ball match."

(*b*) The game consists in each side playing a ball from a teeing-ground into a hole by successive strokes, and the hole is won by the side which holes its ball in fewer strokes than the opposite side, except as otherwise provided for in the rules. If the sides hole out in the same number of strokes, the hole is halved.

(*c*) The teeing-ground shall be indicated by two marks placed in a line, as nearly as possible at right angles to the course.

(*d*) The term "putting-green" shall mean all ground within 20 yards of the hole, except hazards. The hole shall be 4¼ inches in diameter, and at least 4 inches deep.

(*e*) A "hazard" shall be any bunker, water (except casual water), sand, path, road, railway, whin, bush, rushes, rabbit scrape, fence, or ditch. Sand blown on to the grass, or sprinkled on the course for its preservation, bare patches, snow, and ice are not hazards. Permanent grass within a hazard shall not be considered part of the hazard.

(*f*) The term "through the green" shall mean all parts of the course except "hazards" and the putting-green which is being played to.

(*g*) The term "out of bounds" shall mean any place outside the defined or recognized boundaries of the course.

(*h*) "Casual water" shall mean any temporary accumulation of water (whether caused by rainfall or otherwise) which is not one of the ordinary and recognized hazards of the course.

(*i*) A ball shall be "in play" as soon as the player has made a stroke at the teeing-ground in each hole, and shall remain in play until holed out, except when lifted in accordance with the rules.

(*j*) A ball shall be considered to have "moved" only if it leave its original position in the least degree, and stop in another; but if it merely oscillate, without finally leaving its original position, it shall not be considered to have "moved."

(*k*) A ball shall be considered "lost" if it be not found within five minutes after the search for it is begun.

(*l*) A "match" shall consist of one round of the links, unless it be otherwise agreed.

A match is won by the side which is leading by a number of holes greater than the number of holes remaining to be played. If each side win the same number of holes, the match is halved.

(*m*) A "stroke" shall be any movement of the ball caused by the player, except as provided for in Rule 4, or any downward movement of the club made with the intention of striking the ball.

(*n*) A "penalty stroke" is a stroke added to the score of a side under certain rules, and shall not affect the rotation of play.

(*o*) The privilege of playing first from a teeing-ground is called "the honour."

(*p*) "Addressing the ball" shall mean that a player has taken up his position and grounded his club, or if in a hazard, that he has taken up his position preparatory to striking the ball.

(*q*) The reckoning of strokes is kept by the terms—"the odd," "two more," "three more," &c., and "one off three," "one off two," "the like." The reckoning of holes is kept by the terms—so many "holes up," or "all even," and so many "to play."

2. A match begins by each side playing a ball from the first teeing-ground.

The player who shall play first on each side shall be named by his own side.

The option of taking the honour at the first teeing-ground shall be decided, if necessary, by lot.

A ball played from in front of, or outside of, or more than two club lengths behind the two marks indicating the teeing-ground, or played by a player when his opponent should have had the honour, may be at once recalled by the opposite side, and may be re-teed.

The side which wins a hole shall have the honour at the next teeing-ground. If a hole has been halved the side which had the honour at the last teeing-ground shall again have the honour.

On beginning a new match the winner of the long match in the previous round shall have the honour, or if the previous match was halved the side which last won a hole shall have the honour.

3. A player shall not play while his ball is moving, under the penalty of the loss of the hole. But if the ball begin to move while the player is making his upward or downward swing, he shall incur no penalty, except as provided for in Rules 10, 18, and 27, and a stroke lost under Rule 27 shall not in these circumstances be counted as a stroke of the player.

4. If the ball fall or be knocked off the tee in addressing it, no penalty shall be incurred, and it may be replaced, and if struck when moving no penalty shall be incurred.

5. In a threesome or foursome the partners shall strike off alternately from the teeing-grounds, and shall strike alternately during the play of the hole.

If a player play when his partner should have done so, his side shall lose the hole.

6. When the balls are in play, the ball farthest from the hole which the players are approaching shall be played first, except as otherwise provided for in the rules. If a player play when his opponent should have done so, the opponent may at once recall the stroke. A ball so recalled shall be dropped as near as possible to the place where it lay, without penalty.

7. The ball must be fairly struck at, not pushed, scraped, nor spooned, under penalty of the loss of the hole.

8. A ball must be played wherever it lies or the hole be given up, except as otherwise provided for in the rules.

9. Unless with the opponent's consent, a ball in play shall not be moved, nor touched before the hole is played out, under penalty of one stroke, except as otherwise provided for in the rules. But the player may touch his ball with his club in the act of addressing it, without penalty.

If the player's ball move the opponent's ball through the green, the opponent, if he choose, may drop a ball (without penalty) as near as possible to the place where it lay, but this must be done before another stroke is played.

10. Any loose impediment (not being in or touching a hazard) which is within a club length of the ball may be removed. If the player's ball move after any such loose impediment has been touched by the player, his partner, or either of their caddies, the penalty shall be one stroke. If any loose impediment (not being on the putting-green) which is more than a club length from the ball be removed, the penalty shall be the loss of the hole.

11. Any vessel, wheel-barrow, tool, roller, grass-cutter, box, or similar obstruction may be removed. If a ball be moved in so doing, it may be replaced without penalty. A ball lying on or touching such obstruction, or on clothes, nets, or ground under repair or covered up or opened for the purpose of the upkeep of the links, may be lifted and dropped without penalty, as near as possible to the place where it lay, but not nearer the hole. A ball lifted in a hazard, under such circumstances, shall be dropped in the hazard.

A ball lying in a golf hole or flag hole, or in a hole made by the green-keeper, may be lifted and dropped without penalty as near as possible to the place where it lay, but not nearer the hole.

12. Before striking at a ball in play, the player shall not move, bend, nor break anything fixed or growing near the ball, except in the act of placing his feet on the ground for the purpose of addressing the ball, in soling his club to address the ball, and in his upward or downward swing, under penalty of the loss of the hole, except as otherwise provided for in the rules.

13. When a ball lies in or touches a hazard, nothing shall be done to improve its lie; the club shall not touch the ground, nor shall anything be touched or moved before the player strikes at the ball, subject to the following exceptions:—(1) The player may place his feet firmly on the ground for the purpose of addressing the ball; (2) in addressing the ball, or in the upward or downward swing, any grass, bent, whin, or other growing substance, or the side of a bunker, wall, paling, or other immovable obstacle may be touched; (3) steps or planks placed in a hazard by the Green Committee for access to or egress from such hazard may be removed, and if a ball be moved in so doing, it may be replaced without penalty; (4) any loose impediments may be removed from the putting-green; (5) the player shall be entitled to find his ball as provided for by Rule

30. The penalty for a breach of this rule shall be the loss of the hole.

14. A player or caddie shall not press down nor remove any irregularities of surface near a ball in play. Dung, worm-casts, or mole-hills may be removed (but not pressed down) without penalty. The penalty for a breach of this rule shall be the loss of the hole.

15. If a ball lie or be lost in water, the player may drop a ball, under penalty of one stroke. But if a ball lie or be lost (1) in casual water through the green, a ball may be dropped without penalty; (2) in water in a hazard, or in casual water in a hazard, a ball may be dropped behind the hazard, under penalty of one stroke; (3) in casual water on a putting-green, a ball may be placed by hand behind the water, without penalty.

16. When a ball has to be dropped, the player himself shall drop it. He shall face the hole, stand erect behind the hazard or casual water, keep the spot from which the ball was lifted (or in the case of water or casual water, the spot at which it entered) in a line between himself and the hole, and drop the ball behind him from his head, standing as far behind the hazard or casual water as he may please. If it be impossible to drop the ball behind the hazard or casual water, it shall be dropped as near as possible to the place where it lay, but not nearer the hole. If the ball so dropped touch the player dropping it, there shall be no further penalty, and if the ball roll into a hazard, it may be re-dropped without further penalty.

17. When the balls lie within six inches of each other on a putting-green, or within a club length of each other through the green or in a hazard (the distance to be measured from their nearest points), the ball nearer the hole may, at the option of either the player or the opponent, be lifted until the other is played, and shall then be replaced as near as possible to the place where it lay. If the ball farther from the hole be moved in so doing, or in measuring the distance, it shall be replaced without penalty. If the lie of the lifted ball be altered by the player in playing, the ball may be placed in a lie as nearly as possible similar to that from which it was lifted, but not nearer the hole.

18. Any loose impediments may be removed from the putting-green, irrespective of the position of the player's ball. The opponent's ball may not be moved except as provided for by the immediately preceding rule. If the player's ball move after any loose impediment lying within six inches of it has been touched by the player, his partner, or either of their caddies, the penalty shall be one stroke.

19. When the ball is on the putting-green the player or his caddie may remove (but not press down) sand, earth, dung, worm-casts, mole-hills, snow, or ice lying round the hole or in the line of his putt. This shall be done by brushing lightly with the hand only across the putt and not along it. Dung may be removed by a club, but the club must not be laid with more than its own weight upon the ground. The line of the putt must not be touched, except with the club immediately in front of the ball, in the act of addressing it, or as above authorized. The penalty for a breach of this rule is the loss of the hole.

20. When the ball is on the putting-green, no mark shall be placed, nor line drawn as a guide. The line of the putt may be pointed out by the player's caddie, his partner, or his partner's caddie, but the person doing so must not touch the ground.

The player's caddie, his partner, or his partner's caddie may stand at the hole, but no player nor caddie shall endeavour, by moving or otherwise, to influence the action of the wind upon the ball.

The penalty for a breach of this rule is the loss of the hole.

21. When on the putting-green, a player shall not play until the opponent's ball is at rest, under penalty of one stroke.

22. Either side is entitled to have the flag-stick removed when approaching the hole. If the ball rest against the flag-stick when in the hole, the player shall be entitled to remove the stick, and, if the ball fall in, it shall be deemed as having been holed out at the last stroke. If the player's ball knock in the opponent's ball, the latter shall be deemed as having been holed out at the last stroke. If the player's ball move the opponent's ball, the opponent, if he choose, may replace it, but this must be done before another stroke is played. If the player's ball stop on the spot formerly occupied by the opponent's ball, and the opponent declare his intention to replace, the player shall first play another stroke, after which the opponent shall replace and play his ball. If the opponent's ball lie on the edge of the hole, the player, after holing out, may knock it away, claiming the hole if holing at the like, and the half if holing at the odd, provided that the player's ball does not strike the opponent's ball and set it in motion. If after the player's ball is in the hole the player neglect to knock away the opponent's ball, and it fall in also, the opponent shall be deemed to have holed out at his last stroke.

23. If a ball *in motion* be stopped or deflected by any agency outside the match, or by the forecaddie, the ball must be played from where it lies, and the occurrence submitted to as a "rub of the green." If a ball lodge in anything moving, a ball shall be dropped as near as possible to the place where the object was when the ball lodged in it, without penalty. If a ball *at rest* be displaced by any agency outside the match, excepting wind, the player shall drop a ball as near as possible to the place where it lay, without penalty. On the putting-green the ball shall be replaced by hand, without penalty.

24. If the player's ball strike, or be moved by an opponent or an opponent's caddie or clubs, the opponent shall lose the hole.

25. If the player's ball strike, or be stopped by, himself or his partner, or either of their caddies or clubs, his side shall lose the hole.

26. If the player, when making a stroke, strike the ball twice, the penalty shall be one stroke.

27. If the player, when not intending to make a stroke, or his partner or either of their caddies, move his or their ball, or by touching anything cause it to move, when it is in play, the penalty shall be one stroke. If a ball in play move, after the player has grounded his club in the act of addressing it, or, when in a hazard, if he has taken up his stand to play it, he shall be deemed to have caused it to be moved, and shall lose a stroke, which shall be counted as a stroke of the player, except as provided in Rule 3.

28. If a player play the opponent's ball, his side shall lose the hole, unless (1) the opponent then play the player's ball, whereby the penalty is cancelled, and the hole must be played out with the balls thus exchanged, or (2) the mistake occur through wrong information given by the opponent or his caddie, in which case there shall be no penalty, but the mistake, if discovered before the opponent has played, must be rectified by placing a ball as near as possible to the place where the opponent's ball lay.

If it be discovered before either side has struck off from the next teeing-ground (or, after playing the last hole in the match, before any of the players have left the green) that one side has played out the hole with the ball of a party not engaged in the match, that side shall lose that hole.

29. If a ball be lost, except as otherwise provided for in the rules, the player's side shall lose the hole; but if both balls be lost, the hole shall be considered halved.

30. If a ball be lost in fog, bent, whins, long grass, or the like, only so much thereof shall be touched as will enable the player to find his ball. The penalty for a breach of this rule shall be the loss of the hole.

31. If a ball be driven out of bounds, a ball shall be dropped at the spot from which the stroke was played, under penalty of loss of the distance.

32. In a three-ball match, if a player consider that an opponent's ball on the putting-green might interfere with his stroke, he may require the opponent either to lift or hole out his ball at the opponent's discretion.

If an opponent consider (1) that his own ball, if left, might be of assistance to the player, he is entitled to lift it, or hole out at his discretion; or (2) that the ball of the other opponent might be of such assistance, he may require that it be either lifted or holed out at the other opponent's discretion.

33. A player shall not ask for advice from any one except his own caddie, his partner, or his partner's caddie, nor shall he willingly be otherwise advised in any way whatever, under penalty of the loss of the hole.

34. If a ball split into separate pieces, another ball may be put down where the largest portion lies, or if two pieces are apparently of equal size, it may be put where either piece lies, at the option of the player. If a ball crack or become unfit for play, the player may change it, on intimating to his opponent his intention to do so. Mud adhering to a ball shall not be considered as making it unfit for play.

35. If a dispute arise on any point, the players have the right of determining the party or parties to whom it shall be referred, but should they not agree, either side may refer it to the Rules of Golf Committee, whose decision shall be final. If the point in dispute be not covered by the Rules of Golf, the arbiters must decide it by equity.

Special Rules for Stroke Competitions.

1. In stroke competitions, the competitor who holes the stipulated course in fewest strokes shall be the winner.

2. If the lowest scores be made by two or more competitors, the tie or ties shall be decided by another round to be played on the same day. But if the Green Committee determine that to be inexpedient or impossible, they shall then appoint the following or some subsequent day whereon the tie or ties shall be decided.

3. New holes shall be made for stroke competitions, and thereafter no competitor, before starting, shall play any stroke on a putting-green, under penalty of disqualification.

4. The scores shall be kept by a special marker, or by the competitors noting each other's scores. The scores marked shall be

checked after each hole. On completion of the round, the score of the competitor shall be signed by the marker, countersigned by the competitor, and handed to the secretary or his deputy, after which, unless it be found that a card returned shows a score below that actually played (in which case the competitor shall be disqualified), no correction or alteration can be made.

5. If a competitor play from outside the limits of the teeing-ground, the penalty shall be disqualification.

6. If a ball be lost (except as otherwise provided for in the Rules of Golf), the competitor shall return as near as possible to the spot from which the lost ball was struck, tee a ball, and lose a stroke. The lost ball shall continue in play, if it be found before the player has struck another ball.

7. If a competitor's ball strike himself, his clubs or caddie, the penalty shall be one stroke.

8. If a competitor's ball strike another competitor, or his clubs or caddie, it is a "rub of the green," and the ball shall be played from where it lies. If a competitor's ball which is at rest be moved by another competitor or his caddie, or his club, or his ball, or by any outside agency excepting wind, it shall be replaced as near as possible to the place where it lay, without penalty.

9. A competitor shall hole out with his own ball at every hole, under penalty of disqualification. But if it be discovered before he has struck off from the next teeing-ground, or, if the mistake occur at the last hole, before he has handed his card to the secretary or his deputy, that he has not holed out with his own ball, he shall be at liberty to return and hole out with his own ball, without penalty.

10. A ball may be lifted out of a difficulty of any description, and teed, if possible, behind it, under penalty of two strokes. If it be impossible to tee the ball behind the difficulty, it shall be teed as near as possible to the place where it lay, but not nearer the hole.

11. All balls shall be holed out, under penalty of disqualification. When a competitor's ball is within 20 yards of the hole, the competitor shall not play until the flag has been removed, under penalty of one stroke. If the ball nearer the hole might either interfere with the competitor's stroke, or in any way assist the competitor, such ball must be holed out or lifted, at the owner's option. Through the green a competitor may have any other competitor's ball lifted, if he find that it interferes with his stroke.

12. A competitor, unless specially authorized by the Green Committee, shall not play with a professional, and he may not willingly receive advice from any one but his caddie, in any way whatever, under penalty of disqualification.

A forecaddie may be employed.

13. Competitors shall not discontinue play on account of bad weather, under penalty of disqualification.

14. Where, in the Rules of Golf, the penalty for the breach of any rule is the loss of the hole, in stroke competitions the penalty shall be the loss of two strokes, except where otherwise provided for in these Special Rules.

15. Any dispute regarding the play shall be determined by the Rules of Golf Committee.

16. The Rules of Golf, so far as they are not at variance with these Special Rules, shall apply to stroke competitions.

Etiquette of Golf.

1. A single player has no standing, and must always give way to a properly constituted match.

2. No player, caddie, or onlooker should move or talk during a stroke.

3. No player should play from the tee until the party in front have played their second strokes, and are out of range, nor play up to the putting-green till the party in front have holed out and moved away.

4. The player who has the honour should be allowed to play before his opponent tees his ball.

5. Players who have holed out should not try their putts over again when other players are following them.

6. Players looking for a lost ball must allow other matches coming up to pass them.

7. On request being made, a three-ball match must allow a single, threesome, or foursome to pass. Any match playing a whole round may claim the right to pass a match playing a shorter round.

8. If a match fail to keep its place on the green, and lose in distance more than one clear hole on those in front, it may be passed, on request being made.

9. Turf cut or displaced by a stroke should be at once replaced.

10. A player should carefully fill up all holes made by himself in a bunker.

11. It is the duty of an umpire or referee to take cognizance of any breach of rule that he may observe, whether he be appealed to on the point or not.

(H. G. H.)

Goltz, Kolmar von der, Baron (1843-——), Prussian soldier and military writer, was born at Bielkenfeld, East Prussia, on 12th August 1843, educated at the Cadet School at Kulm and Berlin, and received his commission in the infantry in 1861. In 1864 he entered the Berlin Military Academy, but was temporarily withdrawn in 1866 to serve in the Austrian war, in which he was wounded at Trautenau. In 1867 he joined the topographical division of the general staff, and at the beginning of the Franco-German war of 1870–71 was attached to the staff of Prince Frederick Charles. He took part in the battles of Mars-le-Tour and Gravelotte and in the siege of Metz. After its fall he served under the Red Prince in the campaign of the Loire against the French General Chanzy, including the battles of Orleans and Le Mans and the subsequent six days' fighting. He was appointed in 1871 professor at the Military School at Potsdam, and the same year was promoted captain and placed in charge of the historical division of the general staff. It was then he wrote *The Operations of the Second Army to the Capitulation of Metz*, and *The Seven Days of Le Mans*, both published in 1873. In 1874 he was appointed to the staff of the 6th division, and while so employed wrote *The Operations of the Second Army of the Loire*, and *Léon Gambetta and his Armies*, published in 1875 and 1877 respectively. The latter was translated into French the same year, and both are impartially written. In 1878 von der Goltz was appointed professor of military history at the Military Academy at Berlin, where he remained for five years, and attained the rank of major. He published, in 1883, *Rossbach and Jena* and *The Nation in Arms*, and during his residence in Berlin contributed many articles to the military journals. In June 1883 his services were lent to Turkey to organize the military educational establishments of the country, and he was made a pasha. On his return to Germany in 1896 he rose to be lieutenant-general, and was appointed commander of the 5th division in 1898, head of the Engineer and Pioneer Corps and inspector-general of fortifications. He has been a frequent contributor to military periodical literature, and, in addition to the works already named, has published *The Turco-Grecian War* and *The Conduct of War*, the latter of which has been translated into English.

Goluchowski, Agenor, Count (1849-——), Austrian statesman, was born in 1849. His father, descended from an old and noble Polish family, was governor of Galicia. Entering the diplomatic service, the son was in 1872 appointed attaché to the Austrian embassy at Berlin, where he became secretary of legation, and thence he was transferred to Paris. After rising to the rank of counsellor of legation, he was in 1887 made minister at Bucarest, where he remained till 1893. In these positions he acquired a great reputation as a firm and skilful diplomatist, and on the retirement of Count Kalnoky in May 1895 was chosen to succeed him as Austro-Hungarian minister for foreign affairs. In his speech of that year to the delegations he declared the maintenance of the Triple Alliance, and in particular the closest intimacy with Germany, to be the keystone of Austrian policy; at the same time he dwelt on the traditional friendship between Austria and Great Britain, and expressed his desire for a good understanding with all the Powers. In pursuance of this policy he effected an understanding with Russia, by which neither Power was to exert any separate influence in the Balkan peninsula, and thus removed a long-standing cause of friction. Austria's policy in the Balkans, to which he now secured the adhesion of Russia, was, in his words, "the

consolidation of the state of affairs created in the East by international treaties; the preservation of Turkey; the independence, strengthening, and free development of the several Balkan states, and of friendly relations with them; and, finally, the exclusion of the predominant influence of any single great Power to the detriment of the rest." This understanding was formally ratified during a visit to St Petersburg on which he accompanied the Emperor in April 1897. He took the lead in establishing the European Concert during the Armenian troubles of 1896, and again resisted isolated action on the part of any of the Great Powers during the Cretan troubles and the Greco-Turkish war. In November 1897, when the Austro-Hungarian flag was insulted at Mersina, he threatened to bombard the town if instant reparation were not made, and by his firm attitude greatly enhanced Austrian prestige in the East. In his speech to the delegations in 1898 he dwelt on the necessity of expanding Austria's mercantile marine, and of raising the fleet to a strength which, while not vying with the fleets of the great naval Powers, would ensure respect for the Austrian flag wherever her interests needed protection. He also hinted at the necessity for European combination to resist American competition. Count Goluchowski has devoted much of his energies to the problem of supervising emigration so that the loss of population may be compensated by the opening of new markets across the seas.

Gomel (*Homel*), a district town of Russia, 108 miles S.S.E. of Moghilev, on the Sozh, tributary of the Dnieper. It is an important junction of the railways from Wilno to Odessa, and Orel to Poland, and is in steamer communication with Kieff and Moghilev. It has gymnasia for boys and girls, and carries on a brisk trade in corn and timber; there are also paper-pulp mills and oil factories. Gomel was founded in the 12th century, and after changing hands several times between Poles and Russians, was annexed to Russia in 1772. Population (1897), 35,846, nearly half of whom are Jews.

Gomez, Maximo (1823——), Cuban soldier, was born in San Domingo in 1823. He entered the Spanish army in that island as a lieutenant, and rose to be captain. His family emigrated to Cuba and settled near Santiago. He joined the insurgent army in 1868, and obtained victories at Jiguani and Holguin in the following year. In 1872 the commander-in-chief, General Agramonte, promoted him to the rank of brigadier-general and sent him to command at Puerto Principe, where he increased his reputation. He captured Nuevitas, Santa Cruz, and Cascorra, and fought the battle of Las Guarimas. In 1874 he invaded the province of Santa Clara, defeated General Jovellar, and was made a major-general. On the collapse of the rebellion in 1878 he escaped to Jamaica, and lived as a farmer there and in San Domingo until the renewal of the rising in Cuba in 1895 under Jose Marti. He landed in Cuba on 14th April, and was made commander-in-chief of all the insurgent forces. Realizing the great strength of the Spanish forces in the island, he avoided serious encounters, and was content to hold areas of tropical wilderness by scattered squads, with a system of speedy dispersion and concentration. To this policy he added a systematic destruction of the two great Cuban industries—sugar and tobacco production—in order to impoverish the Spaniards and to compel the Cubans to take part in the war. The Spanish general, Campos, failed to make any head against the insurgents, and he was succeeded in February 1896 by Weyler, who strove to quell the rising by extreme severity. Early in 1896 a revolutionary government was formed under the presidency of Salvador Cisneros. In June Gomez defeated General Castillanos near Puerto Principe, and during 1897 he held the field. In October 1897 Weyler was recalled, and the new Spanish ministry under Señor Sagasta resolved to grant autonomy to Cuba, but the offer was rejected by the Cubans. Gomez by no means welcomed the intervention of the United States in 1898, and more than once attacked the President and Government in his public utterances. On the transfer of Cuba to the United States, however, on 1st January 1899, after the conclusion of the war with Spain, he accepted the terms offered him and promised to assist in disbanding the Cuban army. In consequence he was impeached on 12th March by the Cuban military assembly and removed from his command. On 7th April, however, he was reinstated by a majority of the Cuban generals, and he subsequently concluded the negotiations for the disbandment of the Cuban army with General Brooke, the United States military governor. (See CUBA.)

Goncharoff, Ivan Alexandrovich (1812–1891), Russian novelist, was born 6/18 July 1812, being the son of a rich merchant in the town of Simbirsk. At the age of ten he was placed in one of the gymnasiums at Moscow, from which he passed, though not without some difficulty on account of his ignorance of Greek, into the Moscow University. He read many French works of fiction, and published a translation of one of the novels of Eugène Sue. During his university career he devoted himself to study, taking no interest in the political and Socialistic agitation among his fellow-students. He was first employed as secretary to the governor of Simbirsk, and afterwards in the Ministry of Finance at St Petersburg. Being absorbed in bureaucratic work, Goncharoff paid no attention to the social questions then ardently discussed by such men as Herzen, Aksakoff, and Bielinski. He began his literary career by publishing translations from Schiller, Goethe, and English novelists. His first original work was *Obuiknovennaya Istoria*, "A Common Story" (1847). In 1856 he sailed to Japan as secretary to Admiral Putiatin for the purpose of negotiating a commercial treaty, and on his return to Russia he published a description of the voyage under the title of "The Frigate *Pallada*." His best work is *Oblomoff* (1857), which exposed the laziness and apathy of the smaller landed gentry in Russia anterior to the reforms of Alexander II. Russian critics have pronounced this work to be a faithful characterization of Russia and the Russians. Dobroluboff said of it, "Oblomofka [the country seat of the Oblomoffs] is our fatherland: something of Oblomoff is to be found in every one of us." Peesareff, another celebrated critic, declared that "Oblomoffism," as Goncharoff called the sum total of qualities with which he invested the hero of his story, "is an illness fostered by the nature of the Slavonic character and the life of Russian society." In 1858 Goncharoff was appointed a censor, and in 1868 he published another novel called *Obreev*. He was not a voluminous writer, and during the latter part of his life produced nothing of any importance. His death occurred on 15/27 September 1891. (G. D.)

Goncourt, de, the name of a famous French literary family. EDMOND DE GONCOURT was born at Nancy, 26th May 1822, and died at Champrosay, 16th July 1896. JULES DE GONCOURT, his brother, was born at Paris, 17th December 1830, and died at Paris, 20th June 1870. Writing always in collaboration, until the death of the younger, it was their ambition to be not merely novelists, inventing a new kind of novel, but historians; not merely historians, but the historians of a particular century, and of what was intimate and what is unknown in it; to be also discriminating, indeed innovating, critics

of art, but of a certain section of art, the 18th century, in France and Japan; and also to collect pictures and bibelots, always of the French and Japanese 18th century. Their histories (*Portraits intimes du xviii^e^ Siècle*, 1857, *La Femme au xviii^e^ Siècle*, 1862, *La du Barry*, 1878, &c.) are made entirely out of documents, autograph letters, scraps of costume, engravings, songs, the unconscious self-revelations of the time; their three volumes on *L'Art du xviii^e^ Siècle*, 1859–75, deal with Watteau and his followers in the same scrupulous, minutely enlightening way, with all the detail of unpublished documents; and when they came to write novels, it was with a similar attempt to give the inner, undiscovered, minute truths of contemporary existence, the *inédit* of life. The same morbidly sensitive noting of the *inédit*, of whatever came to them from their own sensations of things and people around them, gives its curious quality to the nine volumes of the *Journal*, 1887–96, which will remain, perhaps, the truest and most poignant chapter of human history that they have written. Their novels, *Sœur Philomène*, 1861, *Renée Mauperin*, 1864, *Germinie Lacerteux*, 1865, *Manette Salomon*, 1865, *Madame Gervaisais*, 1869, and, by Edmond alone, *La Fille Elisa*, 1878, *Les Frères Zemganno*, 1879, *La Faustin*, 1882, *Chérie*, 1884, are, however, the work by which they will live as artists. Learning something from Flaubert, and teaching almost everything to Zola, they invented a new kind of novel, and their novels are the result of a new vision of the world, in which the very element of sight is decomposed, as in a picture of Monet. Seen through the nerves, in this conscious abandonment to the tricks of the eyesight, the world becomes a thing of broken patterns, and conflicting colours, and uneasy movement. A novel of the Goncourts is made up of an infinite number of details, set side by side, every detail equally prominent. While a novel of Flaubert, for all its detail, gives above all things an impression of unity, a novel of the Goncourts deliberately dispenses with unity in order to give the sense of the passing of life, the heat and form of its moments as they pass. It is written in little chapters, sometimes no longer than a page, and each chapter is a separate notation of some significant event, some emotion or sensation which seems to throw sudden light on the picture of a soul. To the Goncourts humanity is as pictorial a thing as the world it moves in; they do not search further than "the physical basis of life," and they find everything that can be known of that unknown force written visibly upon the sudden faces of little incidents, little expressive moments. The soul, to them, is a series of moods, which succeed one another, certainly without any of the too arbitrary logic of the novelist who has conceived of character as a solid or consistent thing. Their novels are hardly stories at all, but picture-galleries, hung with pictures of the momentary aspects of the world. French critics have complained that the language of the Goncourts is no longer French, no longer the French of the past; and this is true. It is their distinction—the finest of their inventions—that, in order to render new sensations, a new vision of things, they invented a new language.

(A. Sy.)

Gonda, a town and district of British India, in the Fyzabad division of Oudh. The town is 28 miles north-west of Fyzabad, and is an important junction on the Bengal and North-Western Railway. The population in 1891 was 17,430; the municipal income in 1897–98 was Rs.16,334. The cantonments were abandoned in 1863. The DISTRICT OF GONDA has an area of 2880 square miles. Its population in 1881 was 1,270,926, and in 1891 was 1,459,229, giving an average density of 507 persons per square mile. In 1901 the population was 1,402,350, showing a decrease of 4 per cent. The land revenue and rates were Rs.16,83,221, the incidence of assessment per acre being R.1–6–4 on temporarily settled and R.0–13–11 on permanently settled land; the cultivated area in 1896–97 was 1,047,574 acres, of which 186,616 were irrigated from wells, tanks, &c.; the number of police was 2776; the number of vernacular schools in 1896–97 was 95, with 3873 pupils; the registered death-rate in 1897 was 42·67 per thousand. The district is traversed by the main line of the Bengal and North-Western Railway, with a branch from Gonda town towards Lucknow.

Gondal, a native state of India, within the Gujarat division of Bombay, situated in the centre of the peninsula of Kathiawar. Its area is 1024 square miles; population (1891), 161,036. The estimated gross revenue is about Rs.15,00,000, of which Rs.3,26,760 was expended in 1897–98 on public works; the tribute is Rs.1,10,721. The present chief, whose title is Thakor Saheb, is a Jareja Rajput, of the same clan as the Rao of Cutch. He was educated at the Rajkot college, and afterwards graduated in arts and medicine at the University of Edinburgh. He has published a book in English on the medical system of the Hindus. In 1898 he received the insignia of K.C.I.E. from Queen Victoria in person. The state has always been conspicuous for its progressive administration, and was recently raised from the second to the first class. It is traversed by a railway connecting it with Rajkot and with the sea-board. The TOWN OF GONDAL is 23 miles by rail south from Rajkot. It had in 1891 a population of 15,343. It has an Anglo-vernacular school, an iron foundry, and a state printing-press, issuing an official gazette.

Gooch, Sir Daniel, BART. (1816–1889), English mechanical engineer, was born at Bedlington, in Northumberland, on 16th August 1816. At the age of fifteen, having shown a taste for mechanics, he was put to work at the Tredegar Ironworks, Monmouthshire. In 1834 he went to Warrington, where, at the Vulcan foundry, under Robert Stephenson, he acquired the principles of locomotive design. Subsequently, after passing a year at Dundee, he was engaged by the Stephensons at their Gateshead works, where he seems to have conceived that predilection for the broad gauge for which he was afterwards distinguished, through having to design some engines for a 6-foot gauge in Russia and noticing the advantages it offered in allowing greater space for the machinery, &c., as compared with the standard gauge favoured by Stephenson. In 1837, on Brunel's recommendation, he was appointed locomotive superintendent to the Great Western Railway. When he accepted this post the engines possessed by the railway were very poor and inefficient; in fact, there were only about half-a-dozen that could be depended upon at all, and it was not an infrequent thing to send out one of the sounder ones to search for and help home a train which was more than usually unpunctual. Under Gooch, however, this state of affairs was soon remedied, and he gradually provided his employers with a stock of locomotives, many of which have scarcely even now been surpassed for general excellence and economy of working. One of the most famous, the *Lord of the Isles*, was awarded a gold medal at the Great Exhibition of 1851, and when thirty years afterwards it was withdrawn from active service it had run more than three-quarters of a million miles, all with its original boiler. In 1864 he left the Great Western and interested himself in the problem of laying a telegraph cable across the Atlantic. At this time Brunel's famous steamship, the *Great Eastern*, was in the hands of the bondholders, of whom he himself was one of the most important, and it occurred to him that she might advantageously be utilized in the enterprise. Accordingly, at his instance she was chartered by the Telegraph Construction

Company, of which also he was a director, and in 1865 was employed in the attempt to lay a cable, Gooch himself superintending operations. The cable, however, broke in mid-ocean, and the attempt was a failure. Next year it was renewed with more success, for not only was a new cable safely put in place, but the older one was picked up and spliced, so that there were two complete lines between England and America. For this achievement Gooch was created a baronet. Meanwhile the Great Western Railway had fallen on evil days, being indeed on the verge of bankruptcy when in 1866 the directors appealed to him to accept the chairmanship of the board and undertake the rehabilitation of the company. He agreed to the proposal, and was so successful in restoring its prosperity that in 1889, at the last meeting over which he presided, a dividend was declared at the rate of 7½ per cent. Under his administration the system was greatly enlarged and consolidated by the absorption of various smaller lines, such as the Bristol and Exeter and the Cornwall railways; and his appreciation of its strategic value caused him to be a strenuous supporter of the construction of the Severn Tunnel. His death occurred on 15th October 1889, at his residence, Clewer Park, near Windsor. (H. M. R.)

Goole, a market-town and port in the Osgoldcross parliamentary division of Yorkshire, England, at the confluence of the Don and the Ouse, 24 miles west by south of Hull by rail. Recent erections are a sailors' institute, court house, cottage hospital, post office, and market-hall. A new dock of 2½ acres was opened in 1882, and in 1891 one 620 feet long and 260 feet broad, with a depth of 22 feet. There are now in all eight docks supplied with timber ponds, quays, warehouses, and other accommodation. The registered shipping in 1888 consisted of 245 vessels of 24,787 tons; in 1899, 147 vessels of 26,391 tons. In 1888, 2258 vessels of 530,508 tons entered, and 2597 vessels of 661,616 tons cleared. In 1899, 2641 vessels of 853,440 tons entered, and 2756 vessels of 888,969 tons cleared. Area of urban district, 1441 acres. Population (1881), 10,418; (1901), 16,576.

Gorakhpur, a city, district, and division of the North-West Provinces of British India. The city is situated on the river Rapti, and had a population in 1881 of 57,922, and in 1901 of 63,409. The municipal income in 1897–98 was Rs.67,294; the registered death-rate in 1897 was 61·37 per thousand. It is the civil headquarters of the district, with a military cantonment, and has nine printing-presses, issuing one vernacular newspaper. The DISTRICT OF GORAKHPUR has an area of 4576 square miles. It had a population in 1881 of 2,617,120; in 1891 of 2,994,057, giving an average density of 654 persons per square mile; and in 1901 of 2,955,543, showing a decrease of 3 per cent. The land revenue and rates were Rs.31,59,359, the incidence of assessment being just under R.1 per acre; the cultivated area in 1896–97 was 1,905,024 acres, of which 531,183 were irrigated from wells, tanks, &c.; the number of police was 3263; the number of vernacular schools in 1896–97 was 202, with 9069 pupils; the registered death-rate in 1897 was 35·27 per thousand. The district is traversed by the main line of the Bengal and North-Western Railway, and both the Gogra and Rapti are navigable. There are twenty-eight indigo factories, employing 5500 persons, with an out-turn valued at Rs.3,00,000 per annum. The DIVISION has an area of 9491 square miles. The population in 1891 was 6,508,526, giving an average density of 685 persons per square mile, being more than one to every acre, and the highest for any large tract in India; in 1901 the population was 6,331,356, showing a decrease of 3 per cent.

Gorcum, or GORKUM (Dutch *Gorinchem*), a town in the Netherlands, province of South Holland, 22 miles E.S.E. of Rotterdam, near the influx of the Linge into the Merwede. Railway connexions have been established with Geldermalsum, Bois-le-Duc (1883), and Dordrecht (1885). Trade has also been promoted by the opening in 1894 of the Merwede Canal (Amsterdam–Gorcum). Gold and silver working are carried on. Population (1900), 11,855.

Gordium, an ancient city of Phrygia, situated on the Persian "Royal road" from Pessinus to Ancyra, and not far from the Sangarius. Ramsay identifies it with Yürme, Humann with Chakmak, and Crowfoot with Pebi.

Gordon, Adam Lindsay (1833–1870), Australian poet, was born at Fayal, in the Azores, in 1833, and was the son of a retired Indian officer who taught Hindostanee at Cheltenham College. A youthful indiscretion led to his being sent to South Australia in 1853 with a commission in the mounted police. Here for some years he prospered, married, and obtained a seat in the local parliament. Misfortune, nevertheless, overtook him, and in 1867 he removed to Victoria, where he published his poems. They brought him more praise than emolument, and, thoroughly discouraged, especially by his failure to make good his claim to some property in Scotland to which he believed himself entitled, he committed suicide at New Brighton on Port Phillip Bay on the 24th of June 1870. His reputation rose after his death, and he became the best known and most widely popular of Australian poets, although he must undoubtedly some day give place to one uniting to an equal or superior poetical talent a deeper feeling for Australian scenery and life. Much of Gordon's poetry might have been written in England: when, however, it is really local, it is vividly so; his genuine feeling frequently kindles into passion; his versification is always elastic and sonorous, but sometimes too reminiscent of Swinburne. His compositions are almost entirely lyrical, and their merit is usually in proportion to the degree in which they partake of the character of the ballad.

Gordon, Charles George (1833–1885), British soldier and administrator, fourth son of General H. W. Gordon, Royal Artillery, was born at Woolwich on 28th January 1833. He received his early education at Taunton school, and was given a cadetship in the Royal Military Academy, Woolwich, in 1848. He was commissioned as second lieutenant in the corps of Royal Engineers on 23rd June 1852. After passing through a course of instruction at the Royal Engineers' establishment, Chatham, he was promoted lieutenant in 1854, and was sent to Pembroke Dock to assist in the construction of the fortifications then being erected for the defence of Milford Haven. The Crimean war broke out shortly afterwards, and Gordon was ordered on active service, and landed at Balaclava on 1st January 1855. The siege of Sebastopol was in progress, and he had his full share of the arduous work in the trenches. He was attached to one of the British columns which assaulted the Redan on 18th June, and was also present at the capture of that work on 8th September. He took part in the expedition to Kinburn, and then returned to Sebastopol to superintend a portion of the demolition of the Russian dockyard. After peace with Russia had been concluded, Gordon was attached to an international commission appointed to delimit the new boundary, as fixed by treaty, between Russia and Turkey in Bessarabia; and on the conclusion of this work he was ordered to Asia Minor on similar duty, with reference to the eastern boundary between the two countries. While so employed

Gordon took the opportunity to make himself well acquainted with the geography and people of Armenia, and the knowledge of dealing with Eastern nations then gained was of great use to him in after life.

In China. He returned to England towards the end of 1858, and was then selected for the appointment of adjutant and field-works instructor at the Royal Engineers' establishment, and took up his new duties at Chatham after promotion to the rank of captain in April 1859. But his stay in England was brief, for in 1860 war was declared against China, and Gordon was ordered out there, arriving at Tientsin in September. He was too late for the attack on the Taku Forts, but was present at the occupation of Peking and destruction of the Summer Palace. He remained with the British force of occupation in Northern China until April 1862, when the British troops, under the command of General Staveley, proceeded to Shanghai, in order to protect the European settlement at that place from the Taeping rebels. The Taeping revolt, which had some remarkable points of similarity with the Mahdist rebellion in the Sudan, had commenced in 1850 in the province of Kwangsi. The leader, Hung Seu Tsuen, a semi-political, semi-religious enthusiast, assumed the title of Tien Wang, or Heavenly King, and by playing on the feelings of the lower class of people gradually collected a considerable force. The Chinese authorities endeavoured to arrest him, but the imperialist troops were defeated. The area of revolt extended northwards through the provinces of Hunan and Hupe, and down the valley of the Yang-tse-kiang as far as the great city of Nanking, which was captured by the rebels in 1853. Here the Tien Wang established his court, and while spending his own time in heavenly contemplation and earthly pleasures, sent the assistant Wangs on warlike expeditions through the adjacent provinces. For some years a constant struggle was maintained between the Chinese imperialist troops and the Taepings, with varying success on both sides. The latter gradually advanced eastwards, and approaching the important commercial city of Shanghai, alarmed the European inhabitants of that place, who subscribed to raise a mixed force of Europeans and Manila men for the defence of the town. This force, which was placed under the command of an American named Ward, took up a position in the country west of Shanghai to check the advance of the rebels. Fighting continued round Shanghai for about two years, but Ward's force was not altogether successful, and when General Staveley arrived from Tientsin affairs were in a somewhat critical condition. He decided to clear the district of rebels within a radius of 30 miles from Shanghai, and Gordon was attached to his staff as engineer officer. A French force, under the command of Admiral Prôtet, co-operated with Staveley, and Ward, with his little army, also assisted. Kahding, Singpo, and other towns were occupied, and the country was fairly cleared of rebels by the end of 1862. Ward was, unfortunately, killed in the assault of Tseki, and his successor, Burgevine, having had a quarrel with the Chinese authorities, Li Hung Chang, the governor of the Kiang-su province, requested General Staveley to appoint a British officer to command the contingent. Staveley selected Gordon, who had been made a brevet-major in December 1862 for his previous services, and the nomination was approved by the British Government. The choice was judicious, as further events proved. In March 1863 Gordon proceeded to Sungkiang to take command of the force, which had received the name of "The Ever-Victorious Army," an encouraging though somewhat exaggerated title, considering its previous history. Without waiting to reorganize his troops he marched at once to the relief of Chansu, a town 40 miles north-west of Shanghai, which was invested by the rebels. The relief was successfully accomplished, and the operation established Gordon in the confidence of his troops. He then reorganized his force, a matter of no small difficulty, and advanced against Quinsan, which was captured, though with considerable loss. Gordon then marched through the country, seizing town after town from the rebels, until at length the great city of Suchow was invested by his army and a body of Chinese imperialist troops. The city was taken on the 29th of November, and after its capture Gordon had a serious dispute with Li Hung Chang, as the latter had beheaded certain of the rebel leaders whose lives the former had promised to spare if they surrendered. This action, though not opposed to Chinese ethics, was so opposed to Gordon's ideas of honour, that he withdrew his force from Suchow, and remained inactive at Quinsan until February 1864. He then came to the conclusion that the subjugation of the rebels was more important than his dispute with Li, and visited the latter in order to arrange for further operations. By mutual consent no allusion was made to the death of the Wangs. This was a good example of one of Gordon's marked characteristics, that, though a man of strong personal feelings, he was always prepared to subdue them for the public benefit. He declined, however, to take any decoration or reward from the emperor for his services at the capture of Suchow. After the meeting with Li Hung Chang the "Ever-Victorious Army" again advanced and took a number of towns from the rebels, ending with Chanchufu, the principal military position of the Taepings. This fell in May, when Gordon returned to Quinsan and disbanded his force. In June the Tien Wang, seeing his cause was hopeless, committed suicide, and the capture of Nanking by the imperialist troops shortly afterwards brought the Taeping revolt to a

General Gordon.
(From a photograph by the London Stereoscopic Company.)

conclusion. The suppression of this serious movement was undoubtedly due in great part to the skill and energy of Gordon, who had shown remarkable qualities as a leader of men. The emperor promoted him to the rank of Titu, the highest grade in the Chinese army, and also gave him the Yellow Jacket, the most important decoration in China. He wished to give him a large sum of money, but this Gordon refused. He was promoted lieutenant-colonel for his Chinese services, and made a Companion of the Bath. Henceforth he was often familiarly spoken of as "Chinese" Gordon.

Gordon was appointed on his return to England Commanding Royal Engineer at Gravesend, where he was employed in superintending the erection of forts for the defence of the Thames. He devoted himself with energy to his official duties, and his leisure hours to practical philanthropy. All the acts of kindness which he did for the poor during the six years he was stationed at Gravesend will never be fully known. In October 1871 he was appointed British representative on the international commission which had been constituted after the Crimean war to maintain the navigation of the mouth of the river Danube, with headquarters at Galatz. During 1872 Gordon was sent to inspect the British military cemeteries in the Crimea, and when passing through Constantinople on his return to Galatz he made the acquaintance of Nubar Pasha, prime minister of Egypt, who sounded him as to whether he would take service under the Khedive. Nothing further was settled at the time, but the following year he received a definite offer from the Khedive, which he accepted with the consent of the British Government, and proceeded to Egypt early in 1874. He was then a colonel in the army, though still only a captain in the corps of Royal Engineers.

In the Egyptian Sudan.

To understand the object of the appointment which Gordon accepted in Egypt, it is necessary to give a few facts with reference to the Sudan. That vast territory, bordering the Nile on both sides from the Egyptian frontier to the equator, after a long and varied history, had lapsed into a state of semi-barbarism. Mehemet Ali, the ruler of Egypt, having made himself practically independent of his suzerain, the Sultan of Turkey, conceived the project of founding an African empire, and with this object determined to take possession of the Sudan. An expedition was sent up the Nile in 1820 under the command of Ismail, son of Mehemet Ali. The force reached Khartum after meeting with considerable opposition, and the province of Sennaar was captured, but in 1822 Ismail was murdered by the inhabitants of Shendy near Berber. Notwithstanding this, the Egyptians pressed southwards and conquered Kordofan and Fazogl. In 1865 Turkey ceded the province of Suakin and Massawa on the Red Sea to the Khedive, thus rounding off the possessions of Egypt in the Sudan. One result of the Egyptian occupation of the country was that the slave trade was largely developed, especially in the White Nile and Bahr-el-Ghazal districts. Captains Speke and Grant, who had travelled through Uganda and came down the White Nile in 1863, and Sir Samuel Baker, who went up the same river as far as Albert Nyanza, brought back harrowing tales of the misery caused by the slave-hunters. Public opinion was considerably moved, and in 1869 the Khedive Ismail decided to send an expedition up the White Nile, with the double object of limiting the evils of the slave trade and opening up the district to commerce. The command of the expedition was given to Sir Samuel Baker, who reached Khartum in February 1870, but, owing to the obstruction of the river by the sudd or grass barrier, did not reach Gondokoro, the centre of his province, for fourteen months. He met with great difficulties, and when his four years' service came to an end little had been effected beyond establishing a few posts along the Nile and placing some steamers on the river. It was to succeed Baker as governor of the White Nile province that the Khedive asked for Gordon's services, having come to the conclusion that the latter was the most likely person to bring the affair to a satisfactory conclusion. After a short stay in Cairo, Gordon proceeded to Khartum by way of Suakin and Berber, a route which he ever afterwards regarded as the best mode of access to the Sudan. From Khartum he proceeded up the White Nile to Gondokoro, where he arrived in twenty-four days, the sudd, which had proved such an obstacle to Baker, having been removed since the departure of the latter by the Egyptian governor-general. Gordon remained in the Equatorial Provinces until October 1876, and then returned to Cairo. The two years and a half thus spent in Central Africa was a time of incessant toil. A line of stations was established from Sobat on the White Nile to the frontier of Uganda, and considerable progress was made in the suppression of the slave trade. The river and Lake Albert were mapped by Gordon and his staff, and he devoted himself with wonted energy to improving the condition of the people. Greater results might have been obtained but for the fact that Khartum and the whole of the Sudan north of the Sobat were in the hands of an Egyptian governor, independent of Gordon, and not too well disposed towards his proposals for diminishing the slave trade. On arriving in Cairo Gordon informed the Khedive of his reasons for not wishing to return to the Sudan, but did not definitely resign the appointment of governor of the Equatorial Provinces. But on reaching London he telegraphed to the British consul-general in Cairo, asking him to let the Khedive know that he would not go back to Egypt. Ismail Pasha, feeling, no doubt, that Gordon's resignation would injure his prestige, wrote to him saying that he had promised to return, and that he expected him to keep his word. Upon this Gordon, to whom the keeping of a promise was a sacred duty, decided to return to Cairo, but gave an assurance to some friends that he would not go back to the Sudan unless he was appointed governor-general of the entire province. After some discussion the Khedive agreed, and made him governor-general of the Sudan, inclusive of Darfur and the Equatorial Provinces.

Governor-General.

One of the most important questions which Gordon had to take up on his appointment was the state of the political relations between Egypt and Abyssinia, which had been in an unsatisfactory condition for some years. The dispute centred round the district of Bogos, lying not far inland from Massawa, which both the Khedive and King John of Abyssinia claimed as belonging to their respective dominions. War broke out in 1875, when an Egyptian expedition was despatched to Abyssinia, and was completely defeated by King John near Gundet. A second and larger expedition, under Prince Hassan, the son of the Khedive, was sent the following year from Massawa. The force was routed by the Abyssinians at Gura, but Prince Hassan and his staff got back to Massawa. Matters then remained quiet until March 1877, when Gordon proceeded to Massawa to endeavour to make peace with King John. He went up to Bogos, and had an interview with Wadenkal, an Abyssinian chief, who had joined the Egyptians with a view to raiding on his own account. Gordon, with his usual powers of diplomacy, persuaded Wadenkal to remain quiet, and wrote to the king proposing terms of peace. But he received no reply at that time, as John, feeling pretty secure on the

Egyptian frontier after his two successful actions against the Khedive's troops, had gone southwards to fight with Menelek, king of Shoa. Gordon, seeing that the Abyssinian difficulty could wait for a few months, proceeded to Khartum. Here he took up the slavery question, and proposed to issue regulations making the registration of slaves compulsory, but his proposals were not approved by the Cairo Government. In the meantime an insurrection had broken out in Darfur, and Gordon proceeded to that province to relieve the Egyptian garrisons, which were considerably stronger than the force he had available, the insurgents also being far more numerous than his little army. On coming up with the main body of rebels he saw that diplomacy gave a better chance of success than fighting, and, accompanied only by an interpreter, rode into the enemy's camp to discuss the situation. This bold move, which probably no one but Gordon would have attempted, proved quite successful, as part of the insurgents joined him, and the remainder retreated to the south. The relief of the Egyptian garrisons was successfully accomplished, and Gordon visited the provinces of Berber and Dongola, whence he had again to return to the Abyssinian frontier to treat with King John. But no satisfactory settlement was arrived at, and Gordon came back to Khartum in January 1878. There he had scarcely a week's rest when the Khedive summoned him to Cairo to assist in settling the financial affairs of Egypt. He reached Cairo in March, and was at once appointed by Ismail as president of a commission of inquiry into the finances, on the understanding that the European commissioners of the debt, who were the representatives of the bondholders, and whom Ismail regarded as interested parties, should *not* be members of the commission. Gordon accepted the post on these terms, but the consuls-general of the different Powers refused to agree to the constitution of the commission, and it fell to the ground, as the Khedive was not strong enough to carry his point. The attempt of the latter to utilize Gordon as a counterpoise to the European financiers having failed, Ismail fell into the hands of his creditors, and was deposed by the Sultan in the following year in favour of his son Tewfik. After the conclusion of the financial episode, Gordon proceeded to the province of Harrar, south of Abyssinia, and, finding the administration in a bad condition, dismissed Raouf Pasha, the governor. He then returned to Khartum, and in 1879 went again into Darfur to pursue the slave traders, while his subordinate, Gessi Pasha, fought them with great success in the Bahr-el-Ghazal district and killed Suleiman, the leader. This put an end to the revolt, and Gordon went back to Khartum. Shortly afterwards he went down to Cairo, and when there was requested by the new Khedive to pay a visit to King John and make a definite treaty of peace with Abyssinia. Gordon had an interesting interview with the king, but was not able to do much, as the king wanted great concessions from Egypt, and the Khedive's instructions were that nothing material was to be conceded. The matter ended by Gordon being made a prisoner and sent back to Massawa. Thence he returned to Cairo and resigned his Sudan appointment. He was considerably exhausted by the three years' incessant work, during which he had ridden no less than 8500 miles on camels and mules, and was constantly engaged in the task of trying to reform a vicious system of administration.

In March 1880 Gordon visited the king of the Belgians at Brussels, and King Leopold suggested that he should at some future date take charge of the Congo Free State. In April the Government of the Cape Colony telegraphed to him offering the position of commandant of the Cape local forces, but he declined the appointment. In May the Marquis of Ripon, who had been given the post of Governor-General of India, asked Gordon to go with him as private secretary. This he agreed to do, but a few days later, feeling that he was not suitable for the position, asked Lord Ripon to release him. *1880-1884.*
The latter refused to do so, and Gordon accompanied him to India, but definitely resigned his post on Lord Ripon's staff shortly afterwards. Hardly had he resigned when he received a telegram from Sir Robert Hart, inspector-general of customs in China, inviting him to go to Peking. He started at once, and arrived at Tientsin in July, where he met Li Hung Chang, and learnt that affairs were in a critical condition, and that there was risk of war with Russia. Gordon proceeded to Peking and used all his influence in favour of peace. His arguments, which were given with much plainness of speech, appear to have convinced the Chinese Government, and war was avoided. Gordon returned to England, and in April 1881 exchanged with a brother officer, who had been ordered to Mauritius as Commanding Royal Engineer, but who for family reasons was unable to accept the appointment. He remained in Mauritius until the March following, when, on promotion to the rank of major-general, he had to vacate the position of Commanding Royal Engineer. Just at the same time the premier of Cape Colony telegraphed to him to ask if he would go to the Cape to consult with the Government as regards settling affairs in Basutoland. The telegram stated that the position of matters was grave, and that it was of the utmost importance that the colony should secure the services of some one of proved ability, firmness, and energy. Gordon sailed at once for the Cape, and saw the governor, Sir Hercules Robinson, and the premier, Mr Merriman, who, for political reasons, asked him not to go to Basutoland, but to take the appointment of commandant of the colonial forces at King William's Town. After a few months, which were spent in reorganizing the colonial forces, Gordon was requested to go up to Basutoland to try to arrange a settlement with the chief Masupha, one of the most powerful of the Basuto leaders. Greatly to his surprise, at the very time he was with Masupha a member of the Cape Government was taking steps to induce Lerethodi, another chief, to advance against Masupha. This not only placed Gordon in a position of danger, but was regarded by him as an act of treachery. He advised Masupha not to deal with the Cape Government until the hostile force was withdrawn, and resigned his appointment. He considered that the Basuto difficulty was due to the bad system of administration by the Cape Government. That Gordon's views were correct is proved by the fact that a few years later Basutoland was separated from Cape Colony and placed directly under the Imperial Government. After his return to England from the Cape, being unemployed, Gordon decided to go to Palestine, a country he had long desired to visit. Here he remained for a year, and devoted his time to the study of Biblical history and of the antiquities of Jerusalem. The king of the Belgians then asked him to take charge of the Congo Free State, and he accepted the mission, and returned to London to make the necessary preparations. But a few days after his arrival he was requested by the British Government to proceed immediately to the Sudan. To understand the reasons for this, it is necessary briefly to recapitulate the course of events in that country since Gordon had left it in 1879.

After his resignation of the post of governor-general, Raouf Pasha, an official of the ordinary type, who, as already mentioned, had been dismissed by Gordon for misgovernment in 1878, was appointed to succeed him.

As Raouf was instructed to increase the receipts and diminish the expenditure, the system of government naturally reverted to the old methods, which Gordon had endeavoured to improve. The fact that justice and firmness were succeeded by injustice and weakness tended naturally to the outbreak of revolt, and unfortunately there was a leader ready to head a rebellion—one Mahommed Ahmed, already known for some years as a holy man, who was insulted by an Egyptian official, and retiring with some followers to the island of Abba on the Nile, proclaimed himself as the Mahdi, a successor of the Prophet. Raouf endeavoured to take him prisoner, but without success, and the revolt spread rapidly. Raouf was recalled, and succeeded by Abdel Kader Pasha, a much stronger governor, who had some success, but whose forces were quite insufficient to cope with the rebels. The Egyptian Government was too busily engaged in suppressing Arabi's revolt to be able to send any help to Abdel Kader, and in September 1882, when the British troops entered Cairo, the position in the Sudan was very perilous. Had the British Government listened to the representations then made to them that, having conquered Egypt, it was imperative at once to suppress the revolt in the southern provinces, the rebellion could have been crushed, but unfortunately Great Britain would neither take effective steps herself nor allow Egypt to do so. It is unnecessary to follow the sad history. Suffice it to say that in December 1883 the British Government saw that something must be done, and ordered Egypt to abandon the Sudan. But abandonment was a policy most difficult to carry out, as it involved the withdrawal of thousands of Egyptian employés and their families. Abdel Kader Pasha was asked to undertake the work, and he agreed on the understanding that he would be supported, and that the policy of abandonment was not to be announced. But the latter condition was refused, and he declined the task. The British Government then asked General Gordon to proceed to Khartum to report on the best method of carrying out the evacuation. He received his instructions on the 18th of January 1884, and started at once for Cairo, accompanied by Lieut.-Colonel Stewart.

At Khartum.

At Cairo he received further instructions from the British minister, Sir Evelyn Baring, and was appointed by the Khedive as governor-general, with full powers. Travelling by Korosko and Berber, he arrived at Khartum on the 18th of February, and was well received by the inhabitants, who believed that he had come to save the country from the rebels. Gordon at once commenced the task of sending the women and children and the sick and wounded to Egypt, and about two thousand five hundred had been removed before the Mahdi's forces closed upon Khartum. At the same time he considered what was the best arrangement for the future government of the country, and decided that the only possible man was Zobeir Pasha, who had formerly had great influence in the Sudan, and had been detained in Cairo for some years. But the British Government refused to sanction the appointment, because Zobeir had been a slave-dealer. The advance of the rebels against Khartum was combined with a revolt in the Eastern Sudan, and the Egyptian troops in the vicinity of Suakin met with constant defeat. At length a British force was sent to Suakin under the command of General Sir Gerald Graham, and routed the rebels in several hard-fought actions. Gordon telegraphed to Sir Evelyn Baring urging that the road from Suakin to Berber should be opened by a small force. But this request, though strongly supported by Baring and the British military authorities in Cairo, was refused by the Government in London. In April General Graham and his forces were withdrawn from Suakin, and Gordon and the Sudan were definitely abandoned to their fate. The garrison of Berber, seeing that there was no chance of relief, surrendered a month later, and Khartum was completely isolated. Had it not been for the presence of Gordon the city would also soon have fallen, but with an energy and skill that were almost miraculous, he so organized the defence that Khartum held out until January 1885. When it is remembered that Gordon was of a different nationality and religion to the garrison and population, that he had only one British officer to assist him, and that the town was badly fortified and insufficiently provided with food, it is just to say that the defence of Khartum is one of the most remarkable episodes in military history. The siege commenced on the 18th of March, but it was not until August that the British Government decided to take steps to relieve Gordon. General Stephenson, who was in command of the British troops in Egypt, wished to send a brigade at once to Dongola, but he was overruled, and it was not until the beginning of November that the British relief force was ready to start from Wadi Halfa under the command of Lord Wolseley. The force reached Korti towards the end of December, and from that place a column was despatched across the Bayuda desert to Metemmeh on the Nile. After some severe fighting, in which the leader of the column, Sir Herbert Stewart, was mortally wounded, the force reached the river on the 20th of January, and the following day four steamers, which had been sent down by Gordon to meet the British advance, and which had been waiting for them for four months, reported to Sir Charles Wilson, who had taken command after Sir Herbert Stewart was wounded.

Death.

On the 24th Wilson started with two of the steamers for Khartum, but on arriving there on the 28th he found that the place had been captured by the rebels and Gordon killed two days before. At one time there was an idea current that Wilson might have started earlier and saved the town, but this was quite groundless. In the first place, Wilson could not have started sooner than he did; and in the second, even if he had been able to do so, it would have made no difference, as the rebels could have taken Khartum any time they pleased after the 5th of January, when the provisions were exhausted. Another popular notion, that the capture of the place was due to treachery on the part of the garrison, is equally without foundation. The attack was made at a point in the fortifications where the rampart and ditch had been destroyed by the rising of the Nile, and when the Mahdi's troops entered the soldiers were too weak to make any effectual resistance. Gordon himself expected the town to fall before the end of December, and it is really difficult to understand how he succeeded in holding out until the 26th of January. Writing on the 14th of December he said, "Now, mark this, if the expeditionary force—and I ask for no more than two hundred men—does not come in ten days, the town may fall, and I have done my best for the honour of my country." He had indeed done his best, and far more than could have been regarded as possible. To understand what he went through during the latter months of the siegè, it is only necessary to read his own Journal, a portion of which, dating from 10th September to 14th December 1884, was fortunately preserved and published.

Gordon was not an author, but he wrote many short memoranda on subjects that interested him, and a considerable number of these have been utilized, especially in the work by his brother, Sir Henry Gordon, entitled *Events in the Life of Charles George Gordon, from its Beginning to its End.* He was a voluminous letter writer,

and much of his correspondence has been published. His character was remarkable, and the influence he had over those with whom he came in contact was very striking. His power to command men of non-European races was probably unique. He had no fear of death, and cared but little for the opinion of others, adhering tenaciously to the course be believed to be right in the face of all opposition. Though not holding to outward forms of religion, he was a truly religious man in the highest sense of the word, and was a constant student of the Bible. To serve God and to do his duty were the great objects of his life, and he died as he had lived, carrying out the work that lay before him to the best of his ability. The last words of his last letter to his sister, written when he knew that death was very near, sum up his character: "I am quite happy, thank God, and, like Lawrence, I have *tried* to do my duty."

AUTHORITIES.—*The Journals of Major-General Gordon at Khartoum.* 1885.—C. G. GORDON. *Reflections in Palestine.* 1884.—Edited by D. C. BOULGER. *General Gordon's Letters from the Crimea, the Danube, and Armenia.* 1884.—Edited by G. B. HILL. *Colonel Gordon in Central Africa.* 1881.—*Letters of General C. G. Gordon to his Sister.* 1888.—H. W. GORDON. *Events in the Life of C. G. Gordon.* 1886.—Commander L. BRINE. *The Taeping Rebellion in China.* 1862.—A. WILSON. *Gordon's Campaigns and the Taeping Rebellion.* 1868.—D. C. BOULGER. *Life of Gordon.* 1896.—A. EGMONT HAKE. *The Story of Chinese Gordon.* 1st vol. 1884, 2nd vol. 1885.—Colonel Sir W. F. BUTLER. *Charles George Gordon.* 1889.—ARCHIBALD FORBES. *Chinese Gordon.* 1884.—Edited by A. EGMONT HAKE. *Events in the Taeping Rebellion.* 1891.—S. MOSSMAN. *General Gordon's Diary in China.* 1885.—Lieutenant T. LISTER, R.E. *With Gordon in the Crimea.* 1891.—Lieutenant-General Sir G. GRAHAM. *Last Words with Gordon.* 1887.—WAR CORRESPONDENT. *Why Gordon Perished.* 1896.—Major F. R. WINGATE. *Mahdism and the Egyptian Sudan.* 1891.—*Parliamentary Papers, Egypt,* 1884–85. (C. M. W.)

Görgei, Arthur (1818–——), Hungarian soldier, was born at Toporcz, in Upper Hungary, on the 5th of February 1818. He came of a Saxon patrician family, who were converts to Protestantism. As befitting his rank, he entered in 1837 the Bodyguard of Hungarian Nobles at Vienna, where he combined military service with a course of study at the University. In 1845, on the death of his father, he retired from the army and devoted himself to the study of chemistry at Prague. On the outbreak of the revolutionary war of 1848, Görgei offered his sword to the Hungarian Government. Entering the Honvéd army with the rank of captain, he was almost immediately given the command of the National Garde Mobile north of the Theiss. Whilst he was engaged in preventing the Croatian army from crossing the Danube, at the island of Csepel, below Pesth, the wealthy Hungarian magnate Count Eugene Zichy fell into his hands, and Görgei executed summary justice upon the unfortunate noble, who, being arraigned before a court-martial on a charge of treason, was immediately hanged. After various successes over the Croatian forces, Görgei was appointed commander of the army of the Upper Danube, but, on the advance of Prince Windischgrätz across the Leitha, he retreated, in spite of the remonstrances of Kossuth, upon Waitzen. Here, irritated by what he considered undue interference with his plans, he issued a proclamation throwing the blame for the recent want of success upon the Government, and virtually revolting against their authority. Görgei retired to the Hungarian Erzgebirge and conducted operations on his own initiative. Meanwhile, the supreme command had been conferred upon the Pole, Dembinski, but the latter suffered defeat at Kapolna, and the command again devolved upon Görgei. The campaign in the spring of 1849 was brilliantly conducted by him, and in a series of engagements he defeated Windischgrätz at Izsaszeg and Wohlgemuth at Nagy Sarló; had he followed up his successes by taking the offensive against the Austrian frontier, it is quite possible that he might have dictated terms in the Austrian capital itself. As it was, he contented himself with reducing Ofen, and then he remained inactive for some weeks. Meanwhile, at a Diet held at Debreczin, Kossuth had formally proposed the dethronement of the Hapsburg dynasty, and Hungary had been proclaimed a republic. Görgei, who had refused the field-marshal's baton offered him by Kossuth, now accepted under the new Government the portfolio of Minister of War, while retaining the command of the troops in the field. The Russians had, however, intervened in the struggle and made common cause with the Austrians; they were advancing into Hungary on all sides, and Görgei was defeated by Haynau at Pered. Kossuth perceiving the impossibility of continuing the struggle, and being unwilling himself to make terms, resigned his position as dictator, and was succeeded by Görgei, who, with his army of 20,000 infantry and 2000 cavalry, surrendered to the Russian general Rüdinger at Vilagos. Görgei was not court-martialled, as were his captains, but kept in confinement at Klagenfurt, where he lived until 1867, when he was pardoned, and returned to Hungary. Since then he has not played any rôle in public life, and though in 1885 an attempt was made to rehabilitate him in public estimation, it was not favourably entertained in Hungary. (See also article HUNGARY, *History*, in *Ency. Brit.*, 9th edition.)

Gori, district town of Russia, Transcaucasia, government and 49 miles by rail N.W. of Tiflis, on the Kura; altitude 2000 feet. The surrounding country is very picturesque, the climate very mild, and Gori is one of the best smaller towns of Transcaucasia. It has a high school for girls, and a school for Russian and Tatar teachers. Gori is built at the foot of the hill upon which stood the Goristsikhe fortress, founded, according to tradition, by Byzantine emperors. It was founded probably in the 7th century, and rebuilt in 1123. Population (1897), 10,457.

Gorlice, a district town in South-Western Galicia, Austria, on the Ropa river. It is an old and important trading centre for corn, wine, linen, and woollen stuffs, and other local products, such as the naphtha distilled from the asphalt, of which there are large deposits in the vicinity. Population (1890), 5653; (1900), 6458.

Görlitz, a town of Prussia, province of Silesia, 66 miles east of Dresden by rail, on the Neisse. It is an important industrial town and railway centre, and ranks as the second town in Silesia. In 1889–91 a tower (276 feet) was built to the church of St Peter and St Paul. The town, which has grown rapidly since the demolition of the former walls, has a handsome appearance, and is adorned with statues to the Emperor William I. (1893), Burgomaster Demiani by Schilling (1876), and (in the town park) to Böhme (1898), Prince Frederick Charles (1891), the War of Liberation of 1813, and (in the town) a monument of Roon (1895) and an ornamental fountain (1887). The neighbouring hill of Landeskrone (1410 feet) is adorned with a monumental obelisk to Theodor Körner (1896). Amongst the public institutions may be mentioned the Milich Library and the library of the Upper Lusatia Society—both containing valuable MSS.—the municipal museum of Lusatian antiquities, the Emperor William Museum, commercial, agricultural, industrial, and other special schools, and the railway bridge (1650 feet long), of 32 arches, across the river Neisse. Görlitz is regarded as classic ground for the study of German Renaissance architecture. It also plays a prominent part in the musical world of Silesia. In addition to nearly a

dozen large cloth factories, employing over 2000 hands each, there are factories for the manufacture of alpaca, machinery, gold and silver wares, wirework, chemicals, sausages, railway material, and toys. Population (1885), 55,702; (1900), 80,932.

Gortchakoff, Alexander Michailovitch, PRINCE (1798–1883), Russian statesman, came of a princely family which claimed descent from Rurik. He was born on the 16th of July 1798, and was educated at the lyceum of Tsarskoe Selo, where he had the poet Pushkin as a school-fellow. He became a good classical scholar, and learnt to speak and write in French with facility and elegance. Pushkin in one of his poems described young Gortchakoff as "Fortune's favoured son," and predicted his success. On leaving the lyceum Gortchakoff entered the Foreign Office under Count Nesselrode. His first diplomatic work of importance was the negotiation of a marriage between the Grand Duchess Olga and the Crown Prince Charles of Würtemberg. He remained at Stuttgart for some years as Russian minister and confidential adviser of the Crown Princess. He foretold the outbreak of the revolutionary spirit in Germany and Austria, and was credited with counselling the abdication of Ferdinand in favour of Francis Joseph. When the German confederation was re-established in 1850 in place of the parliament of Frankfort, Gortchakoff was appointed Russian minister to the Diet. It was here that he first met Prince Bismarck, with whom he formed a friendship which was afterwards renewed at St Petersburg. The Emperor Nicholas found that his ambassador at Vienna, Baron Meyendorff, was not a sympathetic instrument for carrying out his schemes in the East. He therefore transferred Gortchakoff to Vienna, where the latter remained through the critical period of the Crimean war. Gortchakoff perceived that Russian designs against Turkey, supported by Great Britain and France, were impracticable, and he counselled Russia to make no more useless sacrifices, but to accept the bases of a pacification. At the same time, although he attended the Paris Conference of 1856, he purposely abstained from affixing his signature to the treaty of peace after that of Count Orloff, Russia's chief representative. For the time, however, he made a virtue of necessity, and Alexander II., recognizing the wisdom and courage which Gortchakoff had exhibited, appointed him minister of foreign affairs in place of Count Nesselrode. Not long after his accession to office Gortchakoff issued a circular to the foreign Powers, in which he announced that Russia proposed, for internal reasons, to keep herself as free as possible from complications abroad, and he added the now historic phrase, "*La Russie ne boude pas; elle se recueille.*" During the Polish insurrection Gortchakoff rebuffed the suggestions of Great Britain, Austria, and France for assuaging the severities employed in quelling it, and he was especially acrid in his replies to Earl Russell's despatches. In July 1863 Gortchakoff was appointed chancellor of the Russian empire expressly in reward for his bold diplomatic attitude towards an indignant Europe. The appointment was hailed with enthusiasm in Russia, and at that juncture Prince Chancellor Gortchakoff was unquestionably the most powerful minister in Europe.

An *approchement* now began between the courts of Russia and Prussia; and in 1863 Gortchakoff smoothed the way for the occupation of Holstein by the Federal troops. This seemed equally favourable to Austria and Prussia, but it was the latter Power which gained all the substantial advantages; and when the conflict arose between Austria and Prussia in 1866, Russia remained neutral and permitted Prussia to reap the fruits and establish her supremacy in Germany. When the Franco-German war of 1870–71 broke out Russia answered for the neutrality of Austria. An attempt was made to form an anti-Prussian coalition, but it failed in consequence of the cordial understanding between the German and Russian chancellors. In return for Russia's service in preventing the aid of Austria from being given to France, Gortchakoff looked to Bismarck for diplomatic support in the Eastern Question, and he received an instalment of the expected support when he successfully denounced the Black Sea clauses of the Treaty of Paris. This was justly regarded by him as an important service to his country and one of the triumphs of his career, and he hoped to obtain further successes with the assistance of Germany, but the cordial relations between the cabinets of St Petersburg and Berlin did not subsist much longer. In 1875 Bismarck was suspected of a design of again attacking France, and Gortchakoff gave him to understand, in a way which was not meant to be offensive, but which roused the German chancellor's indignation, that Russia would oppose any such scheme. The tension thus produced between the two statesmen was increased by the political complications of 1875–78 in South-Eastern Europe, which began with the Herzegovinian insurrection and culminated at the Berlin Congress. Gortchakoff hoped to utilize the complications in such a way as to recover, without war, the portion of Bessarabia ceded by the Treaty of Paris, but he soon lost control of events, and the Slavophil agitation produced the Russo-Turkish campaign of 1877–78. By the preliminary peace of San Stefano the Slavophil aspirations seemed to be realized, but the stipulations of that peace were considerably modified by the Congress of Berlin (13th June to 13th July 1878), at which the aged chancellor held nominally the post of first plenipotentiary, but left to the second plenipotentiary, Count Schuvaloff, not only the task of defending Russian interests, but also the responsibility and odium for the concessions which Russia had to make to Great Britain and Austria. He had the satisfaction of seeing the lost portion of Bessarabia restored to his country by the Berlin Treaty, but at the cost of greater sacrifices than he anticipated. After the congress he continued to hold the post of minister for foreign affairs, but lived chiefly abroad, and resigned formally in 1882, when he was succeeded by M. de Giers. He died at Baden-Baden on the 11th of March 1883. Prince Gortchakoff devoted himself entirely to foreign affairs, and took no part in the great internal reforms of Alexander II.'s reign. As a diplomatist he displayed many brilliant qualities—adroitness in negotiation, incisiveness in argument, and elegance in style. His statesmanship, though marred occasionally by personal vanity and love of popular applause, was far-seeing and prudent. In the latter part of his career his main object was to raise the prestige of Russia by undoing the results of the Crimean war, and it may fairly be said that he in great measure succeeded.

Görz and **Gradisca,** a county and crownland of the Cisleithan half of the Austro-Hungarian Monarchy. In conjunction with the peninsula and islands of Istria, and the town and territory of Trieste, they constitute the Austro-Illyrian Küstenland or littoral. Gradisca is that part of Friuli which remained to Austria after the peace of Nikolsburg in 1866. Population (1880), 211,084; (1900), 232,338. Racially 63 per cent. are Slovenes, 36 per cent. Italians and Ladins, *i.e.*, Friulians who speak the Ladin dialect, and 1 per cent. German. Classified by religions, 99·6 per cent. are Roman Catholic, the remainder being of the Hebrew, Protestant, and Greek Orthodox faiths. In 1896 the marriage-rate was 6·75, the birth-rate

36·40, or, excluding still-births, 35·42, and the death-rate 26·01 per thousand. Of the births 3·38 per cent. were illegitimate, the lowest proportion in Austria. The crownland is represented in the Reichsrath by five members (three Italians and two Slovenes). The provincial Diet is composed of twenty-one Italians and twelve Slovenes. Although 70·47 per cent. of the population is still engaged in agriculture and forestry, industry (17·65 per cent.) is progressing, and particularly the manufacture of silk, of which the chief seats are the town of Görz and the village of Haidenschaft. Viticulture and the cultivation of the silk-worm are the chief agricultural resources. The most important crops are maize, wheat, buckwheat, barley, potatoes, and fruit. A small quantity of rice is also grown. For education, communications, &c., see KÜSTENLAND.

Görz (Italian, *Gorizia*), chief town of the Austrian crownland and administrative district of the same name. Industry is progressing, particularly the manufacture of silk and cotton yarns and stuffs, candles, liqueurs, &c. The principal trade is in early fruit, grapes, and vegetables. The entertainment of visitors is a resource of growing importance, owing to the increasing popularity of the town as a winter resort. The Duc de Chambord, who died at Görz in 1883, was buried in the Franciscan monastery outside the town, where also lie the remains of King Charles X. of France. Population (1890), 21,825; (1900), 25,432; two-thirds Italians, the rest mostly Slovenes and Germans. There is a garrison of 1761 men. The population is almost entirely Catholic, the Jews, Protestants, and members of the Greek Orthodox Church forming a mere fraction.

Goschen, George Joachim Goschen, 1ST VISCOUNT (1831——), British statesman, son of William Henry Goschen, a London merchant of German extraction, was born in London, 10th August 1831. He was educated at Rugby under Dr Tait, and at Oriel College, Oxford, where he took a first-class in classics. He entered his father's firm of Fruhling & Göschen, of Austin Friars, in 1853, and three years later became a director of the Bank of England. His entry into public life took place in 1863, when he was returned without opposition as member for the City of London in the Liberal interest, and this was followed by his re-election, at the head of the poll, in the General Election of 1865. In November of the same year he was appointed Vice-President of the Board of Trade and Paymaster-General, and in January 1866 he was made Chancellor of the Duchy of Lancaster, with a seat in the Cabinet. When Mr Gladstone became Prime Minister in December 1868, Mr Goschen joined the Cabinet as President of the Poor Law Board, and continued to hold that office until March 1871, when he succeeded Mr Childers as First Lord of the Admiralty. In 1874 he was elected Lord Rector of the University of Aberdeen. Being sent to Cairo in 1876 as delegate for the British holders of Egyptian bonds, in order to arrange for the conversion of the debt, he succeeded in effecting an agreement with the Khedive. In 1878 his views upon the County Franchise question prevented him from voting uniformly with his party, and he informed his constituents in the City that he would not stand again at the forthcoming General Election. In the following August he attended the International Monetary Conference at Paris. In 1880 he was elected for Ripon, and continued to represent that constituency until the General Election of 1885, when he was returned for the Eastern Division of Edinburgh. Being opposed to the extension of the franchise, he was unable to join Mr Gladstone's Government in 1880; declining the post of Viceroy of India, he accepted that of Special Ambassador to the Porte, and was successful in settling the Montenegrin and Greek frontier questions in 1880 and 1881. He was made an Ecclesiastical Commissioner in 1882, and when Sir Henry Brand was raised to the peerage in 1884, the Speakership of the House of Commons was offered to him, but declined. During the Parliament of 1880–85 he frequently found himself unable to concur with his party, especially as regards the extension of the franchise and questions of foreign policy; and when Mr Gladstone adopted the policy of Home Rule for Ireland, Mr Goschen followed Lord Hartington and became one of the most active of the Liberal Unionists. His vigorous and eloquent opposition to Mr Gladstone's Home Rule Bill of 1886 brought him into greater public prominence than ever, but he failed to retain his seat for Edinburgh at the election in July of that year. On the resignation of Lord Randolph Churchill in December 1886, Mr Goschen, though a Liberal Unionist, accepted Lord Salisbury's invitation to join his Ministry, and became Chancellor of the Exchequer. Being defeated by Mr Nevill, a Gladstonian Liberal, at Liverpool, 26th January 1887, by seven votes, he was elected for St George's, Hanover Square, on 9th February. His Chancellorship of the Exchequer during the Ministry of 1886 to 1892 was rendered memorable by his successful conversion of the National Debt in July 1889 (see NATIONAL DEBT CONVERSION). With that financial operation, under which the new $2\frac{3}{4}$ per cent. Consols became known as "Goschens," his name will long be connected. Aberdeen University again conferred upon him the honour of the Lord Rectorship in 1888, and he received a similar honour from the University of Edinburgh in 1890. In the Unionist opposition of 1893 to 1895 Mr Goschen again took a vigorous part, his speeches both in and out of the House of Commons being remarkable for their eloquence and debating power. From 1895 to 1900 Mr Goschen was First Lord of the Admiralty, and in that office he earned the highest reputation for his businesslike grasp of detail and his statesmanlike outlook on the naval policy of the country. He retired in 1900, and was raised to the peerage by the title of Viscount Goschen of Hawkhurst, Kent, on 17th December. He married in 1857 Lucy, daughter of Mr John Dalley, but lost his wife in 1898. In educational subjects he had always taken the greatest interest, his best known, but by no means his only, contribution to popular culture being his participation in the University Extension Movement; and his first efforts in Parliament were devoted to advocating the abolition of religious tests, and the admission of Dissenters to the universities. His published works indicate how ably he combined the wise study of economics with a practical instinct for businesslike progress, without neglecting the more ideal aspects of human life. In addition to his well-known work on *The Theory of the Foreign Exchanges*, he is the author of several financial and political pamphlets and numerous addresses on educational and social subjects. Among the latter may be mentioned that on *Cultivation of the Imagination*, Liverpool, 1877, and that on *Intellectual Interest*, Aberdeen, 1888.

Goshen, capital of Elkhart county, Indiana, U.S.A., on the Elkhart river, and on the Cleveland, Cincinnati, Chicago, and St Louis, and the Lake Shore and Michigan Southern railways, at an altitude of 800 feet. It has some manufactures, especially of waggons, agricultural implements, flour, &c., and a large lumber trade. Population (1880), 4123; (1890), 6033; (1900), 7810, of whom 462 were foreign-born.

Goslar, a town of Prussia, province of Hanover, situated at the north foot of the Harz, 31 miles by rail south by west from Brunswick. The post office (1893), classical school (1888), museum of the Natural Science Society (especially the collection of Harz minerals), the Fenkner Museum of Antiquities, and the miners' church of St Peter and St Paul (Frankenberg), built originally in 1108, rebuilt in 1225, and restored in 1880, deserve to be mentioned. The emperor's house was restored in 1867–80. Population (1885), 11,736; (1900), 16,403.

Gospels.—In this article a somewhat different order will be followed from that adopted in *Ency. Brit.*, vol. x. Points connected with the external evidence will be treated first for all the Gospels together, and we shall then pass to the evidence supplied by the study of the works themselves and their relations to one another.

I. *External Evidence.*

A few statements and conclusions in the earlier article seem to require revision in the light of later investigations.

(1) The three Epistles of Ignatius, as known through the Curetonian Syriac, are there regarded as genuine, while the seven Epistles in the short Greek or Vossian form are supposed to be an unauthentic expansion, and are assigned to A.D. 150. It has now been established, mainly through the labours of Zahn and Lightfoot, that the latter are genuine, and that their date must be thrown back somewhat. They may be placed between A.D. 110 and 130. This difference of twenty to forty years is not unimportant in relation to the stages in the recognition of the Gospels.

(2) Formerly the view was taken that the first three Gospels were the documents designated by Justin as *Apostolic Memoirs*, and his chief authorities; but that he made no use at all, or at most an extremely slight one, of the Fourth Gospel, and that his only source besides for the Gospel history was oral tradition. The progress of inquiry has confirmed the opinion that Justin did use the Synoptic Gospels, or at all events, Matthew and Luke, and that they were among the works chiefly referred to by him under the name *Memoirs of the Apostles*. It has, besides, been decidedly favourable to the belief that he knew and used the Fourth Gospel also.

Did Justin Martyr use the Fourth Gospel?

The majority of critics, including many who cannot be suspected of conservative bias, now hold this. A. Hilgenfeld, who in 1850 declared it to be "in the highest degree improbable that he was acquainted with it" (*Krit. Untersuch. über die Evang.*, p. 304), writes in 1875 that "the use [by Justin] of the Johannine Gospel would be difficult to deny" (*Einleit.*, pp. 66, 67); compare Keim, *Jesus of Nazara*, i. p. 186 ff., English translation; Thoma, *Genesis des Evang. Johann.*, p. 824; H. Holtzmann, *Einleit.*, 3rd ed., p. 100; Jülicher, *Einleit.*, p. 293; Harnack, *Chronol.*, i. p. 673 f. At the same time, these writers do not admit that Justin attributed Apostolic authority to the Fourth Gospel, though they allow that he did to the others. This is a point to which we shall return. Among writers who are more unreserved in their admissions as to the testimony borne by Justin's writings to the Fourth Gospel, Prof. James Drummond, *Theological Review* for October 1875, and April and July 1877, and Dr Ezra Abbot, *The Authorship of the Fourth Gospel, External Evidences*, pp. 16–48, may be specially mentioned.

In judging of the signs of Justin's use of the Fourth Gospel, care must be taken not to exaggerate the contrast afforded by his use of Matthew. This is the Gospel from which he unquestionably takes most, but he does not "quote" it in the strict sense of the word. He nowhere refers to it specifically; with only one or two exceptions he does not give its words exactly; most often he departs from it considerably, condensing, or combining passages from different parts of it, and from parallels in Luke. To say the least, we cannot expect greater exactness when he reproduces the substance of passages of the Fourth Gospel.

Further, the verdict must depend upon the cumulative force of a number of indications, many of them slight in themselves. The evidence cannot be massed and examined here, but a few illustrations may be given. In *Dial.* c. 69, in one of his customary summaries of facts which were fulfilments of prophecy, there are no fewer than three traits which forcibly remind us of John. One of these relates to a charge brought by the Jews against Jesus. There are many other allusions in different places in the *Dial.* to our Lord's conflicts with the Jews, which recall this Gospel specially (*e.g.*, comp. turns of expression in *Dial.* c. 136 with Jn. v. 37, 38, 23, 24). To pass to theological teaching: the correspondence between Justin and the Fourth Gospel in regard to the doctrine of the Person and Mission of Christ is extensive. See, *e.g.*, for several points, *Apol.* ii. 6, comparing Jn. i. 1, 2, 3, 12, 13. The peculiarly Johannine thoughts, that Christ came from the Father, that the Father sent Him, that He fulfilled the Father's will, that He derived His power from the Father, are prominent in Justin. See, *e.g.*, *Apol.* i. 6 and *Dial.* 64, and comp. Jn. i. 9, iii. 31, xii. 46, &c.; *Apol.* 14, and comp. Jn. xiv. 6; *Dial.* 140, and comp. Jn. iv. 34, xiv. 10, &c.; *Dial.* 30, and comp. Jn. v. 36; *Dial.* 100, and comp. Jn. x. 18. The same types also appear. In addition to "the light" and "the living water," which will be found in passages already referred to, we have the brazen serpent twice (*Apol.* 60, and *Dial.* 91; see especially the latter).

Among the largely increased number of students who have been convinced that Justin was acquainted with the Fourth Gospel, there are, at the same time, as we have observed, those who hold that it did not in his estimation take rank, like the Synoptics, as a member of the class of *Memoirs of the Apostles*. The ground for supposing this difference is chiefly his more limited and less distinct use of it. But as regards this, it may well be urged that the contents of the Fourth Gospel were on the whole less suited to the purpose he had in hand. It may be added that there are passages in which, according to the most natural interpretation of his language, statements taken from the Fourth Gospel are referred to the Memoirs. (See *Dial.* 105; also *Apol.* i. 46, where he says that "we were taught"—no doubt he would say on the authority of the Apostles, and probably by means of their "Memoirs"—that "Christ was the Word of Whom the whole race of men partook." Comp. also *ibid.* c. 66.)

A few words must be added on another point in connexion with Justin, viz., the question whence he derived those traits and incidents in his representation of the Gospel history, which cannot be traced to the Gospels, or to reflexion upon Old Testament prophecies, aided by his own imagination. Here the view adopted in the earlier article is that which "orthodox" writers had commonly maintained. The use by Justin, to an appreciable extent, of any written source or sources other than the Gospels is denied. Few critics of any school would now feel able to agree to this. Seeing that Hegesippus, a contemporary of Justin, is said by Eusebius to have quoted from the Gospel according to the Hebrews (*H. E.* iv. 22), and that another contemporary, the author of the Homily commonly called the 2nd Ep. of Clement, also quotes from an Apocryphal Gospel, apparently that according to the Egyptians, it is in itself probable that Justin may have known some such work or works, and been quite ready to give credence to its or their statements. Some parallels may be noticed between Justin and the recently recovered fragment of the *Gospel of Peter*, and several critics think that Justin himself refers to this work when he says that a fact about Peter and certain other Apostles is recorded in his (Peter's) Memoirs (*Dial.* 106)—hereby assuming that if we had the whole work we should find therein the statement in question. But there is a passage entirely to the purpose in Mark iii. 16, 17, and Justin's words can be satisfactorily explained as an allusion to this Gospel. It should also be observed that in those few particulars in which there is a measure of resemblance between Justin and the Gospel of Peter, the former (to speak generally) is nearer to the Gospels. In one important respect his language is directly opposed to that of the work in question.

If Justin was not only acquainted with the Gospel of Peter, but believed it to be the composition of that Apostle, or to embody his testimony, he must have regarded it as a high authority. It is contrary to the evidence to suppose that he did this. Whether he included any other writings, afterwards reckoned by the Church as "apocryphal" among his *Apostolic Memoirs*, or even while admitting them to this class was conscious of any difference in value and authenticity between them and other members of it to which afterwards a unique position was attributed, are questions which the indications in his writings hardly enable us to decide.

Earliest evidence of grouping of Gospels.

(3) The so-called Muratorian fragment on the Canon would not now generally be placed so early as A.D. 170. Lightfoot in his latest work seems to regard A.D. 185–190 as more probable (*Apostolic Fathers*, Part i. vol. ii. pp. 413 and 495). Zahn arrives at about A.D. 210 as its date (*Kanon*, ii. 136). The first formal list of the writings of the New Testament which we know of must thus be held to belong to a somewhat later time than has often been supposed.

But as regards the evidence of the special recognition of the four Gospels there is an equivalent in the fuller knowledge which has been obtained of Tatian's *Diatessaron*. Little room now remains for doubting that this work was an account of the life of Christ compiled from the Gospels—from these and not in any comparable degree from other sources, and also not more from the Synoptics than from the Fourth Gospel, with the first words of the Prologue to which the work began, "In the beginning was the Word."[1] The importance of this fact will be perceived, if we bear in mind that Tatian was at Rome with Justin Martyr, and speaks of him with profound reverence. We may take A.D. 160–180 as the period of his chief literary activity.

Authenticity generally.

(4) In judging of the external evidence as to the authenticity of the Gospels, and in an especial manner of the Fourth Gospel, it is essential that we should take account of the position held by the four Gospels in the Church at the end of the second and beginning of the third century, and should endeavour to estimate the age and strength, and to speak generally the trustworthiness, of the traditional beliefs on which it rested. This is a subject on which some of the chief writers on the Canon in recent times have joined issue. It is admitted on all hands that at this epoch the four Gospels were regarded in the most prominent Churches of the Roman Empire as the embodiment, in an altogether unique sense, of the Apostolic testimony in regard to the life and teaching of Christ. Irenæus (*Adv. Hær.* book iii. cc. 1–11) is a witness for ancient Churches on the western coast of Asia Minor and Rome, as well as Southern Gaul; the Muratorian fragment is another witness as to the Church of Rome, whether it is, or is not, by Hippolytus, as also are the undoubted works of Hippolytus; Clement of Alexandria (*Strom.* iii. c. 13) for that great Christian community. Tertullian (*Adv. Marcionem*, iv. 5), again for Rome as well as for North Africa. It can hardly be doubted that the authority of the fourfold Gospel was equally firmly established in at least some other Churches which are not so directly represented; while soon after this time it had certainly come to be accepted in all parts of the Church. Books which had only lately become known could not have been regarded as these were in those divers Churches, and by those eminent teachers to whom we have referred. These men themselves had a long and wide experience of Christian tradition. Irenæus refers in particular to his recollection of what as a boy he had heard Polycarp relate concerning John, by whom he evidently means the Apostle. It has been said that as Irenæus appears to be mistaken when he asserts that Papias was a hearer of John, confusing here between John the Apostle and a certain elder John, so he may be mistaken in the case of Polycarp. His statement, however, in regard to Papias seems to have been founded on what he had read in the latter's book; and it is one thing that he should have formed and preserved an erroneous impression thus, quite another that he should be at fault in reminiscences of what he had heard in early youth, about the distinctness of which in his own case he is very emphatic. But it is, perhaps, more important to observe that in regard to the tradition of the residence of St John in Ephesus, and all that concerned the recognition of the Fourth Gospel, as well as the other three, there must have been abundant opportunities for his own memory to be corrected by that of many other Christians both of the same age as, and older than, himself. The place which we find the four Gospels occupying at the epoch we have indicated was due to an appreciation of their value which had grown by degrees; yet at the same time it would seem to have been one which could not have been attained without a long-standing conviction as to their peculiar claim to be trusted. When written accounts of the life of Christ were put forth—which, according both to the view traditional in the Church and other evidence, was not till about or after the close of the lives of St Paul and St Peter—they naturally did not cause the oral method of transmitting the facts, hitherto relied on exclusively, to be at once laid aside. But as those who could themselves remember the Apostles and their fellow-labourers and the teaching given by them passed away, the importance of documents which came down from the Apostolic age, or its confines, necessarily increased. There are inequalities for a certain period in the signs of their distribution and use. But this is easily understood when it is considered that they appeared in different quarters, and that an interval of about thirty years (again according to both tradition and criticism) elapsed between the publication of the earliest and the Fourth; and when in addition we remember the labour of copying, and allow for the probability that one rather than another might in a special manner commend itself to various individual minds and Churches. Again, attention was at first fixed upon the substance of the Gospel; the precise words of the record were comparatively little regarded. Hence there was small reason for indicating particular sources; and when two or more sources contained parallel passages, there was a disposition to combine them instead of quoting them in their distinctness. Of these statements abundant proofs might be adduced from the writings of the sub-Apostolic age and the Apologists of the middle of the 2nd century. With time the distinct value of each of the several records was perceived, and a conception of their relations to one another was attained. Here, as in many other cases, the work of definition was promoted by conflict with heresy. Gnostics, and others who held more or less exaggerated and one-sided views, were wont to exalt one or more of the four Gospels to the disadvantage of the remainder, or to make use of other Gospels.[2] Hence arose the need of marking off clearly those which were to be deemed authentic, and of insisting that all these were alike to be reverenced. The intrinsic worth of the four Gospels, their manifest superiority to all other works of the kind, and their agreement with the tradition of Apostolic doctrine, may have had a share in procuring this result. But the conclusion in question seems to have been formulated even more on the ground of the actual history of the Gospels. Indeed, we may say with confidence that it could not without this external reason have been arrived at so swiftly and surely, with so little doubt and debate, as it was, when we consider the unfitness of the masses of men at all times, and peculiarly so of the early Christians, for forming a decision on critical grounds. In this connexion it is well to note that, according to the information which we possess, the leading part in framing this Canon of the Gospels was taken by the chief Churches in that Greek-speaking world for which the Gospels (not excepting the First in the form in which we have it) were composed.

II.—*Internal Evidence.*

1. *The Synoptic Problem.*—The "originality of Mark" is a thesis maintained at the beginning of the article in the ninth edition of this work. It is there argued that the

[1] For a narrative of the literary finds and investigations which lead to this conclusion, see *The Diatessaron of Tatian*, by S. Hemphill; or the introduction to *The Diatessaron of Tatian*, by J. H. Hill.

[2] See Iren. *Adv. Hær.* iii. xi. 6; and for the attitude of the Alogi to the Fourth Gospel, *ib.* § 9, and *Epiphan. Hær.* li.; also, for use of Gospel of Peter by Docetae, Eus. *H. E.* vi. 12.

Second Gospel cannot be derived from the First and Third, and that on the contrary it most nearly represents, for that portion of the Gospel history which it gives, a source used in the First and Third. These are some of the most widely accepted and most secure results of modern criticism as to the literary relations of the Gospels. It will not be necessary here to dwell further upon them.

Was the common source oral or written?

We go on to ask whether the common source was oral or written. In judging of this question we must take account not only of the amount of agreement between all three Synoptics, but also of the still fuller agreement between Mark and the two others separately in the same contexts. When, for example, in a passage, the substance and many of the words and phrases of which are common to all three, we find whole sentences and the general structure of the passage identical in Matthew and Mark, though Luke differs more or less, the obvious inference is that the fixity of the common source must at least be measured by the resemblance between the two first, and that the third has departed from it. But this is the case again and again. In like manner there are numerous instances, though, on the whole, not so many, in which Mark and Luke agree, where Matthew is independent. Nearly the whole of the subject-matter, and to a large extent the phraseology, of Mark reappear in Matthew and Luke taken together. Further, the correspondence between the Synoptics, not only in regard to language and the form of separate narratives, but also in regard to the sequence of sections, needs to be particularly noted. And the agreement between the pairs Mark and Matthew, Mark and Luke, once more calls for explanation, as well as that between all three. In point of fact, Mark's order is almost invariably supported by one of the others, as well as frequently by both. The amount of agreement of these different kinds is so great that to the majority of students of the subject at the present time it seems impossible to explain it solely by the influence of a common oral tradition, even when every allowance is made for unusual conditions which may have tended to give stability to such a tradition.

The common source, then, was a document in which almost the whole of the contents of Mark was found, given at least nearly in the same form and arranged in the same manner. Whatever else we may be able to learn about this document, *e.g.*, as to whether any other matter was included in it, we have thus made a first approximation to a knowledge of its character.

We have traced agreements between Mark and either of the other two Synoptics to a source which was also known to and largely used by the third.

Matter common to SS. Matthew and Luke.

May we not, then, also see the same common source revealed in the agreement of the other pair, Matthew and Luke? The answer is that it would not be unreasonable to do so on the same condition as before, viz., that the agreement occurs as part of a more general parallelism between all three. But while this holds universally in connexion with the coincidences between Mark and one of the others, those of Matthew and Luke where this requirement is satisfied are comparatively rare, and they consist for the most part only of isolated words or brief phrases.

An instance in which the agreement is more extensive is afforded by a comparison of the passages in the three Synoptics on the preaching of the Baptist. The relations between the three may be satisfactorily explained by the supposition that the matter which is verbally identical in Matthew and Luke, but omitted by Mark (Matt. iii. 7–10 and 12; Lu. iii. 7–9 and 17), together with the words given by all three (Matt. iii. 11; Mk. i. 7, 8; Lu. iii. 16), was taken from the source from which the common elements generally in the three Gospels are derived. There may be one or two other pieces of discourse in regard to which the same view may deserve to be considered. Holtzmann, however, refers a good deal more matter which is not given in Mark to the same source, where there is not the reason which I have indicated, or any other sufficient grounds for doing so (see below).

The greater part of the matter not contained in Mark, which is common to Matthew and Luke, falls into another category. It is introduced into the Synoptic outline very differently in these two Gospels. This fact clearly suggests that it existed in a separate form, and was independently combined by the first and third Evangelists with the contents of that source which we have hitherto had before us. This matter has also a character of its own; it consists mainly of pieces of discourse; and it is not difficult to imagine influences which during the period of oral teaching may have tended to secure the collection of considerable portions of it at least, in the shape in which we have it. (Comp. Weizsäcker, *Apost. Age*, ii. p. 32 ff., in Eng. trans.) It is, perhaps, most generally believed by critics at the present time that the first and third Evangelists derived it from the same document. But the grounds for supposing a common written source are not so strong in this as in the former case. Some connexion between the source or sources used in the two Gospels must, no doubt, be assumed, for parts of it are reproduced in the two in exactly, or almost exactly, the same form. But in other parts, as pointed out in the earlier article, the agreement is far less close. This strange variety requires explanation. Further, the arrangement of the whole of this matter in Matthew and Luke is very different, not only, as we have already noted, with reference to the general plan of the Gospel narrative, but also regarded simply by itself. It is far more broken up in Luke. If, then, its derivation from a single common document in both is assumed, we have to ask in which of the two that document has been most faithfully followed; or, in other words, whether the first Evangelist has brought together what he found dissevered, or the third has scattered what he found united. The former of these processes would seem to have been the easier and the more natural. But this view of the origin of the difference is hard to reconcile with the tradition which, on the strictest grounds of historical criticism, ought to have considerable weight, as to the connexion of Matthew with the First Gospel. It would still be possible, indeed, that the common document might have been his work, but the Third Gospel would, at least in important respects, be the truest representative of it.

This objection may be avoided, and we shall have a theory which, it would seem, takes account more fully of all the facts, if we suppose that the particular collection of the matter we are considering, which has been embodied in Matthew, was not directly used by the third Evangelist, but that he himself compiled the similar matter which he gives from what he had learnt by oral transmission or obtained in the form of written fragments. Those passages in which the two Gospels agree almost verbally may have been first copied from a Greek version of the Matthew document by some who were making smaller collections of the teaching of our Lord on particular topics for their own use; or, again, they may have been pieces early translated from the Hebrew document, or even portions of Greek oral tradition that had been written down, which were introduced by the editor of the Greek Matthew at the places to which, according to his original, they belonged, but which, as we have supposed before, came independently into the hands of the third Evangelist. The latter seems expressly to claim that the arrangement of what he related was his own (Lu. i. 3).

It will be desirable now to say a few words on the composition of each of the three Synoptic Gospels individually, taking into account as we do so what we have learnt from comparing them, and also touching upon any other points which need to be considered.

St Mark.

Can we determine somewhat more exactly than we have hitherto done how the Second Gospel was related to the document which was at least most nearly reproduced in it? (*a*) To what extent did it differ therefrom by abbreviation? We have seen that the additions to this source which can with any high degree of probability be made on the ground of parallelisms in Matthew and Luke are but scanty. Holtzmann, however, supposes that it contained among other things the Sermon on the Mount. The omission of this sermon, and (with the exception of a couple of sayings) of all parallels to its contents, is a remarkable feature of the Second Gospel. It is impossible to imagine that its author, or editor, could have been ignorant of the whole of this matter. That he should have passed it over entirely, if it was included in his own principal document, would also have been very strange. That he might have thought its inclusion by himself unnecessary would be somewhat more easy to understand, if it had already been set forth in another writing. (*b*) Scattered throughout Mark there are forcible and vivid touches which do not appear in the parallels in Matthew and Luke. Were these added to the document which lay before them subsequently to their use of it? There hardly seems to be good reason for thinking so. Many of the expressions in question appear to be in the style which, to all appearance, belonged to the original document. The third Evangelist often revised, recast, and condensed that which he took from it. To a more limited degree the first did the same. It is natural that their omissions should in some instances have coincided. That some changes were made in the original work during the earliest period of its circulation is not improbable. But these appear to have been slight. On the whole we are justified in believing that the Second Gospel is substantially the work which, as Papias learned from "the Elder," Mark composed from his reminiscences of Peter's teaching.

St Matthew.

The editor who has given us the First Gospel in its present shape in Greek employed mainly, if not exclusively, two documents. Discourses and sayings were the most characteristic contents of one of these, though it is possible that some narratives may also have been comprised in it. Occasions on which the teaching recorded was given may probably have been indicated in it to some extent; but words spoken at different times which bore on the same subject would seem not infrequently to have been put together. This work was originally written in Hebrew (or Aramaic), and if not by the Apostle Matthew, was at least known to represent what he had taught. The editor of the Greek Matthew either himself translated this work, or so much of it as he required for his purpose, or had before him a translation which had already been made. But along with this he used Mark's narrative. Nay, he may without serious exaggeration be said to have incorporated the Matthew document with it. It supplied the framework, while in passage after passage we have virtually a transcript from it, with here and there an abbreviation or the omission of a sentence that may well have appeared redundant, or with some other saying woven in. Additional sayings in such contexts need not indicate the existence of an account parallel in other respects which contained them. They may have been introduced from some distinct group of sayings in the other document, or be fragments of oral tradition inserted by the editor of the Greek Gospel. Yet it is in itself probable that the two documents overlapped; and where sections which have parallels in Mark are not placed in the same connexion as these, or have many marks of an independent origin in their form and substance, or differ in both respects, it is reasonable to see in these variations the influence of the Hebrew original.

It is especially noteworthy that where the placing differs, the similarity in other ways is also less close than usual. Comp. Matt. viii. 23–34 with Mk. iv. 35–v. 20; Matt. ix. 18–26 with Mk. v. 21–43; Matt. x. with Mk. iii. 13–19*a*, and vi. 6*b*–13. (Matt. x. contains much matter which is given in various places in Luke, also six verses (17–22) closely parallel to Mk. xiii. 9–13.) Sometimes, however, Mark's outline seems to have suggested the point for introducing a passage which, though it has a parallel in Mark, seems to have been derived from another source. Thus Christ's answer to the charge of the Pharisees that He cast out devils by Beelzebub occurs in the same general connexion in Matthew as in Mark (Matt. xii. 24; Mk. iii. 22); but the incident which gave rise to the charge is the same as that in Luke (xi. 15–26), where it is part of his "great insertion," while the language of the answer has also far closer affinities with that in Luke than in Mark. Again, a discourse "concerning offences" is given in Matt. xviii. 5–35, in a position corresponding to the one in Mk. ix. 42–50, and several of the sentences in Mark are almost verbally reproduced; but with them we find combined both much that is peculiar and also a short piece on the same topic, which is placed by Luke (xvii. 1–4) towards the close of his "great insertion." Another narrative occurring in a context which closely resembles Mark, but containing itself many signs of independence, is that of the Canaanitish woman (Matt. xv. 21–28; Mk. vii. 24–30).

St Luke.

We possess no such specific information from any early writer in regard to the composition of St Luke's Gospel as we do in the case of Matthew and Mark. But when we examine it in conjunction with the Acts of the Apostles, which is evidently by the same author, we obtain strong confirmation of the traditional view of the authorship. (*a*) We may indicate first an argument based on literary style and vocabulary. As was remarked in the earlier article, there are variations of style in the Gospel, and so there are in the Acts. Nevertheless characteristic words and phrases, which for convenience we will at once call "Lucan," occur throughout, and evidently proceed from the author of the works in their final shape, though in parts where he is using materials derived from others, or possibly adopting a style suited to a special theme, they are naturally less frequent. Certain sections, however, of the Acts, commonly called the "we" sections from the use in them of the first person plural (xvi. 10–17; xx. 5–15; xxi. 1–18; xxvii. 1–xxviii. 16), are generally admitted to be notes of travel by a companion of St Paul. Now it is a remarkable fact that "Lucan" words and phrases are specially abundant in these sections. The inference is that the writer of them was the author of the book as a whole and of the Gospel. (*b*) There are the geographical accuracy and the other elements of historical credibility which have so much impressed Professor W. M. Ramsay and others.

Luke, as well as the editor of the Greek Matthew, used Mark; but he revised its language much more freely, and omitted more. He also supplemented it with other material, but this—if arguments which have been briefly urged above are sound—was not taken from a single source, but amassed by himself through personal inquiry and labour.

2. *The Fourth Gospel.*—The special characteristics of the Fourth Gospel have been for the most part sufficiently brought out in the article in *Ency. Brit.*, vol. x. There would be agreement as to many of them among students who have examined the Gospel from very diverse points of view. The additional remarks here made will mainly have reference to the bearing of those characteristics upon the question of the credibility of the narrative, and their

object will be to direct attention to some points which seem to have been too much disregarded in that article.

(*a*) The foregoing brief inquiry into the history of the composition of the Synoptic Gospels, while it justifies us in regarding them as inestimably precious for what they relate as to the Life and Teaching of Jesus, should prevent us from erecting them into a standard by which every other treatment of the same theme should be tried. There is good reason to think that the material which has been preserved in them had been authenticated by eye-witnesses; but no one of the authors of the works in their present form was in a position to furnish an approximately complete view of their common subject.

Differences from Synoptics.

In respect of one difference between the Synoptics and the Fourth Gospel, namely, the mention by the latter of several visits to Jerusalem at the time of Jewish Feasts, to which the former make no reference, probability is overwhelmingly strong on the side of the Fourth Gospel. In the Synoptic Gospels Jesus is represented as ready to conform to the requirements of the ancient Law. This being so, He could not have refrained persistently from going up to Jerusalem for the great Feasts. Even without this reason He must have been attracted there by those great gatherings of Jews which afforded such excellent opportunities for the fulfilment of His prophetic Mission. In addition to this, we cannot understand the final catastrophe, apart from such previous conflicts between Jesus and the ruling classes in Jerusalem as are described in the Fourth Gospel. His work in Galilee did not sufficiently threaten their authority to have given birth to a settled determination to destroy Him. Nor could their design and plot against Him have taken shape within three or four days after His triumphal entry.[1]

To turn to the Teaching of Jesus: the thoughts in the Fourth Gospel are less apparently simple, and are less confined within Jewish forms. But ought it to be supposed on that account that they are less likely to have been those of the Master Himself? Is the matter-of-fact writer always able to give a truer estimate of a great character, or of a mighty and complex movement, than the man of reflective mind and philosophical bent? That the latter's representation is more liable to be coloured by his own individuality is of course to be admitted. But in spite of this the advantage is not wholly, or even chiefly, on the side of the man of more limited mind and nature. There might well be portions of the teaching of Jesus which the whole body of the Twelve at first, and many of them to the end, understood very imperfectly, which would be little reflected in the ordinary instruction given to Jewish and other converts in Palestine or elsewhere, and the significance of which could only be apprehended by a man of peculiar depth and intensity of mind after long meditation, and when experience had thrown light upon them.

(*b*) The author of the Fourth Gospel undoubtedly desires not merely to give a faithful record of the deeds and words of Jesus, but to impress upon his readers his own view of the Person and Mission of Jesus; and with this intention he makes a selection among the facts, relating, or giving special prominence to, those which are suitable for his purpose. Such selection, designed to bring out certain aspects of the truth, may be perfectly legitimate and necessary. But we have to ask whether the effect which the beliefs of the Evangelist have had upon his narrative extends farther than this. Has his conception of the Person of Jesus led him to transform the facts so that he is not a trustworthy witness even in what he states?

In this connexion we will consider, first, the question of the influence upon him of Philo's philosophy. That there are points of contact between the thought and language of the Fourth Gospel and those of Philo is unquestionable. But was the Evangelist a disciple of Philo, who, after being well grounded in that philosophy, embraced the Gospel, and who, in his later faith, sought for an exemplification of the principles he had before held? Or was he simply a thoughtful Christian believer, who, having formed his idea of Christ and His Mission primarily from the utterances of Jesus Himself and all the facts concerning Him, was ready to avail himself of terms and forms of thought taken from Philo, when he met with them, in order to express what was already in his mind? In the former case there would be far greater danger that his impressions in regard to the facts and his presentment of them might be affected by philosophy than in the other, and consequently, in judging of his trustworthiness as a historian, it should make a wide difference whether his relation to Philo was of the one or the other kind. A careful comparison between the Fourth Gospel and the writings of Philo brings out the essential independence of the Evangelist. Philo's language on the being of the Logos and the relations of the Logos to God and to the world is wavering and contradictory. It is exceedingly difficult to obtain a clear idea of his system of thought, and very different judgments have been formed upon it. The Evangelist, on the other hand, shows a thorough mastery of his subject. In the few verses of his Prologue he gives in firm, strong outlines a majestic view of God and of the whole scheme of creation and human history. He is able to do this because his mind is under the power of certain dominant thoughts, which he did not derive from Philo. The relation of the Father to the Son, and of the Son to the Father, manifested through the Incarnation, have, for him, illuminated the doctrine of the Logos. Nor, on the other hand, are there any signs that the lines of philosophical speculation which commended the great concept of the Logos to Philo were of special interest or significance for the Evangelist. Again, there is evidence of a sense, to say the least, of historic propriety in the fact often noticed, that the use of the term "the Word" to describe the Person of Christ is confined to the Prologue. An instance of a similar kind is the restricted use of μονογένης, an epithet applied to the Logos in Philo. It occurs only in the Prologue (i. 14, 18), and in the comment of the Evangelist (iii. 16–21), which is virtually a prolongation of the last note of the Prologue.

The influence of Philo.

The places after the Prologue in which we have the nearest parallels to the language and thought of Philo are the passages in which Jesus speaks of Himself as the Manna (vi. 26 ff.) and the Light of the World (viii. 12; ix. 5). But it should be remembered that there were other associations which might well have suggested the use of these figures; and further, it should be observed that the whole mode in which they are applied accords with the conditions of His Incarnate state. He is the food of man by that which He communicates through His flesh (vi. 51 ff.). He is the Light to those who mark and follow His human example (viii. 12). The absence, too, of one trait is specially noteworthy. Philo dwells on the high-priestly character of the Logos, whereas the priesthood of Christ is not named or indicated in the Fourth Gospel.[2] And yet that it should have been would have been rendered

[1] In the ninth edition (see vol. x. p. 832, *n.* 3) it is allowed only that the Fourth Gospel may possibly be right as to there having been visits to Jerusalem before the last Passover season, and the really strong reasons for believing that there must have been are overlooked. In the case of another difference between the Fourth Gospel and the other three, that in regard to the day of the Crucifixion, it is more decidedly admitted (*ib.* 828) that the Fourth has the advantage.

[2] Unguarded expressions in *Ency. Brit.*, vol. x. (pp. 824, 827, 830, *n.* 2) may be taken to imply the contrary.

natural even by considerations such as appear in the Epistle to the Hebrews. The fact is also the more striking, because the thought of Christ's death as a propitiation, which is utterly alien to Philo's philosophy, is strongly emphasized. That is, He is set forth as a Sacrificial Victim, but not as the Priest.

Universalism. It is evident that the author of the Fourth Gospel had a conception of the Mission of Christ which transcended all limits of nationality, and that it is part of his aim to bring out its universal and eternal significance. Yet in connexion with this, again, we have marks of fidelity to the actual history. We gather from this Gospel no less than from the Synoptics that the Ministry of Jesus was exercised primarily, and almost exclusively, towards Jews. There is an exception—His conversation with the Samaritan woman, and preaching in a Samaritan village—just as there are one or two exceptions also in the other Gospels. It is true the exception is dwelt upon at considerable length, and the occurrence is the occasion for some profound instruction. But it should also be observed that remarks are introduced by the Evangelist which seem expressly designed to show that this labour formed no part of the proper plan of Jesus (iv. 3, 39, 40).

The portraiture of Jesus. It is said that the human nature of Christ is disregarded in the Fourth Gospel. This plainly is not true in respect to physical infirmity (iv. 6) or human emotion (xi. 35, 38). But it is more important to note that we must turn to this Gospel for the fullest and most vivid representation of Jesus as the perfect Son of the Heavenly Father under the conditions of humanity, living here below a life of dependence upon and submission to the Father, doing on earth the Father's Will, not less than for the plainest declaration of the doctrine of His Divine, Eternal Sonship. In reviewing its teaching as a whole, we may be led to feel that His absolute, Divine Sonship is presupposed even in those passages in which it is not directly suggested. In point of fact He could be *perfect* even as the human Son only in virtue of His true Divinity. Nevertheless, it is an important point that in many places in this Gospel Jesus speaks so completely from the standpoint of humanity, that the question of His Divinity is not raised, or not necessarily so (*e.g.*, iv. 34; vii. 16–18; xiii. 16, 20; xv. 21).

Particularity of description. (c) Some names used, and classes referred to, in the Synoptics do not occur in the Fourth Gospel. We do not hear in it of "scribes" and "elders," terms which would be very misleading to Greek readers; in place thereof we have the easily comprehensible word "rulers." The Sadducees —mentioned only once in Mark and Luke, where Christ gives His answer regarding the Resurrection, and the introduction of whose name in Matthew in two other connexions does not further illustrate their doctrines or party-relations—do not appear; nor do the Herodians, named twice in Mark (and in the parallel to one of these places in Matthew). But the character and position of the Pharisees are given far more clearly than in the Synoptics. Their influence is referred to (xii. 42), and their feeling of abhorrence for the people and its ground (vii. 49), both which traits are confirmed by what we know from Jewish sources. The various parts taken by those who brought about Christ's death stand out more distinctly and in a very life-like manner. The Pharisees watch His proceedings and the growth of His influence, carry on the doctrinal controversy with Him, and are the active instigators of measures against Him (vii. 32; viii. 13; ix. 13, 15, 40, 41; xi. 46, 47; xii. 19). The chief priests come upon the scene when it is a question of official action being taken and of treating with the Roman governor (vii. 32, 45; xi. 47 ff., 57; xii. 10; and cc. xviii., xix.). The special place assigned to Annas also agrees remarkably with other evidence respecting him (see Westcott's *Comm.*, note on Jn. xviii. 13). Christ's popularity with the people is noted (vii. 12; xii. 12, 19), and we are not left in any danger of thinking that the same "multitude" which followed Him with hosannahs clamoured shortly afterwards that Barabbas might be released in place of Him. Those who joined in this cry are "the Jews," a designation which includes Pharisees and Chaberim, men who were faithful members of the covenant, and others who desired to be associated with these (xviii. 12–15). The diverse motives which came into play with the conspirators, or were employed by them to induce Pilate to act, are also touched upon (xi. 48; xviii. 30, 31; xix. 7, 12, 15, 16).

The Evangelist's powers of analysis found an opportunity for even more characteristic exercise in marking the various degrees of faith in and loyalty to Christ among those who were attracted to Him. We are told of many who in His early ministry in Judæa believed, but whom He reckoned untrustworthy (ii. 23 ff.); of many disciples who turned back (vi. 66); of "Jews and Pharisees" after this who belonged in some sense to His following, and yet were ready to take offence at His words (viii. 31 ff.; ix. 40, 41); of men who were convinced, but who were unwilling openly to profess themselves His disciples because they had much to lose thereby (iii. 1 ff.; xii. 42; xix. 38, 39); as well as of the faithful few. And that there must have been this diversity we are sure from our knowledge of human nature and experience of Christian missions. And Jesus Himself depicted it in the Parable of the Sower, in which He doubtless describes what He saw beginning to take place around Him.

Authorship. (*d*) We have seen in discussing the external evidence in regard to the composition of the Gospels that the tradition which ascribes the authorship of the Fourth Gospel to John the son of Zebedee is one which cannot be lightly set aside; a close connexion of some kind between the work and that Apostle seems to be required to explain it. The statement in the book itself which bears most directly on the question—*this is the disciple which beareth witness of these things, and wrote these things* (Jn. xxi. 24)—has commonly been taken to mean that the disciple referred to was the author of the Gospel as a complete work—saving, perhaps, the immediately foregoing narrative. This is a possible meaning of the words, but hardly a necessary, or the most natural, one. They assert that the particulars were supplied by his oral testimony and by records he had left, but not that the arrangement of this matter and the setting in which it is placed are by him.

We turn to other considerations bearing on the question of authorship. The efforts to convict the writer of this Gospel of errors in regard to topography and Jewish customs have failed. The advantage must be pronounced to have lain very decidedly with the defenders of the Johannine authorship so far as the controversy in respect to it has turned upon signs in the work of acquaintance with the facts. The chief difficulties connected with the traditional view appear to be that the position of John the son of Zebedee and all the circumstances of his life for many years as one of the "Apostles of the Circumcision" (Gal. ii. 9) render it unlikely that he should have attained to the wide outlook of the writer of the Gospel; and that the Apocalypse, the authenticity of which as a work of the Apostle John is supported by strong external

evidence, is of the character which might be expected if it proceeded from one with those antecedents, while the differences between its style and thought and those of the Gospel are incompatible with identity of authorship, even when the longest interval that is at all possible has been assumed between the dates of their composition. It is not easy to gauge the amount of weight which should be allowed to these objections. The extent to which the views of the twelve Apostles were limited by Jewish prejudices must not be exaggerated. In particular, one who, like St John, never took the most leading part in the Church at Jerusalem, may well have held a larger faith than most of those with whom he associated, without being thereby brought into sharp conflict with them. Moreover, we ought not to set any narrow bounds to the development which might take place in one who, in those days of unexampled spiritual movement, surrendered himself to the Spirit's influence, especially when he found himself amid entirely new surroundings and brought face to face with new needs.

As regards differences between the Apocalypse and the Gospel, a few more years of residence at Ephesus would explain the greater command of Greek shown in the latter. It must also be borne in mind that for the same writer to attempt more than one form of composition, and in doing so to adopt a different style, is nothing strange. And the doctrinal contrasts may be more superficial than real. The visions of the Apocalypse may for the seer himself have been symbolical to a larger extent than we perhaps imagine; while, on the other hand, we may, through reading modern ideas into the language of the Gospel, be apt to fancy that the writer had discarded the ordinary conceptions of Christians of his time on such subjects as "the last things," far more than he actually had. Striking points of similarity between the Apocalypse and the Gospel have also been pointed out. (See Westcott, *Gospel of St John*, prolegomena, p. lxxxiv ff.)

These considerations, if they are not thought sufficient to remove all ground for calling in question the authorship of the Fourth Gospel by the son of Zebedee, serve at least to show that there need not have been any serious inconsistency between the spirit of his teaching and the thought of the Gospel, and that the actual author may well have been one who looked up to him as a master, and who sought to embody in the work what he had received from him. This view of the Apostle's relation to the Gospel, which we have seen is in harmony with the language of the book itself, appears to be that which does fullest justice to the various items of evidence, external and internal, and to all the probabilities of the case.

The Synoptic Problem.—The importance of mechanical helps by which the phenomena of relationship between the Gospels can be readily perceived alike broadly and in detail, was rightly insisted on in the earlier article. And the Synopticon by W. G. Rushbrooke, printed according to the plan there described (vol. x. p. 790), which was then in preparation, has since been published. Another much less expensive Synopsis, by A. Wright, has also appeared. In this work also the whole of Mark is first given continuously, with the corresponding portions of Matthew and Luke in parallel columns, then the passages parallel in Matthew and Luke only, &c. Various kinds of type are not made use of, as in the former work, except to a very limited degree, and so far it is inferior. But it possesses one distinct advantage in the arrangement of successive clauses in separate lines, whereby the remarkable similarities between the Synoptics in the structure of their sentences are clearly shown. No work of first-rate importance on the Synoptic problem has appeared recently either in England or in Germany. It is treated in a condensed form, but often with considerable thoroughness, in the various *Introductions to the New Testament*, of which several by writers of great learning and ability have appeared in Germany. It will be sufficient to mention those of H. Holtzmann, B. Weiss, and Th. Zahn. The second of these has been translated into English. The section also of Weizsäcker's *Apost. Zeitalter* on "the Evangelical Tradition" (bk. iv. ch. 2, in Eng. trans.) is valuable. In England there have been signs that interest in the subject has been revived and that it is being studied in various quarters, though as yet little has been published beyond popular accounts and articles in journals and dictionaries. One valuable contribution to the knowledge of the subject, published in a separate form, has however been made by Sir J. Hawkins in his *Horæ Synopticæ*. The "oral theory" still finds somewhat more favour in England than in Germany, and has been defended by the Rev. A. Wright, but it can no longer be said that the division of opinion on the point is "almost national."

St John.—Under the head of literature of the Johannine question, the section on "Die Johanneische Schriften" in Harnack's *Chron. d. Altchrist. Lit.* must be mentioned. It may be well also to name Delff's *Rabbi Jesu von Nazareth.* His position, especially in regard to the Fourth Gospel, is an eccentric one in some respects, but he draws attention to characteristics of this Gospel which ought to be pondered. The general reader will obtain a good idea of the controversy from the articles by E. Schürer and W. Sanday in the *Contemporary Review* for September and October 1891.

(V. H. S.)

Gosport, a seaport town in the Fareham parliamentary division of Hampshire, England, facing Portsmouth, across Portsmouth harbour, on the London and South-Western Railway. It is enclosed within a double line of fortifications, consisting of the old Gosport lines, and, about 3000 yards to the east, a series of forts connected by strong lines with occasional batteries, forming part of the defence works of Portsmouth harbour. Recent additions to the public buildings are a soldiers' home, a memorial hall, and a public library. Gosport is in the civil parish and urban district formerly called Alverstoke, but since 1891 Gosport and Alverstoke. Population (1881), 21,581; (1901), 28,879.

Goss, Sir John (1800–1880), English composer, was born at Fareham, Hampshire, on 27th December 1800. He was elected a child of the Chapel Royal in 1811, and in 1816, on the breaking of his voice, became a pupil of Attwood, through whom he may not impossibly have imbibed some of the Mozartian sweetness which characterizes his best work. A few early compositions, some for the theatre, exist, and some glees, &c., were published before 1825. He was appointed organist of St Luke's, Chelsea, in 1824, and in 1838 became organist of St Paul's in succession to his master, Attwood; he kept the post until 1872, in which year he officiated at the public thanksgiving for the recovery of the Prince of Wales, and subsequently, on his resignation, received the honour of knighthood. In 1876 he was given the degree of Mus.D. at Cambridge. Though his few orchestral works have very small importance, his Church music contains things that will not be forgotten, such as the anthems, "O taste and see," "O Saviour of the world," and others. Many anthems were published, as well as collections of chants, &c. He was the last of the great English school of Church composers who devoted themselves almost exclusively to Church music; and in the history of the glee his is an honoured name, if only on account of his finest work in that form, the five-part glee, Ossian's "Hymn to the Sun." He died at Brixton, London, 10th May 1880, and was buried at Kensal Green cemetery, and a tablet to his memory is in the crypt of St Paul's. (J. A. F.-M.)

Gosse, Philip Henry (1810–1888), English naturalist, was born at Worcester on 6th April 1810, his father being a miniature painter. In his youth the family removed to Poole, where Gosse's turn for natural history was noticed and encouraged by his aunt, Mrs Bell, the mother of the zoologist, Thomas Bell. He had, however, little opportunity for developing it until, in 1827, he found himself clerk in a whaler's office at Carbonnear, in Newfoundland, and beguiled the tedium of his life by continual observations, chiefly with the microscope. After

a brief and unsuccessful interlude of farming in Canada, during which he wrote an unpublished work on the entomology of Newfoundland, he travelled in the United States, was received and noticed by men of science, was employed as a teacher for some time in Alabama, and returned to England in 1839. His *Canadian Naturalist* (1840), written on the voyage home, was followed in 1843 by his *Introduction to Zoology*. His first widely popular book was *The Ocean* (1844). In 1844 Gosse, who had meanwhile been teaching in London, was sent by the British Museum to collect specimens of natural history in Jamaica. He spent two years on that island, and after his return published his *Birds of Jamaica* (1847) and his *Naturalist's Sojourn in Jamaica* (1851). He also wrote about this time several zoological works for the S.P.C.K., and laboured to such an extent as to impair his health. While recovering at Ilfracombe, he was attracted by the forms of marine life so abundant on that shore, and in 1853 published *A Naturalist's Rambles on the Devonshire Coast*, accompanied by a description of the marine aquarium invented by him, by means of which he had for the first time succeeded in preserving zoophytes and other marine animals of the humbler grades alive and in good condition away from the sea. This was more fully set forth and illustrated in his *Aquarium* (1854), succeeded in 1855–56 by *A Manual of Marine Zoology*, in two volumes, illustrated by nearly 700 wood engravings after the author's drawings. A volume on the marine fauna of Tenby succeeded in 1856. In June of the same year he was elected F.R.S. Gosse, who was a most careful observer, but who lacked the philosophical spirit, was now tempted to essay work of a more ambitious order, publishing in 1857 two books, *Life* and *Omphalos*, embodying his speculations on the appearance of life on the earth, which he considered to have been instantaneous, at least as regarded its higher forms. His views met with no favour from scientific men, and he returned to the field of exact research, which he was better qualified to cultivate with advantage. Taking up his residence at St Marychurch, in South Devon, he produced from 1858 to 1860 his standard work on sea-anemones, the *Actinologia Britannica*. *The Romance of Natural History* and other popular works followed, until in 1865 he abandoned the field of authorship. His later years were chiefly devoted to the cultivation of orchids and the study of the Rotifera, upon which, with the assistance of Dr C. T. Hudson, he published a monograph in 1886. He died at Torquay on 23rd August 1888. His life has been written by his son, Mr Edmund Gosse. (R. G.)

Göta.—(1) A river of Sweden, which flows out of the south extremity of Lake Wener, and goes almost due south to the Cattegat, entering it by two arms, one on each side of the island of Hisingen, the east arm flowing past Gothenburg. It is navigable for large vessels throughout its entire course of 47 miles, the famous (four) falls of Trollhätta (108 feet descent in four-fifths of a mile) being avoided by means of the Trollhätta canal, made in 1793–1800, but enlarged and altered in 1838–44. At the village of Trollhätta (population, 5615) there are iron-works, paper and calcium carbide factories, saw-mills, &c. (2) A canal of Sweden, which connects Lake Wener with the Baltic, passing on the way through Lakes Wetter, Boren, Boxen, and numerous smaller ones, giving a waterway 125 miles long (54 miles of artificial cuttings), 47 feet wide at the bottom and 85¼ feet wide at the surface, with a depth of 9 feet 9½ inches, and with 58 locks in all. The canal starts at Sjötorp, on the east side of Wener, enters Lake Wetter at Carlsberg, passes out of it again at Motala, and connects with the Baltic at Mem, 3 miles below Söderköping. It was constructed in 1810–32 by B. B. von Platen, with the assistance of Telford, though the idea dated back to the year 1516. The highest point (300 feet above sea-level) of the canal is in Lake Viken, between Lakes Wener and Wetter. The traffic through the canal has increased to such an extent that the question of enlarging it throughout was forced to the front in 1900.

Gotha, a town of Germany, capital of the grand-duchy of Coburg-Gotha, at the north foot of the Thuringian Forest, 17 miles by rail west from Erfurt. It alternates with Coburg as the grand-ducal residence. The town hall, built in 1574, was restored in 1898. There are monuments to Arnoldi (1778–1841), a benefactor of the town, and of the war of 1870–71. Population (1885), 27,802; (1900), 34,648.

Gothenburg (Swedish *Göteborg*), a seaport town of Sweden, on the east bank of the river Göta, 285 miles south-west from Stockholm by rail. It ranks in respect of industry, commerce, and population as the second city in the kingdom. The industries of Gothenburg produced 10·3 per cent. of the value of the gross output of the entire kingdom in 1895 (Stockholm = 27·4 per cent.). The commerce of Gothenburg in 1895 represented 27·2 per cent. of the aggregate foreign trade of the kingdom, as compared with 19·7 per cent. for Stockholm; the imports amounting to £5,300,000, and the exports to £4,611,000, or an aggregate of £9,911,000. The principal items of export are iron (annual average, nearly 110,000 tons), butter, timber, paper, cereals and flour, matches, wood-pulp, zinc ore, joinery, fish, bottles, bacon, bobbins, and cardboard. Of the imports the most important are textiles, raw cotton, grain and flour, sugar and molasses, coffee, coal, bricks, wines and spirits, and machinery. In 1900 the port was cleared by 2687 vessels of 1,186,500 tons, as compared with 2341 vessels of 845,800 tons in 1885. The harbour in the Göta river is kept open in winter by ice-breakers. In 1893 a new quay, 1530 feet long, was completed, giving 20 feet depth alongside. In 1902 it was proposed to build a new dry dock, 490 feet long and 25 feet deep, so as to accommodate vessels of 6000 to 8000 tons displacement. The merchant fleet numbers about 200 vessels of some 100,000 tons. Gothenburg is the principal port of embarkation of Swedish emigrants for the United States. During the last years of the 19th century this city expanded at a rapid rate. In 1898 it was decided to equip it with modern fortifications. The old East India Company's house, in which the museum has been sheltered since 1861–63, was restored in 1894–96. A university college, with arts faculty, was opened in 1891. Other new buildings are the Oscar Frederick church (1889–93), and an imposing asylum (Gibraltar) for old age (1896). Population (1880), 76,401; (1890), 104,657; (1898), 123,105, or including the widespread suburbs, 130,619. If, as is proposed, Lundby (9730), on the island of Hisingen, on the opposite side of the river, were incorporated with the city, the population would exceed 140,000. Gothenburg is famous for the plan of liquor law reform known as the Gothenburg Licensing System. Although first formally adopted in Gothenburg in 1865, modified forms of the system seem to have been in existence earlier at Falun (1850), Jönköping (1852), and Marstrand. A further modification of the system was adopted in Norway in 1871, but repealed in favour of local option pure and simple in 1894. (See LIQUOR LAWS.) (J. T. BE.)

Gothland (Swedish, *Gotland* and *Götaland*), the southernmost of the three territorial divisions of Sweden. It embraces the counties of Malmöhus, Christianstad,

Blekinge, Halland, Göteborg and Bohus, Kronoberg, Calmar, Jönköping, Elfsborg, Skaraborg, Östergötland, and Gotland (the island of Gothland), with an area of 35,788 square miles. Population (1880), 2,593,621; (1900), 2,696,233. The island of GOTHLAND, between 56° 54′ and 57° 56′ N. lat. and 18° 7′ and 19° 22′ E. long., in the Baltic, about 40 miles from the east coast of Sweden, forms, together with the island of Fårö (39 square miles), Gotska Sandö (about 30 miles north by east, area 14 square miles), and the Charles Islands, a separate county, with an area of 1215 square miles. Population (1880), 54,668; (1900), 52,781. It is a level plateau of Silurian limestone, inclined gently eastwards, with steep coasts, fringed with tapering, columnar, free-standing buttresses of limestone (*raukar*). The climate is mild and the soil fertile. The marshy moorlands (*e.g.*, Martebo) have in recent years been drained and cultivated. In 1897, 19·7 per cent. of the total area was under the plough, 10·7 per cent. meadow land, and 44·5 per cent. forest. There are nearly 80 miles of railway on the island. Perhaps the most characteristic feature of Gothland is the very large number of 13th-century churches, with massive towers, often standing detached, and generally considered to have been built for defensive purposes. (See WISBY.)

Goto Islands (GOTO RETTO), a group of islands belonging to Japan, lying westward of the province of Hizen, in 33° N. lat. and 129° E. long. The southern of the two principal islands, Fukae-jima, measures 17 miles by 13½; the northern, Nakaori-jima, measures 23 miles by 7½. These islands lie almost in the direct route of steamers plying between Nagasaki and Shanghai, and are distant some 50 miles from Nagasaki. Some dome-shaped hills command the old castle-town of Fukae. The islands are highly cultivated; deer and other game abound, and trout are plentiful in the mountain streams. A majority of the inhabitants are Christians.

Göttingen, a town of Prussia, province of Hanover, 67 miles south from Hanover by the railway to Cassel. The battlemented town hall, dating from 1369–71, was restored in 1880. There are a natural history museum, municipal collection of antiquities, picture gallery, agricultural institute, physical institute, institute for physical chemistry and electro-chemistry, provincial lunatic asylum, commercial and technical trade schools; also a monument to the mathematicians Gauss and Weber (1899), and another to the poet Bürger (1895). In 1900 the University was attended by 1314 students, and had 131 professors. Population (1885), 21,561; (1900), 30,234.

Gottschee (Slovene, KOČEVJE), a duchy, government district, and town on the southern border of the Austrian crownland of Carniola—a German enclave in a Slovene province. The *duchy* has an area of over 270 square miles and a population of about 25,000, of whom the majority are "Gottscheer," a people of Franconian and Thuringian origin, who have apparently been settled in the country at least since the 14th century. They have preserved their racial characteristics and dialect, notwithstanding their absolute isolation in a purely Slav country. The duchy lies entirely within the barren limestone region of the Karst. The *government district* has a larger area than the duchy, and a Slovene majority. The *chief town*, on the Rinsee rivulet, which disappears into the earth in the immediate vicinity, has 2421 German inhabitants and a certain amount of trade and industry (wood-carving, turnery, glass, pottery, &c.). The Friedrichstein ice-cave and numerous other caverns in the neighbourhood, with their singular subterranean fauna, attract many visitors.

Goulburn, a town of New South Wales, 134 miles S.W. of Sydney by the Great Southern Railway. It lies in a productive agricultural district, and has an ample water supply. There are Church of England and Roman Catholic cathedrals. The gaol was erected at a cost of £72,000. Manufactures of boots and shoes, flour, and beer, and tanning are important. The altitude is 2129 feet. Population (1881), 6839; (1901), 10,190.

Goulburn, Edward Goulburn (1818–1897), English Churchman, son of Mr Serjeant Goulburn, M.P., Recorder of Leicester, and nephew of the Right Hon. Henry Goulburn, Chancellor of the Exchequer in the Ministries of Sir Robert Peel and the Duke of Wellington, was born in London, 11th February 1818, and educated at Eton and Balliol, Oxford. In 1839 he became fellow and tutor of Merton, and in 1841 was ordained. In 1850 he was chosen to succeed Tait as headmaster of Rugby, but in 1858 he resigned, and in 1859 became vicar of St John's, Paddington. In 1866 he was made Dean of Norwich, and for twenty-three years exercised a marked influence on Church life in that capacity. A strong Conservative and a Churchman of traditional orthodoxy, he was a keen antagonist of "higher criticism" and rationalism in all its varieties. As an author, his *Thoughts on Personal Religion* and *Pursuit of Holiness* were well-known books; and he wrote the *Life* of his friend Dean Burgon, with whose doctrinal views he was substantially in agreement. He resigned the deanery in 1889, and died at Tunbridge Wells on 3rd May 1897.

Gould, Benjamin Apthorp (1824–1896), American astronomer, was born in Boston, Mass., 27th September 1824, the son of Benjamin Apthorp Gould (1787–1859), principal of the Boston Latin School and editor of several classical text-books for schools. Young Gould graduated at Harvard in 1844, and afterwards studied mathematics and astronomy at Göttingen. On his return to America he was employed in the astronomical work of the United States Coast Survey, under Superintendents Bache and Pierce, devoting himself chiefly to longitude determinations, and employing land and submarine telegraphs for the purpose. Between 1849 and 1861 he conducted an *Astronomical Journal*. From 1856 to 1859 he acted as director of the Dudley Observatory at Albany, New York. During the Civil War of 1861–65 he was for a time in charge of the statistics of the Sanitary Commission; but his most important work was done between 1868 and 1885, when he planned a private astronomical expedition to Argentina, for the purpose of extending to the southern hemisphere zone-observations like those of Bessel and Argelander in the northern. The value of his labours was perceived by the Argentine Government, and out of them grew the national observatory at Cordoba, which he organized and from which he issued astronomical reports and maps. Of particular importance is a series of sidereal charts, or uranometry, of the southern heavens (1872–77), in which he practically extended Argelander's scale to the whole heavens. For this service he received the gold medal of the Royal Astronomical Society. Gould had been one of the first to see the use of photography in accurate determination of star-places, having, as far back as 1866, co-operated with L. M. Rutherfurd in photographing the Pleiades. Returning to America in 1885, he re-established his *Astronomical Journal* and engaged in other similar labours until his death in Cambridge, Massachusetts, 26th November 1896.

Gould, Jay (1836–1892), American financier, was born in Roxbury, Delaware county, New York, 27th May 1836. He was brought up on his father's farm, and

studied in Hobart Academy. After some business experience in several states, he removed in 1859 to New York City, where he became a broker in railway stocks, and in 1868 was elected president of the Erie Railroad. The management of this road under his control led to litigation begun by the English bondholders, and Gould was forced out of the company and compelled to restore securities valued at $7,500,000. He had become interested in other railways, and by means of consolidations, reorganizations, and constructing branch lines, built up the "Gould system" in the south-western states. He also gained control of the Western Union Telegraph Company, and after 1880 of the elevated railways in New York City. He was intimately connected with many of the largest railway and financial operations in the United States for the twenty years following 1868, including the panic in the New York gold market on "Black Friday." He was one of the wealthiest men in the United States, and his property aggregated $72,000,000 at the time of his death, which took place in New York City on the 2nd of December 1892.

Gounod, Charles François (1818–1893), French composer, was born in Paris on 17th June 1818, the son of F. L. Gounod, a talented painter. He entered the Paris Conservatoire in 1836, studied under Reicha, Halévy, and Lesueur, and won the "Grand Prix de Rome" in 1839. While residing in the Eternal City he devoted much of his time to the study of sacred music,

Charles Gounod.
(From a photograph by Elliott and Fry.)

notably to the works of Palestrina and Bach. In 1843 he went to Vienna, where a "requiem" of his composition was performed. On his return to Paris he tried in vain to find a publisher for some songs he had written in Rome. Having become organist to the chapel of the "Missions Étrangères," he turned his thoughts and mind to religious music. At that time he even contemplated the idea of entering into holy orders. His thoughts were, however, turned to more mundane matters when, through the intervention of Madame Viardot, the celebrated singer, he received a commission to compose an opera on a text by Émile Augier for the Académie Nationale de Musique. *Sapho*, the work in question, was produced in 1851, and if its success was not very great, it at least sufficed to bring the composer's name to the fore. Some critics appeared to consider this work as evidence of a fresh departure in the style of dramatic music, and Adolphe Adam, the composer, who was also a musical critic, attributed to Gounod the wish to revive the system of musical declamation invented by Gluck. The fact was that *Sapho* differed in some respects from the operatic works of the period, and was to a certain extent in advance of the times. When it was revived at the Paris Opéra in 1884, several additions were made by the composer to the original score not altogether to its advantage, and *Sapho* once more failed to attract the public. Gounod's second dramatic attempt was again in connexion with a classical subject, and consisted in some choruses written for *Ulysse*, a tragedy by Ponsard, played at the Théâtre Français in 1852, when the orchestra was conducted by Offenbach. The composer's next opera, *La Nonne Sanglante*, given at the Paris Opéra in 1854, was a failure.

Goethe's *Faust* had for years exercised a strong fascination over Gounod, and he at last determined to turn it to operatic account. The performance at a Paris theatre of a drama on the same subject delayed the production of his opera for a time. In the meanwhile he wrote in a few months the music for an operatic version of Molière's comedy, *Le Médecin malgré lui*, which was produced at the Théâtre Lyrique in 1858. Berlioz well described this charming little work when he wrote of it, "Everything is pretty, piquant, fluent, in this 'opéra comique'; there is nothing superfluous and nothing wanting." The first performance of *Faust* took place at the Théâtre Lyrique on 19th March 1859. Goethe's masterpiece had already been utilized for operatic purposes by various composers, the most celebrated of whom was Spohr. The subject had also inspired Schumann, Berlioz, Liszt, Wagner, to mention only a few, and the enormous success of Gounod's opera did not deter Boito from writing his *Mefistofele*. *Faust* is without doubt the most popular French opera of the second half of the 19th century. Its success has been universal, and nowhere has it achieved greater vogue than in the land of Goethe. For years it remained the recognized type of modern French opera. At the time of its production in Paris it was scarcely appreciated according to its merits. Its style was too novel, and its luscious harmonies did not altogether suit the palates of those dilettanti who still looked upon Rossini as the incarnation of music. Times have indeed changed, and French composers have followed the road opened by Gounod, and have further developed the form of the lyrical drama, adopting tho theories of Wagner in a manner suitable to their national temperament. Although in its original version *Faust* contained spoken dialogue, and was divided into set pieces according to custom, yet it differed greatly from the operas of the past. Gounod had not studied the works of German masters such as Mendelssohn and Schumann in vain, and although his own style is eminently Gallic, yet it cannot be denied that much of its charm emanates from a certain poetic sentimentality which seems to have a Teutonic origin. Certainly no music such as his had previously been produced by any French composer. Auber was a gay trifler, scattering his bright effusions with absolute *insouciance*, teeming with melodious ideas, but lacking depth. Berlioz, a musical Titan, wrestled against fate with a superhuman energy, and, Jove-like, subjugated his hearers with his thunderbolts. It was, however, reserved for Gounod to introduce *la note tendre*, to sing the tender passion in accents soft and languorous. The musical language employed in *Faust* was new and fascinating, and it was soon to be adopted by many other French composers, certain of its idioms thereby becoming hackneyed. Gounod's opera was given in London in 1863, when its success, at first doubtful, became enormous, and it was heard concurrently at Covent

Garden and Her Majesty's Theatres. Since then it has never lost its popularity.

Although the success of *Faust* in Paris was at first not so great as might have been expected, yet it gradually increased and set the seal on Gounod's fame. The fortunate composer now experienced no difficulty in finding an outlet for his works, and the succeeding decade is a specially important one in his career. The opera from his pen which came after *Faust* was *Philémon et Baucis*, a setting of the mythological tale in which the composer followed the traditions of the Opéra Comique, employing spoken dialogue, while not abdicating the individuality of his own style. This work was produced at the Théâtre Lyrique in 1860. It has repeatedly been heard in London. *La Reine de Saba*, a four-act opera, produced at the Grand Opéra on 28th February 1862, was altogether a far more ambitious work. For some reason it did not meet with success, although the score contains some of Gounod's choicest inspirations, notably the well-known air, "Lend me your aid." *La Reine de Saba* was adapted for the English stage under the name of *Irene*. The non-success of this work proved a great disappointment to Gounod, who, however, set to work again, and this time with better results, *Mireille*, the fruit of his labours, being given for the first time at the Théâtre Lyrique on 19th March 1864. Founded upon the *Mireio* of the Provençal poet Mistral, *Mireille* contains much charming and characteristic music. The libretto seems to have militated against its success, and although several revivals have taken place and various modifications and alterations have been made in the score, yet *Mireille* has never enjoyed a very great vogue. Certain portions of this opera have, however, been popularized in the concert-room. *La Colombe*, a little opera in two acts without pretension, deserves mention here. It was originally heard at Baden in 1860, and subsequently at the Opéra Comique. A suavely melodious *entr'acte* from this little work has survived and been repeatedly performed.

Animated with the desire to give a pendant to his *Faust*, Gounod now sought for inspiration from Shakespeare, and turned his attention to *Romeo and Juliet*. Here, indeed, was a subject particularly well calculated to appeal to a composer who had so eminently qualified himself to be considered the musician of the tender passion. The operatic version of the Shakespearean tragedy was produced at the Théâtre Lyrique on 27th April 1867. It is generally considered as being the composer's second best opera. Some people have even placed it on the same level as *Faust*, but this verdict has not found general acceptance. Gounod himself is stated to have expressed his opinion of the relative value of the two operas enigmatically by saying, "*Faust* is the oldest, but I was younger; *Romeo* is the youngest, but I was older." The luscious strains wedded to the love scenes, if at times somewhat cloying, are generally in accord with the situations, often irresistibly fascinating, while always absolutely individual. The success of *Romeo* in Paris was great from the outset, and eventually this work was transferred to the Grand Opéra, after having for some time formed part of the *répertoire* of the Opéra Comique. In London it was not until the part of Romeo was sung by Jean de Reszke that this opera obtained any real hold upon the English public.

After having so successfully sought for inspiration from Molière, Goethe, and Shakespeare, Gounod now turned to another famous dramatist, and selected Pierre Corneille's *Polyeucte* as the subject of his next opera. Some years were, however, to elapse before this work was given to the public. The Franco-German war had broken out, and Gounod was compelled to take refuge in London, where he composed the "biblical elegy" *Gallia* for the inauguration of the Royal Albert Hall. During his stay in London Gounod composed a great deal and wrote a number of songs to English words, many of which have attained an enduring popularity, such as "Maid of Athens," "There is a green hill far away," "Oh that we two were maying," "The fountain mingles with the river." His sojourn in London was not altogether pleasant, as he was embroiled in lawsuits with publishers. On Gounod's return to Paris he hurriedly set to music an operatic version of Alfred de Vigny's *Cinq-Mars*, which was given at the Opéra Comique on the 5th April 1877 (and in London in 1900), without obtaining much success. *Polyeucte*, his much-cherished work, appeared at the Grand Opéra the following year on 7th October, and did not meet with a better fate. Neither was Gounod more fortunate with *Le Tribut de Zamora*, his last opera, which, given on the same stage in 1881, speedily vanished, never to reappear. In his later dramatic works he had, unfortunately, made no attempt to keep up with the times, preferring to revert to old-fashioned methods.

The genius of the great composer was, however, destined to assert itself in another field—that of sacred music. His friend Camille Saint-Saëns, in a volume entitled *Portraits et Souvenirs*, writes—

> "Gounod did not cease all his life to write for the church, to accumulate masses and motetts; but it was at the commencement of his career, in the *Messe de Sainte Cécile*, and at the end, in the oratorios *The Redemption* and *Mors et Vita*, that he rose highest."

Saint-Saëns, indeed, has formulated the opinion that the three above-mentioned works will survive all the master's operas. Among the many masses composed by Gounod at the outset of his career, the best is the *Messe de Sainte Cécile*, written in 1855. He also wrote the *Messe du Sacré Cœur*, 1876, and the *Messe à la mémoire de Jeanne d'Arc*, 1887. This last work offers certain peculiarities, being written for solos, chorus, organ, eight trumpets, three trombones, and harps. In style it has a certain affinity with Palestrina. *The Redemption*, which seems to have acquired a permanent footing in Great Britain, was produced at the Birmingham Festival of 1882. It was styled a sacred trilogy, and was dedicated to Queen Victoria. The score is prefixed by a commentary written by the composer, in which the scope of the oratorio is explained. It cannot be said that Gounod has altogether risen to the magnitude of his task. The music of *The Redemption* bears the unmistakable imprint of the composer's hand, and contains many beautiful thoughts, but the work in its entirety is not exempt from monotony. *Mors et Vita*, a sacred trilogy dedicated to Pope Leo XIII., was also produced for the first time in Birmingham at the Festival of 1885. This work is divided into three parts, "Mors," "Judicium," "Vita." The first consists of a Requiem, the second depicts the Judgment, the third Eternal Life. Although quite equal, if not superior, to *The Redemption*, *Mors et Vita* has not obtained similar success.

Gounod was a great worker, an indefatigable writer, and it would occupy too much space to attempt even an incomplete catalogue of his compositions. Besides the works already mentioned may be named two symphonies which were played during the 'fifties, but have long since fallen into neglect. Symphonic music was not Gounod's *forte*, and the French master evidently recognized the fact, for he made no further attempts in this style. The incidental music he wrote to the dramas *Les deux Reines* and *Jeanne d'Arc* must not be forgotten. He also attempted to set Molière's comedy, *Georges Dandin*, to

music, keeping to the original prose. This work has never been brought out. Gounod composed a large number of songs, many of which are very beautiful. One of the vocal pieces that have contributed most to his popularity is the celebrated *Meditation on the First Prelude of Bach*, more widely known as the *Ave Maria*. The idea of fitting a melody to the Prelude of Bach was original, and it must be admitted that in this case the experiment was successful.

Gounod died at St Cloud on the 18th of October 1893. His influence on French music was immense, though during the last years of the 19th century it was rather counterbalanced by that of Wagner. Whatever may be the verdict of posterity, it is unlikely that the quality of individuality will be denied to Gounod. To be the composer of *Faust* is alone a sufficient title to lasting fame. (A. He)

Gourko, Joseph Vladimirovitch, Count (1828–1901), Russian general, was born, of Lithuanian extraction, on the 15th of November 1828. He was educated in the Imperial *Corps de Pages*, entered the Hussars of the Imperial Body Guard as sub-lieutenant in 1846, became captain in 1857, adjutant to the Emperor in 1860, colonel in 1861, commander of the 4th Hussar regiment of Mariupol in 1866, and major-general of the Emperor's suite in 1867. He subsequently commanded the grenadier regiment, and in 1873 the 1st brigade, 2nd division, of the cavalry of the guard. Although he took part in the Crimean war, being stationed at Belbek, his claim to distinction is due to his services in the Turkish war of 1877. He led the van of the Russian invasion, took Trnovo on the 7th July, crossed the Balkans by the Hain Bogaz pass, debouching near Hainkioi, and, notwithstanding considerable resistance, captured Uflani, Maglish, and Kezanlyk; on the 18th July he attacked Shipka, which was evacuated by the Turks on the following day. Thus within sixteen days of crossing the Danube Gourko had secured three Balkan passes and created a panic at Constantinople. He then made a series of successful reconnaissances of the Tunja valley, cut the railway in two places, occupied Eski and Yeni Saghra, checked the advance of Suleiman's army, and returned again over the Balkans. In October he was appointed commander of the allied cavalry, and attacked the Plevna line of communication to Orkhanie with a large mixed force, captured Gorni-Dubnik, Telische, and Vratza, and, in the middle of November, Orkhanie itself. Plevna was isolated, and after its fall in December Gourko led the way amidst snow and ice over the Balkans to the fertile valley beyond, totally defeated Suleiman, and occupied Sophia, Philippopolis, and Adrianople, the armistice at the end of January 1878 stopping further operations. Gourko was made a count, and decorated with the 2nd class of St George and other orders. In 1879–80 he was Governor of St Petersburg, and from 1883 to 1894 Governor-General of Poland. He died on 29th January 1901. (R. H. V.)

Gourock, a police burgh and watering-place of Renfrewshire, Scotland, on the southern shore of the Firth of Clyde, 3¼ miles west of Greenock by rail. There is an extensive pier, and the bay affords good anchorage for yachts. The Gamble Institute includes recreation rooms, public library, and baths; and there are three excellent bowling greens. There is tramway communication with the suburb of Ashton, finely situated on the hillside facing the Firth of Clyde, and commanding magnificent views of the Argyllshire Highlands and the famous salt-water lochs. Population (1881), 3336; (1901), 5244.

Gout. See Pathology (*Metabolic Diseases*).

Govan, a police burgh of Lanarkshire, Scotland, on the south bank of the Clyde adjacent to Glasgow, and in a parish of the same name which includes a large part of the city. Govan remained little more than a village till about 1860, when the growth of shipbuilding and allied trades on the Clyde gave its development an impetus which is not yet exhausted. It was formed into a police burgh in 1864, and the police commission is now in occupation of its third set of municipal chambers (costing £40,000); there are also a theatre (1899) and a combination fever hospital. The Elder Park, presented to the burgh in 1885, contains a statue of John Elder, the pioneer shipbuilder, the husband of the donor. A statue of Sir William Pearce, another well-known Govan shipbuilder and once M.P. for the burgh, stands at Govan Cross. The Govan Lunacy Board opened in 1896 a new asylum near Paisley. Govan is supplied with Glasgow gas and water, and its tramways are leased by the Glasgow Corporation; but it has an electric light installation of its own (1899), and performs all other municipal functions quite independently of the city, annexation to which it has always strenuously resisted. Four of the shipbuilding yards noticed under Glasgow are situated in the burgh, and its other industries are match-making, silk-weaving, hair-working, copper-working, tube-making, weaving, and the manufacture of locomotives and electrical apparatus. The town forms the greater part of the Govan division of Lanarkshire, which returns a member to Parliament. Area, 1069 acres. Population (1901), 76,351.

Government. See Politics.

Gowreeshankar Vodeyshankar (1805–1892), native minister and (during the minority of the prince, Sir Takht Singhji) joint administrator of the State of Bhaunagar in Kathiawar, was born on the 21st August 1805 at the seaport town of Gogo, in a respectable, though not affluent, family of Nagar Brahmans. After receiving the ordinary education of those rude unsettled times, he, in 1822, was appointed to assist Mr Shevakram Desai, the vakil or representative of the Bhaunagar State at the Political Agency for Kathiawar, just then established by the Bombay Government. In a short time he became a revenue officer, and successfully resisted some exorbitant claims made against the State in the British courts. In 1847 his services were acknowledged by the Thakoresaheb Vaje Singhji, who promoted him to be joint *karbhari*, or State minister, in association with Desai Suntokeram Sheorkeram. The reforming hand was soon felt. Old complaints made by the British Agent were disposed of, and the punitive fines called *moshul*, which then cost the Durbar Rs.18,000 a year, were terminated. A claim on seventy-six villages made by the Nawab of Junagarh was settled by a money payment. An Arab Jamedar, a sort of a military commandant, had also a claim for 72 lakhs of rupees as guarantor of debts incurred by a former chief. As security for payment this subject had got possession of the fine district of Mahuwa. Colonel Lang, the Political Agent, intervened, an account was taken, and the claim being reduced to 3½ lakhs was paid off, and the territory recovered, not without imminent risk of bloodshed. Gowreeshankar was also the moving spirit of the diplomacy which in 1866 led the British Government to restore to Bhaunagar the jurisdiction over 116 villages which had been treated as British from the year 1816. The tribute also to be paid to the British Government by the State, which was increasing every year, was permanently settled at Rs.52,000. Similar activity was shown in internal affairs. Judicial regulations were passed, public works undertaken, and education was promoted by an

Anglo-vernacular school. Even female education was fostered. The reigning chief, Juswant Singhji, who had received the honour of K.C.S.I., dying in 1870, Gowreeshankar took charge of the State pending an arrangement by which Mr E. H. Percival, chosen from the Bombay civil service on account of his great experience and even temper, was joined with him to exercise the powers of the Chief, then a minor. The experiment was in every respect successful. Under the simple and economical forms used in native States, improvements suggested by British Indian experience were introduced. The land revenue was based on a cash system, the fiscal and customs systems were remodelled, and tree planting was encouraged. The town of Bhaunagar received the great boon of the Gowreeshankar Waterworks, on which 6 lakhs of rupees were spent. The Percival Markets too were built. The Bhaunagar State also warmly pressed for railway communication with the continent of India, and thus began a movement which has spread a network of railway lines over the peninsula of Kathiawar. The British Government rewarded these many services of Gowreeshankar with the distinction of C.S.I. in 1877. He helped to establish the Rajkumar College at Rajkot, for the education of native princes, and also the Rajasthanik Court, which, after settling almost innumerable disputes between the land-owning classes and the chiefs, has since been abolished. On the 13th January 1879 Gowreeshankar resigned office, after a service of fifty-five years, and devoted himself absolutely to the study of the higher literature of that Vedanta philosophy which through his whole life had been to him a solace and a guide. In 1884 he wrote a work called *Svarupanusandhan*, on the union of the soul with Deity, which led to a letter of warm congratulation and regard from Max Müller, who also published a short biography of him. In 1887 he put on the robe of the *Sanyasi* or ascetic, the fourth stage, according to the Hindu Shastrus, in the life of the twice-born man, and in this manner passed the remainder of his life, giving above ten hours each day to Vedantic studies and holy contemplations. He died, revered by all classes, in December 1892. Born before the first intervention of the British in the affairs of Kathiawar, Gowreeshankar was acquainted with all the events that followed the settlement made by Colonel A. Walker in 1808. Trained among the Nagar Brahmans, who have supplied many ministers to the princely houses of the peninsula, his career was that of a statesman, devoid of English education and essentially Hindu in mind and tastes and methods. His influence was great with the ministers of the neighbouring States. His advice was at all times valued by the British officers, who publicly honoured his ability, his prudence, and his integrity, and ever treated him with the highest consideration and deference. (N. B. W.)

Goyaz, a state of Brazil, having on the N. Pará and Maranhao, on the W. Matto Grosso and Pará, on the S. Minas Geraes and S. Paulo, and on the E. Maranhao, Piauhy, Minas Geraes, and Bahia. Area, 288,546 square miles. Population (1890), 227,572. The capital, Goyaz, on the Rio Vermelho, has 3000 inhabitants; other towns are Boa Vista, Bomfim, Entre Rios, Formosa, Porto Nacional, &c.

Graaff Reinet, a town of Cape Colony, on the Upper Sunday river, which rises a little farther north on the southern slopes of the Sneeuwbergen, and here ramifies into several channels flowing through the surrounding fields and gardens. The town is one of the oldest Dutch settlements in the interior of the colony, dating from the latter part of the 18th century, and is the present inland terminus of a serpentine railway which runs from Port Elizabeth through Uitenhage northwards nearly to the sources of the Sunday river. Graaff Reinet is a flourishing market for the local agricultural produce. Population (1891), 5946.

Grabow, a town of Prussia, province of Pomerania, on the left bank of the Oder, immediately north of Stettin, of which it is now a suburb, with important industries. Its parish church dates from 1890, and it has a school of navigation. Population (1885), 14,541; (1900), 22,583.

Grace, William Gilbert (1848– ——), English cricketer, was born at Downend, in Gloucestershire, on 18th July 1848. He early found himself in an atmosphere charged with cricket, his father (Henry Mills Grace) and his uncle (Alfred Pocock) being as enthusiastic over the game as his elder brothers, Henry, Alfred, and Edward Mills; indeed, in E. M. Grace the family name first became famous. A younger brother, George Frederick, also added to the cricket reputation of the family. "W. G." witnessed his first great match when he was hardly six years old, the occasion being a game between W. Clarke's All-England Eleven and twenty-two of West Gloucestershire. When he grew up, he was endowed by nature with a splendid physique as well as with powers of self-restraint and determination. At the acme of his career he stood full 6 feet 2 inches, being powerfully proportioned, loose yet strong of limb. A non-smoker, and very moderate in all matters, he kept himself in condition all the year round, shooting, hunting, or running with the beagles as soon as the cricket season was over. He was also a fine runner, 440 yards over 20 hurdles being his best distance; and it may be quoted as proof of his stamina that on 30th July 1866 he scored 224 not out for England *v.* Surrey, and two days later won such a race in the National and Olympian Association meeting at the Crystal Palace. He speedily made his name a household word wherever the game of cricket was a matter of interest. The title of "champion" was well earned by one who for a space of thirty-six years (1865–1900 inclusive) was actively engaged in first-class cricket. In no one of these years was he not invited to represent the Gentlemen in their matches against the Players, or, when an Australian eleven visited England, to play for the mother country against her colony. As late as 1899 he played in the first of the five international contests; in 1900 he played against the Players at the Oval, scoring 58 and 3. At the age of fifty-three, he scored nearly 1300 runs in first-class cricket, made 100 runs and over on three different occasions, and could claim an average of 42 runs. Moreover, his greatest triumphs were achieved when only the very best cricket grounds received serious attention, when, as some consider, bowling was maintained at a higher standard, and when all hits had to be run out. He, with his two brothers, E. M. and G. F., assisted by some fine amateurs, made Gloucestershire in one season a first-class county; and it was he who first enabled the amateurs of England to meet the paid players on equal terms, and to beat them. There is hardly a "record" connected with the game which has not at some time or another stood to his credit. Dr Grace did not, however, "specialize" in batting; he was at all times one of the finest fieldsmen in England, in his earlier days generally taking long-leg and cover-point, in later times generally standing point when he was not bowling. He was, at his best, a fine thrower, fast runner, and safe "catch." As a bowler he was long in the first flight, originally bowling fast, but in later times adopting a slower and more tricky style, which, from his intimate knowledge of

the game, was frequently very effective. By profession he was a medical man. In later years he became secretary and manager of the London County Cricket Club. He was married in 1873 to Miss Agnes Day, and one of his sons played for two years in the Cambridge eleven. He has been the recipient of two national testimonials: the first, amounting to £1500, being presented to him in the form of a clock and a cheque at Lord's ground by Lord Charles Russell, on 22nd July 1879; the second, collected by the M.C.C., the county of Gloucestershire, the *Daily Telegraph*, and the *Sportsman*, amounted to about £10,000, and was presented to him in 1896. He visited Australia in 1873–74 (captain), and in 1891–92 with Lord Sheffield's Eleven (captain); America and Canada in 1872, with R. A. Fitzgerald's team.

Dr Grace played his first great match in 1863, when, being only fifteen years of age, he scored 32 against the All-England Eleven and the bowling of Jackson, Tarrant, and Tinley; but the scores which first made his name prominent were made in the next year, viz., 170 and 56 not out for the South Wales Club against the Gentlemen of Sussex. It was in 1865 that he "first took an active part in first-class cricket," being then seventeen years of age, 6 feet in height, and 11 stone in weight, and playing twice for the Gentlemen *v.* the Players, but his selection was mainly due to his bowling powers, the best exposition of which was his aggregate of 13 wickets for 84 runs for the Gentlemen of the South *v.* the Players of the South. His absolutely highest score was 400 not out, made in July 1876 against twenty-two of Grimsby; but on three occasions he was twice dismissed without scoring in matches against odds, a fate that never befell him in important cricket. In first-class matches his highest score was 344, made for the M.C.C. *v.* Kent at Canterbury, in August 1876: two days later he made 177 for Gloucestershire *v.* Notts, and two days after this 318 not out for Gloucestershire *v.* Yorkshire, the two last-named opposing counties being possessed of exceptionally strong bowling; thus in three consecutive innings Dr Grace scored 839 runs, and was only got out twice. His 344 is the third highest individual score made in a big match in England up to the end of 1901. He also scored 301 for Gloucestershire *v.* Sussex at Bristol, in August 1896. He made over 200 runs on ten occasions, the most notable perhaps being in 1871, when he performed the feat twice, each time in benefit matches, and each time in the second innings, having been each time got out in the first over of the first innings. He scored over 100 runs on 121 occasions, the hundredth score being 288, made at Bristol for Gloucestershire *v.* Somersetshire in 1895. He made every figure from 0 to 100, on one occasion "closing" the innings when he had made 93, the only total he had never made between these limits. In 1871 he made no fewer than ten "centuries," ranging from 268 to 116. In the matches between the Gentlemen and Players he scored "three figures" fifteen times, and at every place where these matches have been played. He made over 100 in each of his "first appearances" at Oxford and Cambridge. Three times he made over 100 in each innings of the same match, viz., at Canterbury, in 1868, for South *v.* North of the Thames, 130 and 102 not out; at Clifton, in 1887, for Gloucestershire *v.* Kent, 101 and 103 not out; and at Clifton, in 1888, for Gloucestershire *v.* Yorkshire, 148 and 153. In 1869, playing at the Oval for the Gentlemen of the South *v.* the Players of the South, Dr Grace and B. B. Cooper put on 283 runs for the first wicket, Dr Grace scoring 180 and Cooper 101. In 1886 he and Scotton put on 170 runs for the first wicket of England *v.* Australia; this occurred at the Oval in August, and Dr Grace's total score was 170. In consecutive innings against the Players from 1871 to 1873 he scored 217, 77 and 112, 117, 163, 158, and 70. He only twice scored over 100 in a big match in Australia, nor did he ever make 200 at Lord's, his highest being 196 for the M.C.C. *v.* Cambridge University in 1894. His highest aggregates were 2739 (1871), 2622 (1876), 2346 (1895), 2139 (1873), 2135 (1896), and 2062 (1887). He scored three successive centuries in first-class cricket in 1871, 1872, 1873, 1874, and 1876. Playing against Kent at Gravesend in 1895, he was batting, bowling, or fielding during the whole time the game was in progress, his scores being 257 and 73 not out. He scored over 1000 runs and took over 100 wickets in seven different seasons, viz., in 1874, 1665 runs and 129 wickets; in 1875, 1498 runs, 192 wickets; in 1876, 2622 runs, 124 wickets; in 1877, 1474 runs, 179 wickets; in 1878, 1151 runs, 153 wickets; in 1885, 1688 runs, 118 wickets; in 1886, 1846 runs, 122 wickets. No one else has performed this feat more than twice, except G. Giffen, the Australian. He never captured 200 wickets in a season, though he came very near to the feat in 1875 with 192. Playing against Oxford University in 1886, he took all the wickets in the first innings, at a cost of 49 runs. In 1895 he not only made his hundredth century, but actually scored 1000 runs in the course of the month of May alone, his chief scores in that month being 103, 288, 256, 73, and 169, he being then forty-seven years old. He also made during that year scores of 125, 119, 118, 104, and 103 not out, his aggregate for the year being 2346, and his average 51; his innings of 118 was made against the Players (at Lord's), the chief bowlers being Richardson, Mold, Peel, and Attewell; he scored level with his partner, A. E. Stoddart (his junior by fifteen years), the pair making 151 before a wicket fell, Grace making in all 118 out of 241. This may fairly be considered one of his most wonderful years. In 1898 the match between Gentlemen *v.* Players was, as a special compliment, arranged by the M.C.C. committee to take place on his birthday, and he celebrated the event by scoring 43 and 31 not out, though handicapped by lameness and an injured hand. In twenty-six different seasons he scored over 1000 runs, in three of these years being the only man to do so, and five times being one out of two. His first three-figure innings was 244 not out, made at the Oval, July 30 and 31, 1866, for England *v.* Surrey; his last, 126, made at Lord's, 13th September 1900, for South *v.* North.

During the thirty-six years which may be taken as covering his cricket career he scored nearly 51,000 runs, with an average of 43; and in bowling he took more than 2800 wickets, at an average cost of about 20 runs per wicket. He made his highest aggregate (2739 runs) and had his highest average (78) in 1871; his average for the decade 1868–77 was 57 runs, a marvellously fine record for so long a period, when the bowling was splendid and grounds were often rough, while, boundaries being only occasionally used, the majority of the runs had to be run out. It may be added as a matter of interest that he has thrown the cricket ball more than 116 yards, and has hit it a measured distance of 140 yards from the pitch. This latter distance he has probably exceeded. His style as a batsman was more commanding than graceful, but as to its soundness and efficacy there were never two opinions; the severest criticism ever passed upon his powers was to the effect that he did not play slow bowling quite as well as fast.

Grafton, a town in the county of Clarence, New South Wales, Australia, on both sides of the Clarence river, at a distance of 45 miles from its mouth, 342 miles N.E. of Sydney by sea. It comprises two sections, North Grafton and South Grafton, now forming separate municipalities; communication between the two is maintained by a ferry. The river is navigable from the sea to the town for ships of moderate burden, and for small vessels to a point 35 miles beyond it. Extensive harbour works are now in progress at the river mouth. The dairy interest is of growing importance, and the agricultural prospects are good. In the district are several large sugar mills. The mean rainfall is 33·83 inches. Population (1881), 3891; (1901), 4174; South Grafton, 976.

Grafton, capital of Taylor county, West Virginia, U.S.A., on the Tygart Valley river and on two lines of the Baltimore and Ohio Railway. It has large railway shops and several iron foundries. Population (1890), 3159; (1900), 5650, of whom 226 were foreign-born.

Graham, Sir Gerald (1831–1899), English soldier, only son of Dr Robert Hay Graham of Eden Brows, Cumberland, was born on 27th June 1831 at Acton, Middlesex, educated at Dresden and Woolwich Academy, and entered the Royal Engineers in 1850. He served with distinction through the Russian war of 1854 to 1856, was present at the battles of Alma and Inkerman, was twice wounded in the trenches before Sebastopol, and was awarded the Victoria Cross for gallantry at the attack on the Redan and for devoted heroism on numerous occasions (medal with three clasps, Turkish medal, 5th class Legion of Honour, 5th class Medjidie, and brevet majority). In the China war of 1860 he took part in the actions of Sin-ho and Tang-ku, the storming of the Taku Forts, where he was severely wounded, and the entry into Peking (medal with two clasps, brevet lieutenant-colonelcy, and C.B.). Promoted colonel in 1869, he was employed in routine duties until 1877, when he was appointed assistant-director of works for barracks at the War Office, a position he held until his promotion

to major-general in 1881. In command of the advanced force in Egypt in 1882, he bore the brunt of the fighting, was present at the action of Magfar, commanded at the first battle of Kassassin, took part in the second, and led his brigade at the storming of Tel-el-Kebir (medal with clasp, bronze star, 2nd class Medjidie, K.C.B., and thanks of Parliament). In 1884 he commanded the expedition to the Eastern Sudan, and fought the successful battles of El Teb and Tamai, but was forbidden to march to General Gordon's assistance *viâ* Berber, and returned home (two clasps to medal, 1st class Medjidie, thanks of Parliament, lieutenant-general for distinguished service in the field). In 1885 he commanded the Suakin expedition, defeated the Arabs at Hashin and Tamai, and advanced the railway from Suakin to Otao, when the expedition was withdrawn (thanks of Parliament and G.C.M.G.). In 1896 he was made G.C.B., and in 1899 colonel-commandant Royal Engineers. He died on 17th December 1899. He published in 1875 a translation of Goetze's *Operations of the German Engineers in 1870–71*, and in 1887 *Last Words with Gordon.* (R. H. V.)

Graham's Town, a city of Cape Colony, the administrative centre for the Eastern Provinces. It lies 1760 feet above sea-level in a remarkably healthy district, a short distance N. by W. of Port Alfred, and N.E. of Port Elizabeth, with both of which places it is connected by rail. It is one of the earliest English settlements in the colony, dating from the year 1812, and was the chief military station towards Great Fish river during the Kaffir wars. Owing to the sour quality of the herbage in the surrounding "Zuurveld" district, stock-breeding and wool-growing, formerly the chief occupation of the settlers, have in recent years been largely replaced by ostrich-farming, for which industry Graham's Town is the most important centre. Its chief seaward outlet is PORT ALFRED, at the mouth of the little river Kowie, where extensive harbour works now give access to vessels drawing 8 or 10 feet. The great majority of the population is of British descent, and numbered 10,500 in 1891.

Grain Coast. See LIBERIA.

Grain Trade.—The complexity of the conditions of life at the opening of the 20th century may be well illustrated from the mutations of a penny roll. To think that such a common household necessary as a loaf of bread, which in a simpler state of society each family made at home from grain grown in its own patch of land, should have called into existence fleets of ocean and lake steamers, giant railway waggons, mammoth warehouses, and colossal mills, is a good illustration of the distance which we have travelled; moreover, when it is considered that all this progress has been made, say, since 1850, it may be seen what giant strides civilization is now taking. Contrast the cargo of the leviathan ocean tramp of to-day with the freight of a mediæval coaster; the one carrying in a single voyage the whole crop of an entire English county, such as Derbyshire, the other a load of perhaps a hundred tons. Or compare a modern freight car of North America, with its burden of a thousand or thirteen hundred bushels, with the farmer's waggon of 1880; or the latest American canal barge of 4000 tons capacity with its prototype drawn by a bargee or mule. Or, again, take a farmer's barn of the last generation and place it alongside the grain storage silos in Liverpool, which are capable of holding 3,000,000 bushels, the annual produce of one of the larger English counties. Last, but not least significant, is the wonderful development in the appliances for milling wheat. Think of the ancient quern or the picturesque windmill, and compare it with a modern roller flour mill, with, for instance, a stately building like the Chancellot Mills at Edinburgh, or with one of those colossal fabrics that has an endless series of machines, and miles upon miles of pipes and elevators, and is equipped with machinery of such scientific accuracy as to be capable of distinguishing between the fineness of two particles of flour, which together would be barely palpable; mills with a capacity to produce a million sacks per annum, sufficient to feed a city of 10,000 inhabitants for a hundred years.

General considerations.

The origin of wheat is shrouded in mystery. It is alleged to have been found growing wild somewhere between the Euphrates and the Tigris; but the discovery has never been authenticated, for, unless the plant be sedulously cared for, the species dies out in a surprisingly short space of time. Recent experiments in cross-fertilization in Lancashire by the Garton Brothers have evolved the most extraordinary, not to say monstrous, "sports," showing, it is claimed, that in the course of development the plant has probably passed through stages of which until the present day we have not had the slightest conception. The tales that grains of wheat found in the cerements of Egyptian mummies have been planted and come to maturity are no longer credited, for the vital principle in the wheat berry is extremely evanescent; indeed, it is doubtful whether wheat twenty years old is capable of reproduction. The Garton artificial fertilization experiments have shown that endless deviations from the ordinary type can be evolved, ranging from minute seeds with a closely adhering husk to big berries almost as large as sloes and about as worthless. The author of the experiment in question is reported to be of the opinion that the wheat plant, as we know it now, is a degenerate form of something much finer which flourished thousands of years ago, and that it is not unreasonable to look forward to a time when it will be restored to its pristine excellence, yielding an increase twice or thrice as large as that to which we are now accustomed, and thus postponing to a distant period the famine doom prophesied by Sir W. Crookes in his presidential address to the British Association in 1898 (see CROOKES). It is certainly remarkable what latent possibilities seem to lurk in this seed of the *Triticum vulgare*, and how readily it yields them as rewards to man for his research and labour. Contrast the produce of a carelessly tilled Russian or Indian field and the bountiful yield on a good Lincolnshire farm, the former with its average yield of 8 bushels, the latter with its 50 bushels per acre; or compare the quality, as regards the quantity and flavour of the flour from a fine sample of British wheat, such as is on sale at almost every agricultural show in Great Britain, with the produce of an Egyptian or Syrian field; the difference is so great as to cause one to doubt whether the berries are of the same species.

The ordinary loaf which one sees in a baker's shop in Great Britain may be said to represent the product of nearly every country in both hemispheres outside of the tropics, each of the five divisions of the world contributing its share. It may be stated roundly that an average quartern loaf in Great Britain is made from wheat grown in the following countries in the proportions named :—

U.S.A.	U.K.	Russia.	Argentina.	British India.	Canada.	Rumania-Bulgaria.	Australia.	Other Countries.
Oz. 26	Oz. 13	Oz. 9	Oz. 5	Oz. 4	Oz. 3	Oz. 2	Oz. 1	Oz. 1
Or expressed in percentages as follows :—								
40	20	14	8	6	5	3	2	2

Wheat, the great staple food of the most progressive portion of mankind, occupies of all cereals the widest region of any foodstuff. Rice, which shares with millet the distinction of being the principal foodstuff of the greatest number of human beings, is not grown nearly as widely as the white man's favourite cereal. Wheat grows as far south as Patagonia, and as far north as the edge of the Arctic Circle; it flourishes throughout Europe, and across the whole of Northern Asia and in Japan; it is cultivated in Persia, and raised largely in India, as far south as the Nizam's dominions. It is grown in almost every state of the American Union, from Southern California to the State of Washington. In the Dominion of Canada a very fine wheat crop was raised in the autumn of 1898 as far north as the mission at Fort Providence, on the Mackenzie river, in a latitude above 62°—the latitude of the Faroe Islands, or less than 200 miles south of the latitude of Dawson City—the period between seed-time and harvest having been ninety-one days. In Africa we hear of it as an article of commerce in the days of the patriarch Jacob, whose son Joseph may be said, in the parlance of the corn market, to have run the first and only successful "corner" in the staff of life. For many centuries Egypt was famous as a wheat raiser; it was a cargo of wheat from Alexandria which the Apostle St Paul helped to jettison on the occasion of one of his shipwrecks, as was also, in all probability, that of the "ship of Alexandria whose sign was Castor and Pollux," named in the same narrative. General Gordon is quoted as having stated that the Sudan when properly settled would be capable of feeding the whole of Europe. It is known that the cereal flourishes on all the high plateaux of South Africa, from Cape Town to the Zambezi. Additional land is being rapidly and extensively put under wheat in the pampas of South America and in the prairies of Siberia. There are tracts along the north coast of Africa which, if properly irrigated, as was done in the days of Carthage, and as is done in India under British rule to-day, could produce a sufficiency of wheat to feed half of the Caucasian race. For an instance, the vilayet of Tripoli, with an area of 400,000 square miles, or three times the extent of Great Britain and Ireland, according to the opinion of a British consul could raise millions of acres of wheat.

In the raising of the standard of farming to an English level the volume of the world's crop would be trebled, another fact which Sir William Crookes seems to have overlooked. Or, again, take the experiments of the late Sir J. B. Lawes in Hertfordshire, which have proved that the natural fruitfulness of the wheat plant can be increased threefold by the application of the proper fertilizer. A brief digest of the principal results of these most valuable experiments (see also under AGRICULTURE) may not be out of place here. It is taken from a compendium issued from the Rothamsted Agricultural Experimental Station.

Experiment on the growth of wheat year after year on the same land: without manure, and with different descriptions of manure.

Average 46 years. 1852 to 1897.

	Dressed Grain.		Total Straw.
	Quantity. Bushels per Acre.	Weight. Per Bushel, lb.	Per Acre. Cwts.
Unmanured continuously	12⅞	58⅝	9⅜
Farmyard manure . .	35¼	60½	33
Mixed mineral manure (most successful instance) . .	36¾	59⅞	40⅛

Experiment on wheat alternated with fallow and wheat grown continuously.

(Area under experiment 1 acre.)

Averages—Produce after fallow reckoned at the yield per acre, of the half in crop, each year.

	Yield. Bushels per Acre.	Weight per Bushel, lb.	Total Grain, lb.	Total Straw, lb.	Total Grain and Straw, lb.
Wheat after fallow each year .	17⅜	58·7	1073	1595	2668
Wheat after wheat each year .	12¾	58·8	795	1127	1921

It should be noticed that, if after fallow had been reckoned at the yield per acre of the whole area, half in crop and half fallow, the results would of course have been very different. "The conclusion to be drawn is that although there is an increase of produce after fallow compared with that of wheat grown continuously, it is obtained at the sacrifice of a crop every other year, and that a given area of land yields more when the crop is grown year after year, than when alternated with fallow. The explanation doubtless is, that much of the nitrogen brought into an available condition under the influence of the fallow is lost by drainage during the long period that the land is without a crop." This conclusion would seem to be in direct conflict with the advice given to the Israelites of old, and with the practice of many agriculturists abroad at the present time.

As far as can be traced in the report to the Lawes Agricultural Trust Committee by Sir J. H. Gilbert, F.R.S., the highest yield per acre in the twelve years 1871–82 was obtained in the year 1874 with Rivett's (red), the manures used being nitrate after mangels (with dung) were carted off, the yield per acre amounting to 67 bushels of dressed grain; the natural weight, however, was only 58⅛ lb per bushel, the same class of wheat again in 1878 giving 66⅛ bushels of 58⅞ lb natural weight. But in the wet season of 1879 the same seed gave only 16 bushels, weighing 49⅛ lb. Taken over an eight years period, 1871 to 1878, some of the best- and worst-yielding sorts were the following:—

	Total Weight, lb.	Yield per Acre. Bushels.	Weight per lb.
(1) Rivett's (red)	3189	52½	60¾
(2) Belgian (white) . . .	3150	53⅝	58¾
(3) Original red Halletts . .	2302	37⅛	62
(4) White Chiddam . . .	2167	36½	59⅜

The palm for a high natural weight must be awarded to Red Nursery, which on an eight years average scored 63⅛ lb, and for a single year as high as 66 lb (in 1876).

In these comparisons of one class of seed wheat with another, we do not purpose drawing invidious distinctions; indeed, it is by no means the wheat which yields the greatest number of bushels per acre which is the most valuable from a miller's standpoint, for in his estimation the thinness of the bran and the fineness and strength of the flour are most important considerations, too often overlooked by the farmer when buying his seed. But after all, it is the deficient quantity of the wheat raised of late years in the British Islands, and not the quality of the grain, which has been the cause of so much anxiety to economists and statesmen.

Sir J. Caird, writing as recently as in the year 1880, expressed the opinion that arable land in Great Britain would always command a substantial rent of at least 30s. per acre, for he calculated that the cost of carriage from

abroad of wheat, or the equivalent of the product of an acre of good wheat land in Great Britain, would not be less than 30s. per ton. But freights had come down by the year 1900 to half the rates predicated by that authority; indeed, during a portion of the interval they ruled very close to zero, as far as steamer freights from America were concerned. In 1900 an all-round freight rate for wheat might be taken at 15s. *per ton* (a ton representing approximately the produce of an acre of good wheat land in England), say from 10s. for Atlantic American and Russian, to 30s. for Pacific American and Australian; about midway between these two extremes we find Indian and Argentine, the greatest bulk coming at about the 15s. rate. Inferior land bearing less than 4½ quarters per acre would not of course be protected to the same extent, and moreover, seeing that a portion of the British wheat crop has to stand a charge as heavy for land carriage across a county as that borne by foreign wheat across a continent or an ocean, the protection is not nearly so substantial as Caird would make out. The compilation showing the changes in the rates of charges for the railway and other transportation services issued by the Division of Statistics, Department of Agriculture, U.S.A. (Miscellaneous Series, Bulletin No. 15, 1898), is a valuable reference book. From its pages are culled the following facts relating to the changes in the rates of freight up to the year 1900. In Table 3 the average rates per ton per mile in cents are shown since 1846. For the Fitchburg Railroad the rate for that year was 4·523 cents per ton per mile, since when a great and almost continuous fall has been taking place, until in 1897, the latest year given, the rate had declined to ·870 of a cent per ton per mile. The railway which shows the greatest fall is the Chesapeake and Ohio, for the charge has fallen from over 7 cents in 1862 and 1863 to ·419 of a cent in 1897, whereas the Erie rates have fallen only from 1·948 in 1852 to ·609 in 1897. Lumping the rates of the twelve returning railways together, we find the average freight in the two years 1859–60 was 3·006 cents per ton per mile, and that in 1896–97 the average rate had fallen to ·797 of a cent per ton per mile. This difference is very large when the smallness of the unit is borne in mind. Coming now to the *raison d'être* of this inquiry, viz., the rates on grain, we find (in Table 23) a record for the forty years 1858–97 of the charge on wheat from Chicago to New York, *vià* all rail from 1858, and *vià* lake and rail since 1868, the authority being the secretary of the Chicago Board of Trade. From 1858 to 1862 the rate varied between 42·37 and 34·80 cents per bushel for the whole trip of roundly 1000 miles, the average rate in the quinquennium being 38·43. In the five years immediately prior to the time at which Sir J. Caird expressed the opinion that the cost of carriage from abroad would always protect the British grower, the average all-rail freight from Chicago to New York was 17·76 cents, while the summer rate (partly by water) was 13·17 cents. These rates in 1897, the last year shown on the table, had fallen to 12·50 and 7·42 respectively. The rates have been as follows in quinquennial periods, *vià* all rail:—

Freight rates.

Chicago to New York in Cents per Bushel.

1858–62.	1863–67.	1868–72.	1873–77.	1878–82.	1883–87.	1888–92.	1893–97.
38·43	31·42	27·91	21·29	16·77	14·67	14·52	12·88

Calculating roundly a cent as equal to a halfpenny, and eight bushels to the quarter, the above would appear in English currency as follows:—

Chicago to New York in Shillings and Pence per Quarter.

1858–62.	1863–67.	1868–72.	1873–77.	1878–82.	1883–87.	1888–92.	1893–97.
s. d. 12 8	s. d. 10 6	s. d. 9 3	s. d. 7 1	s. d. 5 7	s. d. 4 10½	s. d. 4 10	s. d. 4 3

Another table (No. 38) is of interest, as showing the average rates from Chicago to New York by lakes, canal, and river. These in their quinquennial periods are given for the season as follows:—

In Cents per Bushel of 60 *lbs.*

1857–61.	1876–80.	1893–97.
22·15	10·47	4·92

In Shillings and Pence per Quarter of 480 *lbs.*

1857–61.	1876–80.	1893–97.
s. d. 7 4	s. d. 3 6	s. d. 1 7

In Shillings and Pence per Ton of 2240 *lbs.*

1857–61.	1876–80.	1893–97.
s. d. 34 6	s. d. 16 6	s. d. 7 6

This latter mode is the cheapest by which grain can be carried to the eastern seaboard from the American prairies, and, as will be seen from the foregoing, it can now be done at a cost of 7s. 6d. per ton. The ocean freight has to be added before the grain can be delivered free on the quay at Liverpool. In December 1900 the rate from New York to Liverpool was 2½d. per bushel, or 7s. 10d. per ton, a low rate, it is true, in comparison with that which prevailed in former years, but yet sufficiently high, it was claimed, to leave a profit on a modern steamship; indeed, there have frequently been times when the rate was as low as 1d. per bushel, or 3s. 1d. per ton; and occasionally, in periods of great trade depression, wheat is carried from New York to Liverpool as ballast, actually being paid for by the shipowner. Another route which is also worked more cheaply than formerly is that by river, from the centre of the winter wheat belt, say at St Louis, to New Orleans, and thence by steamer to Liverpool. The river rate is now down below five cents per bushel, or 7s. per ton, 2240 lb. In Table No. 71 the cost of transportation is compared year by year with the export price of the two leading cereals in the States, and as we have not yet shown the annual average rates for the years severally, we reproduce the whole of this tabular statement:—

Wheat and Corn—Export Prices and Transportation Rates Compared.

Year.	Wheat. Export price per bushel.	Wheat. Rate, Chicago to New York by lake and canal, per bushel.	Wheat. Number of bushels carried for price of one bushel.	Corn. Export price per bushel.	Corn. Rate, Chicago to New York by lake and canal, per bushel.	Corn. Number of bushels carried for price of one bushel.
		Cents.			Cents.	
1867	$0·92	15·95	5·77	$0·72	14·58	4·94
1868	1·36	16·23	8·38	·84·1	13·57	6·20
1869	1·05	17·20	6·10	·72·8	14·98	4·86
1870	1·12	14·85	7·54	·80·5	13·78	5·84
1871	1·18	17·75	6·65	·67·9	16·53	4·11
1872	1·31	21·55	6·08	·61·8	19·62	3·15
1873	1·15	16·89	6·81	·54·3	15·39	3·53
1874	1·29	12·75	10·12	·64·7	11·29	5·73
1875	·97	9·90	9·80	·73·8	8·93	8·26
1876	1·11	8·63	12·86	·60·3	7·93	7·60
1877	1·12	10·76	10·41	·56·0	9·41	5·95
1878	1·33	9·10	14·62	·55·8	8·27	6·75

Wheat and Corn—Export Prices and Transportation Rates Compared (continued).

Year.	Wheat. Export price per bushel.	Wheat. Rate, Chicago to New York by lake and canal, per bushel.	Wheat. Number of bushels carried for price of one bushel.	Corn. Export price per bushel.	Corn. Rate, Chicago to New York by lake and canal, per bushel.	Corn. Number of bushels carried for price of one bushel.
		Cents			Cents.	
1879	1·07	11·60	9·22	0·47·1	10·43	4·52
1880	1·25	12·27	10·19	·54·3	11·14	4·87
1881	1·11	8·19	13·55	·55·2	7·26	7·60
1882	1·19	7·89	15·08	·66·8	7·23	9·24
1883	1·13	8·37	13·50	·68·4	7·66	8·93
1884	1·07	6·31	16·96	·61·1	5·64	10·83
1885	·86	5·87	14·65	·54·0	5·38	10·04
1886	·87	8·71	9·99	·49·8	7·98	6·24
1887	·89	8·51	10·46	·47·9	7·88	6·08
1888	·85	5·93	14·33	·55·0	5·41	10·17
1889	·90	6·89	13·06	·47·4	6·19	7·66
1890	·83	5·86	14·16	·41·8	5·10	8·20
1891	·93	5·96	15·60	·57·4	5·36	10·71
1892	1·03	5·61	18·36	·55	5·03	10·93
1893	·80	6·31	12·68	·53	5·71	9·28
1894	·67	4·44	15·09	·46	3·99	11·53
1895	·58	4·11	14·11	·53	3·71	14·29
1896	·65	5·38	12·08	·38	4·94	7·69
1897	·75	4·35	17·24	·31	3·79	8·18

So much improved is the American farmer's position to-day as compared with what it was about the year 1870, that the transport companies in 1901 carried 17¼ bushels of his grain to the seaboard in exchange for the value of one bushel, whereas in 1867 he had to give up one bushel in every six in return for the service. As regards the British farmer, it does not appear as if he had improved his position at all; for, in the first place, he has to send his wheat to greater distances, owing to the collapse of so many country millers or their removal to the seaboard, while railway rates have fallen only to a very small extent; in the second place, the farmer's wheat is worth only half of what it was formerly; so in round numbers, it may be said that the British farmer has to give up one bushel in nine to the railway company for the purpose of transportation, whereas in the 'seventies he gave up one in eighteen only. Enough has been said to prove that the advantage of position claimed for the British farmer by Caird was somewhat illusory. Speaking broadly, the Kansas or Minnesota farmer's wheat does not have to pay (1902) for carriage to Liverpool more than 2s. 6d. to 7s. 6d. per ton in excess of the rate paid by a Yorkshire farmer; this, it will be admitted, does not go very far towards enabling the latter to pay rent, tithes, and rates and taxes, such as obtain in England and in nearly all old countries.

The subject of the rates of ocean carriage at different periods requires consideration if a proper understanding of the working of the foreign grain trade is to be obtained. Somewhat contrary to general expectations, it will be found that only a very small proportion of the decline in the price of wheat since 1880 is due to cheapened transport rates; for while the mileage rate has been falling, the length of haulage has been extending, until in 1900 the principal wheat fields of America were 2000 miles farther from the eastern seaboard than was the case in 1870, and consequently, notwithstanding the fall in the mileage rate of 50 to 75 per cent., it still cost the United Kingdom nearly as much to have its quota of foreign wheat fetched from abroad as it did then. The exact difference in the cost of the operation is shown in the following tabular statement, both the cost in the aggregate on a year's imports and the cost per quarter :—

Quantity of Wheat and Wheaten Flour (*as wheat*) *imported into the United Kingdom from various sources during the calendar year* 1900, *together with the average rate of freight.*

1900.

Countries of Origin.	Quantities. Qrs. 480 ℔	Ocean Freight to United Kingdom. Per 480 ℔.	Total Cost of Ocean Carriage.
		s. d.	£
Atlantic America . .	11,171,100	2 3	1,257,100
South Russia . . .	569,000	2 2	62,000
Pacific America . .	2,389,900	8 1	966,000
Canada	1,877,100	2 8	250,000
Rumania . . .	176,400	2 6	22,000
Argentina and Uruguay	4,322,300	4 10	1,045,000
France	251,900	1 3	16,000
Bulgaria and Rumelia .	30,600	2 6	4,000
India	2,200	4 0	400
Austria-Hungary . .	389,300	1 9	34,000
Chile	600	..	..
North Russia . . .	462,700	1 6	35,000
Germany . . .	438,700	1 6	33,000
Australasia . . .	883,900	6 5	284,000
Minor Countries . .	225,100	2 6	28,000
Total . . .	23,190,800	Average 3s. 6d.	£4,036,500

Comparing the foregoing with a similar statement for the year 1872, the most remote year for which similar facts are available, it will be found that the actual total cost per quarter for ocean carriage has not much decreased.

Quantity of Wheat and Wheaten Flour (*as wheat*) *imported into the United Kingdom from various sources during the calendar year* 1872, *together with the average rate of freight.*

1872.

Countries of Origin.	Quantities. Qrs.	Ocean Freight to United Kingdom. Per qr.	Total Cost of Carriage.
		s. d.	£
South Russia . .	3,678,000	8 6	1,563,000
United States . . .	2,030,000	6 6	659,000
Germany . . .	910,000	2 0	91,000
France	660,000	3 0	99,000
Egypt	536,000	4 6	120,000
North Russia . . .	490,000	2 0	49,000
Canada	400,000	7 6	150,000
Chile	330,000	12 0	198,000
Turkey	195,000	7 6	72,000
Spain	130,000	3 6	23,000
Scandinavia . . .	160,000	2 0	16,000
Total, Chief Countries	9,519,000	Average 6s. 5d.	£3,040,000

N.B.—There was a trifling quantity of Californian and Australian wheat imported in the period in question, but the Board of Trade records do not distinguish the quantities, therefore they cannot be given. The freight in that year from those countries averaged about 13s. per quarter.

The exact difference between the average freight for the years 1872 and 1900, it will be seen, amounts to about 2s. 11d. per quarter (480 ℔), a mere trifle in comparison with the actual fall in the price of wheat during the same years.

The following data bearing upon the subject, for selected periods, are partly taken from the *Corn Trade Year-Book* of 1896 :—

Year.	United Kingdom Annual Imports. Wheat and Flour. Qrs.	Ocean Freight to United Kingdom. Per qr.	Aggregate Cost of Carriage.
		s. d.	£
1872 .	9,469,000	6 5	3,040,000
1882 .	14,850,000	7 4	5,420,000
1894 .	16,229,000	3 9	3,041,000
1895 .	25,197,000	3 0	3,825,000
1896 .	23,431,000	2 9	3,258,000
1900 .	23,196,000	3 6	4,036,000

In passing, it may be pointed out that for a period of four years, from 1871 to 1874, the price of wheat averaged 56s. per quarter (or 7s. per bushel), with the charge for ocean carriage at 6s. 5d. per quarter, whereas in 1901 we had wheat at 28s. (or 3s. 6d. per bushel), and the

charge for ocean carriage at 3s. 6d. per quarter; the ocean transport companies carried eight bushels of wheat across the seas in 1901 for the value of one bushel, or exactly at the same ratio as in 1872. The contrast between the case of railway freight and ocean freight is striking, but is to be explained by the greater length of the present ocean voyage, which now extends to 10,000 miles in the case of Europe's importation of white wheat from the Pacific Coast of the United States and Australia, in contrast with the short voyage from the Black Sea or across the English Channel or German Ocean. It is largely due to the overlooking of this phase of the question that an American statistician has fallen into the error of stating that about 16s. per quarter of the fall in the price of wheat, which happened between 1880 and 1894, is attributable to the lessened cost of transport, he having apparently drawn his deduction from the narrow premises of the American railway and ocean freights.

It thus appears to be a fact that, whatever the cause of the decline in the price of wheat may be, it is not due solely to the fall in the rate of rail or ocean freights. Incidental charges, it is true, are lower than they were in 1870; handling charges, brokers' commissions, and insurance premiums have been in many instances reduced in recent years. Port dues and charges have occasionally been lowered by 1s. to 2s. per ton on each side of the Atlantic; commissions have been reduced by 1 per cent., or perhaps by a little more; insurance premiums are a trifle lower; but all these economies when combined will only amount to about 2s. per quarter. Now if we add together all these savings in the rate of rail and ocean freights and incidental expenses, we arrive at an aggregate economy of 8s. per quarter, or not one-third of the actual difference between the average price of wheat in 1872 and 1900. To what the remaining difference was due it is difficult to say with certitude; there are some who argue that the tendency of prices to fall is inherent, and that the constant whittling away of intermediaries' profits is sufficient explanation, while the bi-metallists maintain that the phenomenon is clearly to be traced to the action of the German Government in demonetizing silver in 1872.

Wheat Prices for 246 Years.

The following figures show the fluctuations from year to year, for 246 years, of English wheat, chiefly according to a record published by Mr T. Smith, Melford, the period covered being from 1656 to 1900:—

Price per Quarter.

	s.	d.		s.	d.		s.	d.		s.	d.		s	d.
1656	38	2	1706	23	1	1756	40	1	1806	79	1	1856	69	2
1657	41	5	1707	25	4	1757	53	4	1807	75	4	1857	56	4
1658	57	9	1708	36	10	1758	44	5	1808	84	4	1858	44	2
1659	58	8	1709	69	9	1759	35	3	1809	97	4	1859	43	9
1660	50	2	1710	69	4	1760	32	5	1810	106	5	1860	53	3
1661	62	2	1711	48	0	1761	26	9	1811	95	3	1861	55	4
1662	65	9	1712	41	2	1762	34	8	1812	126	6	1862	55	5
1663	50	8	1713	45	4	1763	36	1	1813	109	9	1863	44	9
1664	36	0	1714	44	9	1764	41	5	1814	74	4	1864	40	2
1665	43	10	1715	38	2	1765	48	0	1815	65	7	1865	41	10
1666	32	0	1716	42	8	1766	43	1	1816	78	6	1866	49	11
1667	32	0	1717	40	7	1767	57	4	1817	96	11	1867	64	5
1668	35	6	1718	34	6	1768	53	9	1818	86	3	1868	63	9
1669	39	5	1719	31	1	1769	40	7	1819	74	6	1869	48	2
1670	37	0	1720	32	10	1770	43	6	1820	67	10	1870	46	11
1671	37	4	1721	33	4	1771	47	2	1821	56	1	1871	56	8
1672	36	5	1722	32	0	1772	50	8	1822	44	7	1872	57	0
1673	41	5	1723	30	10	1773	51	0	1823	53	4	1873	58	8
1674	61	0	1724	32	10	1774	52	8	1824	63	11	1874	55	9
1675	57	5	1725	43	1	1775	48	4	1825	68	6	1875	45	2
1676	33	9	1726	40	10	1776	38	2	1826	58	8	1876	46	2
1677	37	4	1727	37	4	1777	45	6	1827	58	6	1877	56	9
1678	52	5	1728	48	5	1778	42	0	1828	60	5	1878	46	5
1679	53	4	1729	41	7	1779	33	8	1829	66	3	1879	43	10
1680	40	0	1730	32	5	1780	35	8	1830	64	3	1880	44	4
1681	41	5	1731	29	2	1781	44	8	1831	66	4	1881	45	4
1682	39	1	1732	23	8	1782	47	10	1832	58	8	1882	45	1
1683	35	6	1733	25	2	1783	52	8	1833	52	11	1883	41	7
1684	39	1	1734	34	6	1784	48	10	1834	46	2	1884	35	8
1685	41	5	1735	38	2	1785	51	10	1835	39	4	1885	32	10
1686	30	2	1736	35	10	1786	38	10	1836	48	6	1886	31	0
1687	22	4	1737	33	9	1787	41	2	1837	55	0	1887	32	6
1688	40	10	1738	31	6	1788	45	0	1838	64	7	1888	31	10
1689	26	8	1739	34	2	1789	51	2	1839	70	8	1889	29	9
1690	30	9	1740	45	1	1790	54	9	1840	66	4	1890	31	11
1691	30	2	1741	41	5	1791	48	7	1841	64	4	1891	37	0
1692	41	5	1742	30	2	1792	43	0	1842	57	3	1892	30	3
1693	60	1	1743	22	1	1793	49	3	1843	50	1	1893	26	4
1694	56	10	1744	22	1	1794	52	3	1844	51	3	1894	22	10
1695	47	1	1745	24	5	1795	75	2	1845	50	10	1895	23	1
1696	63	1	1746	34	8	1796	78	7	1846	54	8	1896	26	2
1697	53	4	1747	30	11	1797	53	9	1847	69	9	1897	30	2
1698	60	9	1748	32	10	1798	51	10	1848	50	6	1898	34	0
1699	56	10	1749	32	10	1799	69	0	1849	44	3	1899	25	8
1700	35	6	1750	28	10	1800	113	10	1850	40	3	1900	28	11
1701	33	5	1751	34	2	1801	119	6	1851	38	6	1901	26	9
1702	26	2	1752	37	2	1802	69	10	1852	40	9			
1703	32	0	1753	39	8	1803	58	10	1853	53	3			
1704	41	4	1754	30	9	1804	62	3	1854	72	5			
1705	26	8	1755	30	1	1805	89	9	1855	74	8			
Average 50 years.	42	10		36	0		51	9		65	10		[a] 42	7

[a] Average for 46 years only.

Dividing the period into ten parts, we have the following as the average prices for each 25 years:—

	s.	d.		s.	d.		s.	d.		s.	d.		s.	d.
1650–74	45	0	1700–24	37	0	1750–74	43	0	1800–24	78	0	1850–74	53	0
1675–99	44	0	1725–49	35	0	1775–99	48	0	1825–49	58	0	1875–1901	35	6

The World's Visible Supply of Wheat (in million bushels) and Average Price, per imperial quarter, of British Wheat in England and Wales in each month from August 1891 *to July* 1901.

	August.	September.	October.	November.	December	January.	February.	March.	April.	May.	June.	July.
1891–92 .	110 39/9	112 38/5	155 35/0	179 37/10	203 37/6	200 35/4	197 32/6	181 32/11	187 31/2	161 31/5	148 30/1	132 29/2
1892–93 .	123 29/7	146 28/11	166 28/2	196 28/1	232 26/3	237 26/3	234 25/9	229 24/10	222 25/1	215 26/8	205 27/1	184 26/7
1893–94 .	178 26/2	183 26/3	196 27/7	221 27/3	237 26/8	232 26/3	233 25/0	222 24/3	216 24/7	207 24/7	196 23/10	173 24/6
1894–95 .	174 24/3	189 20/7	205 17/8	221 18/10	219 20/7	228 20/7	223 20/0	212 19/11	198 20/5	186 22/5	171 25/9	160 24/9
1895–96 .	158 24/2	152 22/10	176 24/6	210 25/9	219 24/11	225 25/7	203 26/2	192 25/2	181 24/10	161 25/6	147 25/1	137 24/4
1896–97 .	124 22/11	126 23/9	151 27/10	190 32/4	202 31/8	185 31/2	173 29/4	155 27/11	139 27/3	121 28/0	107 27/3	89 27/9
1897–98 .	77 30/3	87 33/7	119 32/5	139 33/9	156 33/11	157 34/9	152 35/1	140 35/7	132 36/0	111 46/0	110 43/7	87 37/5
1898–99 .	70 33/1	66 26/5	83 26/6	107 28/1	136 27/2	147 26/11	146 26/2	151 25/8	145 24/8	139 25/3	137 25/6	140 25/5
1899–1900 .	134 24/8	142 25/3	163 27/4	191 26/4	203 25/6	203 25/10	190 25/11	181 25/11	184 25/11	176 25/8	157 25/9	150 28/8
1900–1901 .	150 28/8	165 28/6	188 28/5	201 27/2	203 26/8	200 26/8	198 26/5	193 25/10	188 26/6	172 27/3	153 27/7	136 27/4

The World's Grain Trade.

In the following statistical account of the world's grain trade, the principal details of each country's share are shown over a period of ten years or more. The accompanying diagram shows the world's crop, imports and exports, of the season 1898–99. For the chief countries, such as the United Kingdom and the United States, data for longer periods have been set down. The order in which the information is given is, as a rule, according to the importance of the country's contribution to the international trade, the United States claiming attention first of all, as it is *facile princeps* as a producer of foodstuffs.

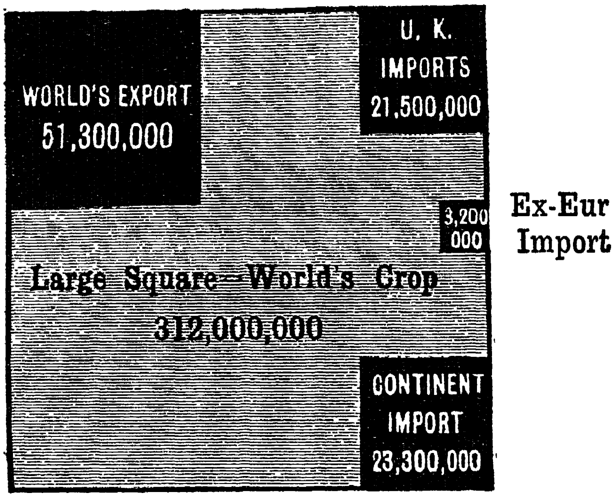


Diagram showing the World's Crop: Imports and Exports, Season 1898–99.
(The discrepancy between Exports and Imports is chiefly due to variations in quantities afloat.)
(*From a drawing by Mr Ernest Procter.*)

United States of America (population, 76,303,387: census 1900).—The record of America's development in this department of human industry is one of triumphant success. Every twenty-five years she doubles the size of her crops, partly owing to the rapid increase of population, but also largely due to improved methods of cultivation; the extent to which the latter statement is correct will be seen from the following figures:—

Per Capita Production of America during two Quinquenniums.

Years.	Wheat.	Maize.	Oats.	Barley.	Rye.
	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.
1870–1874 .	6·3	24·4	6·2	0·7	0·4
1896–1900 .	7·2	27·2	9·9	0·8	0·3

The consumption per capita of wheat in the United States averages about $4\frac{2}{3}$ bushels as compared with about 6 bushels in the United Kingdom and 8 bushels in France. Of late years the discrepancy between the American and European rate has tended to become greater, and it is often doubted if the American domestic consumption now exceeds $4\frac{1}{2}$ bushels. The consumption of maize for all purposes per head of the population averages 25 bushels, and of oats $9\frac{1}{2}$ bushels.

While it will be seen that America raises enormous crops of grain, yet the rate of yield per acre is relatively very small. Of late years there has been a slight improvement in this respect, but still the average weight of wheat obtained from an American acre is only about one-half of that taken off an English, Scottish, or German area of equal size. The average yield between 1896 and 1900 was in the United States as follows:—

Wheat.	Maize.	Oats.	Rye.	Barley.
Bushels.	Bushels.	Bushels.	Bushels.	Bushels.
13·4	25·6	28 2	15·1	24·3

Production.

(*According to the Year-Book of the Department of Agriculture.*)

Year	Wheat.	Rye.	Barley.	Oats.	Maize.	Potatoes.
	Qrs. 8 imp. bush.	Qrs. 8 imp. bus.	Qrs. 8 imp. bush.	Qrs. 8 imp. bush.	Qrs. 8 imp. bush.	Tons. 2240 lb.
1880	60,430,287	2,974,645	5,474,587	50,652,773	208,173,853	4,191,489
1881	46,458,192	2,509,090	4,989,252	50,482,545	144,838,303	2,728,637
1882	61,113,390	3,631,519	5,933,808	59,181,892	196,003,042	4,274,312
1883	51,040,746	3,401,040	6,077,102	69,248,775	188,008,108	5,179,110
1884	62,153,333	3,471,515	7,418,545	70,742,787	217,639,454	4,766,050
1885	43,286,303	2,637,090	7,073,939	76,292,000	234,688,000	4,375,725
1886	55,420,363	2,968,363	7,203,393	75,652,606	201,871,636	4,201,275
1887	55,312,606	2,508,242	6,886,303	79,953,696	176,504,363	3,352,575
1888	50,408,242	3,444,242	7,743,515	85,058,787	240,944,242	5,059,125
1889	59,461,818	3,444,884	9,494,906	91,092,727	256,108,121	5,124,759
1890	48,395,393	3,128,178	8,141,616	63,469,212	180,602,424	3,701,974
1891	74,155,151	3,848,711	10,525,957	89,502,303	249,715,636	6,360,674
1892	62,539,272	3,391,372	9,708,698	80,125,454	197,389,575	3,916,370
1893	48,015,966	3,218,842	8,469,029	77,436,951	196,302,561	4,575,855
1894	55,789,989	2,239,710	7,442,480	80,246,900	147,002,430	4,269,683
1895	56,618,539	3,298,190	10,554,272	99,932,549	260,744,070	7,430,934
1896	51,840,526	2,953,824	8,447,906	85,738,958	270,772,747	6,305,863
1897	64,260,505	3 316,766	8,083,045	84,699,128	230,662,779	4,100,399
1898	81,836,206	3,110,002	6,762,697	88,594,744	233,234,504	4,807,658
1899	66,300,000	2,910,020	8,953,000	96,500,000	252,000,000	5,701,000
1900	63,000,000	2,900,000	7,060,000	98,000,000	255,000,000	5,200,000

N.B.—The wheat crops of certain years were under-estimated by the Department, as indicated by subsequent distribution. They were estimated by the *Corn Trade News* to be as follows:—1900, 74,000,000 qrs.; 1899, 72,000,000 qrs.; 1898, 87,000,000 qrs.; 1897, 74,000,000 qrs.; 1896, 59,000,000 qrs.; 1895, 61,000,000 qrs.; 1894, 66,000,000 qrs.; 1893, 60,000,000 qrs.; 1892, 72,000,000 qrs.; 1891, 86,000,000 qrs.

Note.—In the reduction of the American Winchester bushel we reckon that 33 such bushels are the equivalent of 32 imperial bushels.

Wheat Crops—Acreage and Yield.

The following shows Department of Agriculture estimates of wheat production in 1900 for winter and spring wheat crops:—

States and Territories.	1900. Acreage.	1900. Bushels.
Ohio	1,420,646	8,523,876
Michigan . . .	1,219,969	9,271,764
Indiana . . .	1,209,755	6,411,702
Illinois	1,383,236	17,982,068
Missouri . . .	1,507,737	18,846,713
Kansas	4,660,376	82,488,655
Kentucky . . .	957,142	12,442,846
Tennessee . . .	1,181,423	11,696,088
New York . . .	367,015	6,496,166
New Jersey . . .	122,753	2,344,582
Pennsylvania . .	1,502,321	20,281,334
Delaware . . .	72,864	1,479,139
Maryland . . .	778,864	15,187,848
Virginia . . .	791,759	9,421,932
North Carolina . .	620,917	5,960,803
South Carolina . .	238,092	2,142,828
Georgia . . .	550,674	5,011,133
Alabama . . .	96,458	916,351
Mississippi . . .	4,248	40,781
Texas	1,271,517	23,395,913
Arkansas . . .	266,279	2,689,418
West Virginia . .	454,377	4,452,895
California . . .	2,771,226	28,543,628
Oregon	1,173,769	16,198,012
Oklahoma . . .	981,967	18,657,373
Winter Wheat . .	25,605,384	330,883,848
Minnesota . . .	4,905,643	51,509,252
Wisconsin . . .	849,458	13,166,599
Iowa	1,397,322	21,798,223
Nebraska . . .	2,066,825	24,801,900
North Dakota . .	2,689,023	13,176,213
South Dakota . .	2,920,244	20,149,684
Colorado . . .	318,899	7,207,117
Washington . . .	1,067,943	25,096,661
Nevada	40,457	991,196
Idaho	149,261	3,104,629
Montana . . .	72,555	1,929,963
New Mexico . . .	183,207	3,847,347
Utah	176,895	3,697,106
Arizona . . .	25,045	365,657
Wyoming . . .	20,819	366,414
Maine	2,090	40,755
New Hampshire . .	496	8,085
Vermont . . .	3,487	81,992
Connecticut . . .	330	6,864
Spring Wheat . .	16,889,999	191,345,657
Total crop, bushels .	...	522,229,505
Total area, acres . .	42,495,383	...
Yield per acre . .	...	12·29

MAIZE CROPS—ACREAGE AND YIELD.

Department of Agriculture estimates of production of corn (maize) in 1900:—

States and Territories.	1900. Acreage.	1900. Bushels.
Maine	12,229	440,244
New Hampshire	25,264	934,768
Vermont	48,477	1,939,080
Massachusetts	40,667	1,545,346
Rhode Island	8,197	262,304
Connecticut	46,610	1,771,180
New York	538,626	17,236,032
New Jersey	257,364	8,493,012
Pennsylvania	1,308,316	32,707,900
Delaware	208,763	5,010,312
Maryland	585,877	15,232,802
Virginia	1,761,485	28,183,760
North Carolina	2,482,515	29,790,180
South Carolina	1,875,591	13,129,137
Georgia	3,411,953	34,119,530
Florida	519,524	4,156,192
Alabama	2,668,722	29,355,942
Mississippi	2,293,818	25,231,998
Louisiana	1,453,094	24,702,598
Texas	4,553,495	81,962,910
Arkansas	2,380,313	45,225,947
Tennessee	2,849,894	56,997,880
West Virginia	714,804	19,299,708
Kentucky	2,664,124	69,267,224
Ohio	2,888,924	106,890,188
Michigan	1,080,235	38,888,460
Indiana	4,031,600	153,200,800
Illinois	7,139,898	264,176,226
Wisconsin	1,238,681	49,547,240
Minnesota	963,476	31,794,708
Iowa	8,048,946	305,859,948
Missouri	6,453,943	180,710,404
Kansas	8,624,770	163,870,630
Nebraska	8,093,464	210,430,064
South Dakota	1,200,697	32,418,819
North Dakota	23,824	381,184
Montana	1,598	23,970
Wyoming	2,403	81,702
Colorado	167,839	3,188,941
New Mexico	25,216	554,752
Arizona	...	...
Utah	8,459	169,180
Idaho	...	...
Washington	5,307	106,140
Oregon	13,789	317,147
California	54,079	1,351,975
Oklahoma	544,002	14,144,052
Total crop, bushels	...	2,105,102,516
Total acres	83,320,872	...
Yield per acre	...	25·3
Average farm price	...	36·0

EXPORTS.

(*According to the Year-Book of the Department of Agriculture.*)

In quarters of 8 Winchester bushels.

Year ending 30th June.	Wheat.	Rye.	Barley.	Oats.	Maize.	Flour.
	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.	Sacks, 280 lb.
1880	17,906,600	362,500	137,500	100,000	12,250,000	4,211,620
1881	18,820,600	237,500	112,500	50,000	11,500,000	5,565,161
1882	11,908,900	125,000	25,000	75,000	5,375,000	4,144,443
1883	13,298,200	271,200	54,100	57,500	5,125,000	6,448,186
1884	8,793,600	27,500	90,000	220,000	5,625,000	6,406,582
1885	10,581,700	368,700	78,600	525,000	6,500,000	7,453,701
1886	7,219,800	25,000	31,200	708,700	8,000,000	5,725,468
1887	12,744,000	37,500	162,500	50,000	5,000,000	8,065,253
1888	8,223,600	9,848	68,500	37,500	3,025,000	8,374,501
1889	5,801,700	35,906	180,000	75,000	8,700,000	6,562,362
1890	6,798,400	262,500	175,000	1,700,000	12,750,000	8,562,197
1891	6,891,500	37,500	125,000	125,000	3,875,000	7,941,012
1892	19,660,000	1,475,000	350,000	1,175,000	9,425,000	10,637,738
1893	14,640,000	184,600	378,700	287,500	5,750,000	11,634,337
1894	11,051,903	28,852	652,425	718,783	8,165,605	11,801,673
1895	9,512,838	1,179	195,469	71,247	3,461,392	10,688,244
1896	7,581,260	123,558	960,041	1,626,573	12,449,104	10,234,604
1897	9,945,252	1,070,034	2,503,787	4,387,092	22,114,545	10,198,681
1898	18,528,907	1,942,697	1,404,636	8,641,286	26,093,117	10,744,960
1899	17,194,834	1,264,482	283,297	3,773,257	21,585,934	12,780,544
1900	12,740,000	296,000	2,960,000	5,171,400	26,170,000	13,087,000
1901	16,300,000	300,000	767,000	4 633,000	22,073,000	12,973,800

It will be noticed that the wheat exports show no particular growth, but that considerably larger quantities of maize, flour, oats, and barley are being sent abroad now than in former years.

IMPORTS.

(*According to the Year-Book of the Department of Agriculture.*)

In quarters of 8 Winchester bushels.

Year.	Wheat.	Rye.	Barley.	Oats.	Maize.	Flour.
	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.	Sacks, 280 lb.
1885	25,819	29,876	1,248,313	4,300	563	..
1886	47,567	21,724	1,274,639	11,306	2,013	..
1887	34,730	2,308	1,294,449	10,922	3,817	..
1888	72,889	5	1,353,932	8,479	4,686	..
1889	16,331	2	1,421,051	2,788	300	..
1890	19,632	24,699	1,416,568	2,679	203	..
1891	68,246	17,592	634,841	1,211	264	4,312
1892	199,480	19	260,662	2,111	181	400
1893	138,098	1,063	158,115	2,211	275	266
1894	174,598	1,595	203,536	21,358	673	588
1895	241,142	36	153,173	19,262	1,830	1,526
1896	184,101	12	118,785	9,056	691	1,435
1897	191,700	9	158,900	5,800	785	1,575
1898	248,000	3,992	15,100	1,100	412	1,920

From the foregoing it will be observed that the States have never been importers of cereals excepting on a trifling scale, the only exception being in the case of barley, which during the 'eighties was freely imported from Canada, a trade which was cut short in the year 1891 by the imposition of prohibitive duties.

DISTRIBUTION OF WHEAT.

The following table exhibits the production of wheat, quantities required for food, seed, and exports between 1880 and 1899, on the authority of the Department of Agriculture crop returns, compiled by Mr C. B. Murray:—

Year.	Production. Bushels.	For Food. Bushels.	For Seed. Bushels.	Exportation. Bushels.	Total Distribution. Bushels.
1880	498,549,868	242,086,655	56,563,530	186,321,514	484,971 699
1881	383,280,099	243,000,000	55,215,573	121,892,389	420,107,962
1882	504,185,470	250,000,000	52,770,312	147,811,316	450,581,628
1883	421,086,160	256,000,000	54,683,389	111,534,182	422,217,571
1884	512,765,000	261,000,000	55,266,239	132,570,367	448,836,606
1885	357,112,000	267,000,000	51,474,906	94,565,794	413,040,700
1886	457,218,000	271,000,000	51,528,658	153,804,970	476,333,628
1887	456,329,000	277,000,000	53,009,982	119,625,344	449,635,326
1888	415,868,000	283,000,000	54,012,702	88,600,743	425,613,445
1889	490,560,000	289,000,000	53,973,000	109,430,467	452,403,467
1890	399,262,000	295,000,000	56,582,000	102,312,074	453,894,074
1891	611,780,000	302,000,000	54,508,000	225,665,000	582,173,000
1892	515,949,000	304,000,000	54,000,000	191,912,000	549,912,000
1893	396,000,000	310,000,000	49,000,000	164,000,000	523,000,000
1894	460,000,000	[a]377,300,000	49,000,000	142,000,000	568,300,000
1895	467,000,000	323,000,000	54,000,000	126,000,000	503,000,000
1896	427,000,000	327,000,000	55,000,000	145,000,000	527,000,000
1897	530,000,000	330,000,000	55,000,000	217,000,000	602,000,000
1898	675,000,000	330,000,000	57,000,000	222,000,000	609,000,000
1899	547,000,000	330,000,000	65,000,000	188,000,000	583,000,000

[a] Including 60,000,000 bushels fed to live stock.

(*Bradstreet's Report of Wheat Stocks east of the Rockies on 1st of each month,* 1889 *to* 1900 *inclusive.*)

In hundreds of thousands [00,000 omitted] of bushels.

	1900.	1899.	1898.	1897.	1896.	1895.	1894.	1893.	1892.	1891.	1890.	1898.
Jan.	89,2	50,1	54,1	73,2	97,7	113,7	99,5	107,0	69,2	47,1	54,2	52,7
Feb.	87,4	51,6	51,1	68,0	97,5	106,9	98,8	111,9	66,5	44,2	49,6	47.4
Mar.	85,5	51,0	45,0	61,6	94,5	98,7	96,2	105,2	64,6	42,4	44.3	44.6
Apr.	79,6	51,2	49,0	55,9	89,1	91,2	89,3	108,3	59,7	40,6	40,4	39,6
May	70,7	47,2	31,0	49,6	80,3	80,4	82,0	95,7	49,3	33,6	33,3	34,3
June	57,6	42,0	27,4	37,9	68,7	64,3	71,8	86,0	39,2	28,0	30,6	27,0
July	58,5	46,5	18,0	27,0	61,3	53,5	65,2	72,6	33,2	21,0	26,8	20,3
Aug.	60,3	49,1	11,4	23,7	58,4	46,7	66,3	68,6	31,3	23,1	24,0	16,0
Sept.	66,2	48,0	11,4	20,3	57,5	44,7	79,8	64,3	42,8	25,5	22,6	20 8
Oct.	76,0	60,0	22,8	31,5	63,9	55,0	92,1	71,1	59,8	36,5	27,9	26,7
Nov.	82,2	77,1	33,9	42,6	76,7	75,5	105,8	83,2	78 6	50 5	37,0	46,9
Dec.	86,5	84,6	45,9	49,8	76,4	87,6	113,1	96,5	94,6	62,3	44,8	54,4

(*Bradstreet's Report of Wheat Stocks west of the Rockies on 1st of each month,* 1889 *to* 1900 *inclusive.*)

In hundreds of thousands [00,000 omitted] of bushels.

	1900.	1899.	1898.	1897.	1896.	1895.	1894.	1893.	1892.	1891.	1890.	1889.
Jan.	10,0	5,9	6,6	4,1	7,1	13,3	10,7	9,3	8,8	12,9	7,5	5,7
Feb.	8,9	5,0	5,3	3,0	5,5	13,1	9,8	6.4	6,0	10,6	6,1	4.4
Mar.	7,8	5,1	4,4	1,8	4,2	11,8	9,6	5,4	3,3	8,5	5,0	3,5
Apr.	7,2	4,3	3,4	1,7	3,8	10,4	9,0	4,7	2,6	7,0	4,7	2,1
May	7,0	4,4	3,0	1,6	3,1	10,1	9,3	3,5	2,4	4,2	3,8	1,7
June	6,8	3,6	3,2	1,2	2,5	8,4	8,7	3,0	2,4	2,4	3,1	1,2
July	5,9	3,4	2,9	1,1	1,9	6,5	8,2	2.8	2,3	1,0	2,8	6
Aug.	5,7	4,1	2,6	2,2	1,9	6,8	8,5	4,4	2,7	2,0	2,8	5,9
Sept.	7,4	6,2	3,0	4,6	3,5	8,7	8,5	6,1	3,5	3,4	5,0	7,0
Oct.	10,2	8,8	4,6	6,2	5 4	9,7	9,0	7,1	8,1	9,5	6,7	9,5
Nov.	9,9	11,0	5,6	7,3	6.8	9,6	12,0	7,7	8,7	12,7	7,5	9,3
Dec.	10,0	10,6	6,2	6,9	6,5	8,2	14,5	10,6	10,4	10,6	12,3	8,1

(*Bradstreet's Report of Corn Stocks east of the Rockies on 1st of each month*, 1890 *to* 1900 *inclusive.*)

In hundreds of thousands [00,000 omitted] of bushels.

	1900.	1899.	1898.	1897.	1896.	1895.	1894.	1893	1892.	1891.	1890.
January	19,0	26,9	48,2	26,4	9,1	12,8	11,3	13,5	8,5	5,0	15,4
February	20,1	36,7	53,5	29,7	17,0	16,7	18,0	14,4	8,9	4,7	18,4
March	28,3	44,7	52,4	33,7	17,0	17,0	21,9	17,5	12,5	5,5	21,3
April	31,8	43,6	52,2	32,6	19,2	16,3	21,3	17,2	13,2	5,3	27,7
May	30,4	34,2	34,7	21,7	13,2	13,1	14,8	13,0	8,1	5,0	17,7
June	18,2	19,0	28,2	16,1	11,2	12,6	9,5	9,4	4,8	7,2	17,9
July	19,0	21,5	32,9	21,5	11,1	10,7	7,7	10,1	9,4	48,6	19,2
August	18,6	17,6	25,4	20,0	13,2	5,7	4,9	9,9	8,8	4,7	15,1
Septem.	8,7	11,0	24,0	37,5	18,6	6,1	4,2	6,9	8,7	6,6	12,4
October	11,1	16,6	30,1	45,4	17,8	6,7	5,2	9,9	12,2	8,5	12,3
Novem.	11,0	18,7	33,1	52,9	23,9	6,3	3,5	11,3	15,1	4,1	10,0
Decem.	12,7	17,5	25,8	44,5	22,6	7,3	6,3	9,4	12,6	4,0	5,2

The chief customer for the agricultural surplus of America is the United Kingdom, where more than half of her total exports are disposed of. The principal ports of export in the Union are New York, Baltimore, Philadelphia, New Orleans, Boston, Galveston, San Francisco, Williamette, and Puget Sound—named in the order of their importance.

Russia (population in Europe, 106,159,141; in Asia, 23,051,972: census 1897).—The Russian empire comes immediately after America as a grower of foodstuffs. As will be seen, the production of cereals (chiefly rye and oats) amounts roundly to 300,000,000 quarters.

PRODUCTION.

(*From Returns of the Central Statistical Committee and of the Ministry of Agriculture.*)

Year.	Wheat.	Rye.	Barley.	Oats.	Maize.	Potatoes.
	Qrs. of 8 meas. bushels.	Qrs. of 8 meas. bushels.	Qrs. of 8 meas. bushels.	Qrs. of 8 meas. bushels.	Qrs. of 8 meas. bushels.	Tons 2240.
[a]1885	21,557,900	84,900,900	12,124,300	47,086,100	2,097,800	5,842,900
[a]1886	19,787,000	80,221,400	16,158,600	68,948,500	2,756,100	6,713,800
[a]1887	33,737,600	90,087,700	20,317,900	74,852,200	1,573,700	7,560,100
[b]1888	39,367,200	96,930,400	23,610,200	72,563,500	3,391,700	11,745,500
[b]1889	25,171,600	73,923,000	16,516,300	65,844,900	1,851,200	12,162,500
[b]1890	28,038,300	87,478,641	21,251,900	70,045,600	2,933,500	12,245,600
[b]1891	21,974,600	65,368,600	18,337,900	55,851,300	3,562,700	9,943,300
[b]1892	32,202,800	78,507,700	22,703,600	58,018,200	2,650,300	16,598,500
	Qrs. 480.	Qrs. 480.	Qrs. 400.	Qrs. 304.	Qrs. 480.	
[c]1893	56,448,000	99,095,000	40,949,000	87,782,000	5,275,500	20,514,000
[c]1894	55,730,000	104,206,000	33,536,000	89,796,000	2,744,200	18,764,000
[d]1895	51,506,600	93,186,000	30,247,200	82,188,900	3,686,000	21,047,000
[e]1896	45,517,100	90,570,100	30,304,800	84,333,000	2,765,000	23,957,500
[e]1897	42,375,100	76,055,500	28,550,000	69,986,000	6,044,000	22,559,700
[e]1898	57,232,300	85,773,400	36,715,700	72,498,700	5,715,400	23,956,300
[e]1899	56,591,300	106,024,900	27,144,000	104,952,700	3,598,250	24,568,200
[e]1900	52,708,000	107,013,000	28,349,000	90,021,000	3,984,000	25,694,000
[e]1901	53,100,000	88,000,000	28,700,000	61,800,000	8,300,000	..

[a] Returns for 50 governments. [b] Returns for 60 governments.
[c] Returns for 66 governments. [d] Returns for 69 governments.
[e] Returns for 71 governments.

In Russia the average yield per acre is, of winter wheat, 12·5 bushels; of spring wheat, 8 bushels; rye, 11 bushels; barley, 13 bushels; oats, 15 bushels; maize, 14 bushels.

The proportions of each sort of wheat raised in the different divisions of the empire are as follows, taking the official figures of the year 1899 as an instance:—

	Winter Wheat.	Spring Wheat.	Total.
	Qrs.	Qrs.	Qrs.
European Russia, 50 governments	12,300,000	26,960,000	39,260,000
Poland, 10 governments	2,600,000	25,000	2,625,000
Caucasia, 4 governments	5,340,000	1,800,000	7,140,000
Siberia, 4 governments	16,000	5,650,000	5,666,000
Central Asia, 4 governments	15,000	1,846,000	1,861,000
Total, 72 governments	20,271,000	36,281,000	56,552,000

During the eight years ending 1899 Russia has raised on an average 52,500,000 qrs. of wheat, and exported 13,000,000 qrs., leaving 39,500,000 qrs. for home consumption. Besides the cereal crops enumerated in the tabular statement, Russia annually produces four to five million qrs. of millet, three million qrs. of pease, and one million qrs. of spelt. In addition to the exports shown in the tabular statement, there were exported in the year 1899 556,000 cwt. of buckwheat, 271,000 cwt. of millet, 1,921,000 cwt. of pease, 1,853,357 cwt. of rye flour, and 7,292,570 cwt. of bran of all kinds. There are also certain quantities of beans and lentils grown and exported; in 1899 the quantity exported was 1,464,000. The consumption per head of wheat amounts to about 2½ bushels for the whole empire; of rye to 2·8 bushels per head for European Russia, and for the whole empire to a little over 5 bushels. The rye crop is almost entirely sown in the autumn, as is also half the wheat, but barley, oats, and maize are all spring-sown.

The chief shipping ports are Odessa, Nicolaieff, Taganrog, Rostoff, Novorossiysk for wheat, rye, and barley; but Libau, St Petersburg, Revel, and Riga ship the bulk of the oats. Odessa, Poti, and Novorossiysk are the chief shippers of maize. The chief customers for Russia's wheat exports are Germany, Italy, Belgium, Holland, France, Switzerland, and Spain. Great Britain occasionally takes considerable quantities when American wheat is relatively dear. Great Britain, Germany, and Holland are the principal buyers of Russian barley. Germany takes almost half the rye exports, and Great Britain half the oats and maize.

The effectiveness of Russia as a shipper is largely dependent upon prices, much more so than would seem to be the case with America, the explanation being, it is believed, that when prices are low only that portion of the empire immediately contiguous to the littoral remains operative as a shipper, for railway freights are not so elastic in Russia as they are in America.

EXPORTS (EXCLUSIVE OF FINNISH).

(*From Returns of Exports of Russian Goods to Foreign Countries.*)

Year.	Wheat.	Rye.	Barley.	Oats.	Maize.	Flour.
	Qrs. 480.	Qrs. 480.	Qrs. 400.	Qrs. 304.	Qrs. 480.	Imperial bushels.
1890	13,656,400	5,768,000	5,462,400	6,162,100	1,545,000	1,400,000
						Sks. 280
1891	13,227,700	5,100,500	4,141,700	5,469,500	2,115,700	480,465
1892	6,116,800	905,000	3,956,100	2,443,000	1,620,500	331,578
1893	11,717,300	2,463,800	10,010,500	6,759,300	1,195,600	410,265
[a]1894	15,355,425	6,072,750	13,782,510	11,233,000	4,369,425	484,326
[a]1895	17,787,075	6,846,975	9,748,710	7,941,941	1,920,000	539,100
[a]1896	16,469,100	5,944,125	7,344,450	8,033,928	970,125	486,513
[a]1897	15,998,025	5,511,525	8,049,690	5,190,423	1,587,000	484,065
[b]1898	12,660,600	4,665,200	8,292,900	2,838,600	2,051,100	579,200
[b]1899	7,399,100	4,272,800	6,451,000	3,249,500	1,675,400	412,800
[b]1900	8,700,000	6,900,000	4,770,000	9,400,000	1,400,000	460,000
[c]1901	9,600,000	6,108,000	4,853,000	9,180,000	723,000	460,000

[a] From "Statistical Abstract for the Principal and other Foreign Countries."
[b] From the *Journal of Industry and Commerce of St Petersburg.*
[c] Cereal year, commercial return.

IMPORTS.

As might be expected, the imports of agricultural products are very small. In recent years they have been so insignificant that the returns have not been issued through the ordinary channels. Prior to the year 1886 certain quantities of wheat and spelt were imported, the official returns in quarters for the years named being, 160,000 in 1880, 150,000 in 1881, 452,000 in 1882, 306,000 in 1883, 302,000 in 1884, 1,394,000 in 1885, and 604,000 in 1886.

Rumania (population, 5,912,520; census 1899).—This little kingdom has always been a successful raiser of foodstuffs, for as far back as 1862 the records show that substantial crops of wheat, maize, and barley were grown, and indeed the yields of cereals in the year 1868 were as important as they are to-day. Unfortunately the agricultural data between the years 1877 and 1885 are missing, or otherwise we should have a forty years' record, or one twice as old as Great Britain possesses.

PRODUCTION.

(*Returns of the Ministry of Agriculture; also from "Recueil de Statistique Roumaine."*)

Year.	Wheat.	Rye.	Barley.	Oats.	Maize.	Millet.
	Qrs. of 8 bush.	Qrs. of 8 bush.	Qrs. of 8 bush.	Qrs. of 8 bush.	Qrs. of 8 bush.	Qrs. of 8 bush.
1890	6,498,336	572,381	2,000,939	918,562	7,514,491	117,167
1891	5,532,983	470,339	2,685,324	934,904	7,265,974	279,388
1892	7,770,000	561,500	2,493,400	1,333,500	12,321,000	578,210
1893	7,361,220	933,034	4,329,813	1,872,290	8,819,958	349,470
1894	5,283,455	698,899	2,048,111	1,213,802	3,620,965	20,355
1895	8,300,000	1,100,000	2,700,000	1,260,000	8,670,000	95,430
1896	8,624,240	1,479,878	3,850,584	1,783,134	7,925,740	165,790
1897	4,415,228	823,040	2,571,147	1,193,465	9,663,603	378,331
1898	7,100,000	900,000	3,600,000	2,100,000	12,350,000	309,000
1899	3,160,000	240,000	550,000	760,000	3,400,000	200,000
1900	6,900,000	700,000	1,800,000	1,000,000	10,300,000	[a]300,000
1901	8,800,000	1,100,000	2,500,000	2,000,000	14,000,000	..

[a] Unofficial.

The average yield per acre of wheat is 14 bushels, barley $16\frac{1}{2}$ bushels, oats 19 bushels, rye 15 bushels, maize 17 bushels, and millet 12 bushels. The average rate of consumption per capita in Rumania comprises 5 bushels of wheat and 7 bushels of maize. The present area under wheat is 3,855,000 acres, under maize 5,000,000 acres, under barley 1,500,000 acres, under oats 700,000 acres, under rye 500,000.

Exports.

(*From " Statistique du Commerce Extérieur."*)

Year.	Wheat.	Rye.	Barley.[a]	Oats.	Maize.	Flour.
	Qrs. 480.	Qrs. 480.	Qrs. 400.	Qrs. 304.	Qrs. 480 lb.	Sacks, 280 lb.
1890	4,138,970	397,971	996,421	46,000	3,428,169	69,811
1891	3,039,371	334,992	1,756,059	44,371	3,219,574	87,929
1892	3,541,587	417,305	1,042,994	251,106	3,021,030	136,323
1893	3,328,962	602,708	2,538,891	782,203	5,567,620	160,866
1894	3,140,036	626,449	1,600,770	98,978	3,189,737	246,646
1895	4,462,522	895,059	1,363,728	84,746	1,519,655	173,456
1896	5,630,400	1,025,800	2,183,500	134,989	2,037,800	189,000
1897	1,996,400	657,800	1,837,000	236,090	3,597,200	76,000
1898	2,668,000	558,200	1,996,500	538,587	5,147,400	147,000
1899	832,900	140,200	368,200	180,600	2,735,300	183,900

[a] Including malt from and after 1887.

One often meets with higher estimates of Rumania's exports, but that is due to the fact that considerable quantities of Bulgarian grain coming down the Danube get mixed up with the quantities actually grown in Rumania. The chief ports of export are Braila and Galatz on the Danube in the summer, and Sulina at the mouth of the Danube and Constanza on the Black Sea in the winter. The chief customers for Rumania's wheat are Belgium, Germany, Holland, and Italy, while the United Kingdom takes the principal share of the maize.

Bulgaria (population, 3,733,189 ; census 1900).—Agricultural statistics are not so readily obtainable from this principality as from the neighbouring kingdom of Rumania, but the *Corn Trade News* has collected returns from various authorities which are believed to be trustworthy. These are given below, in which are also comprised the figures for Eastern Rumelia.

Bulgaria and Eastern Rumelia : Production.

(*From the Corn Trade Year-Book and Commercial Estimates.*)

Year.	Wheat.	Rye.	Barley.	Oats.	Maize.
	Qrs. 480.	Qrs. 480.	Qrs. 400.	Qrs. 304.	Qrs. 480.
1890	2,500,000	..	..	.	..
1891	3,700,000	1,298,000	1,463,000	840,000	..
1892	3,600,000	850,000	1,688,000	900,000	..
1893	3,600,000	700,000	2,000,000	600,000	..
1894	3,100,000	800,000	1,500,000	800,000	..
1895	3,800,000	900,000	2,000,000	800,000	..
1896	5,000,000	600,000	2,500,000	700,000	2,800,000
1897	3,400,000	1,200,000	1,400,000	500,000	3,500,000
1898	4,700,000	800,000	1,600,000	1,100,000	4,000,000
1899	2,900,000	600,000	1,250,000	620,000	2,400,000
1900	4,000,000	900,000	1,250,000	500,000	1,500,000
1901	4,100,000	1.000,000	1,600,000	800,000	3,700,000

Eastern Rumelia is credited with raising 700,000 quarters of soft wheat and 80,000 quarters of hard wheat, which are included in above. The official figures for Bulgaria alone, appearing in the *Résultats des Ensemencements et de Récolte dans la Principauté de Bulgarie,* are as follows :—

Bulgaria : Acreage under Crops in Statute Acres.

Year.	Wheat.	Rye.	Barley.	Oats.	Maize.
1897-98	1,932,753	347,000	498,900	346,000	1,221,000
1898-99	2,039,444	365,000	528,000	337,000	1,104,000

Bulgaria : Yield of Crops in Imperial Bushels.

Year.	Wheat.	Rye.	Barley.	Oats.	Maize.
1897-98	33,983,000	5,072,000	11,712,000	8,746,000	35,224,000
1898-99	21,623,000	4,343,000	6,382,000	4,731,000	19,092,000

The yield per acre for the two years averaged nearly 14 bushels of wheat, 13 bushels of rye, $17\frac{1}{2}$ bushels of barley, 20 bushels of oats, and over 23 bushels of maize.

The consumption per capita of wheat would seem to be about 5 bushels.

Bulgaria : Exports.

(*From " Statistique du Commerce de Bulgarie."*)

Year.	Wheat.	Rye.	Barley.	Oats.	Maize.	Flour.
	Qrs. 480.	Qrs. 480.	Qrs. 400.	Qrs. 304.	Qrs. 480.	Sacks, 280.
1890	1,234,137	131,798	151,000	79,970	616,902	16,030
1891	1,440,152	374,770	202,422	17,393	199,447	18,637
1892	1,558,560	250,102	137,804	48,540	358,150	32,705
1893	1,610,426	212,813	226,578	124,628	1,473,124	26,126
1894	1,292,703	135,100	126,253	31,754	982,072	35,230
1895	1,772,500	203,259	137,253	2,431	222,873	53,970
1896	2,777,700	213,738	127,342	6,240	495,713	55,923
1897	1,293,900	77,115	96,771	25,833	358,330	27,855
1898	856,423	109,440	269,072	32,082	609,501	56,280
1899	554,200	30,000	56,100	40,500	722,000	51,500
1900	585,500	112,100	220,000	9,400	186,000	70,900

The chief ports from which direct shipments are made are Varna and Baltchick in Northern Bulgaria, but a great deal of stuff is sent down the Danube and is included in the Rumanian quantities. Bourgas is the port of Southern Bulgaria or Eastern Rumelia.

The imports of agricultural products are trifling.

Servia (population, 2,493,770 ; census 1900).—Agricultural returns of this kingdom are issued only at long intervals. In 1893, 783,162 acres were credited with producing 8,700,000 bushels of wheat ; 227,540 acres with 2,412,000 bushels of barley ; 261,735 acres with 2,672,000 bushels of oats ; 147,755 acres with 1,226,000 bushels of rye ; and 1,313,562 acres with 16,882,000 bushels of maize ; the yields per acre being 11 bushels of wheat, $10\frac{1}{2}$ bushels of barley, 10 bushels of oats, $8\frac{1}{4}$ bushels of rye, and $12\frac{3}{4}$ bushels of maize. The total production of several years, as given by various authorities, is shown below :—

Production.

(*British Consular data, excepting* 1893, *which is official.*)

Year.	Wheat.	Rye.	Barley.	Oats.	Maize.	Potatoes.
	Qrs. 480.	Qrs. 480.	Qrs. 400.	Qrs. 304.	Qrs. 480.	Tons, 2240
1890	1,275,200	161,600	474,100	515,300	2,986,200	..
1891	1,331,600	170,800	491,000	525,000	3,157,100	..
1892	1,256,800	178,800	494,000	518,700	3,284,600	..
1893	1,081,500	148,400	297,000	363,000	2,110,000	21,300
1894	1,284,400	190,900	512,900	551,800	3,344,300	..
1895	1,157,800	194,200	455,500	579,300	3,528,800	..
1896	1,300,300	160,900	508,600	624,400	3,606,000	..
1897	1,674,100	222,400	469,000	1,032,200	3,975,200	..
1898	1,314,200	212,400	540,400	646,100	3,743,800	..
1899	1,482,000	197,800	474,300	628,400	3,840,500	..
1900	955,285	102,657	148,234	273,559	..	..
1901	1,100,000	..	..	..	..	..

The quantities exported are not very important ; such as they are they will be found in the following tabular statement. The consumption per capita in the year 1893 was estimated as follows :—Wheat $5\frac{3}{4}$ bushels, and maize $6\frac{1}{3}$ bushels, but in subsequent years maize appears to have amounted to 11 bushels and over.

Exports.

(*From " Statistique du Commerce Extérieur du Royaume de Serbie."*)

Year.	Wheat.	Rye.	Barley.	Oats.	Maize.	Flour.
	Qrs. 480.	Qrs. 480.	Qrs. 400.	Qrs. 304.	Qrs. 480.	Sacks, 280.
1890	291,000	40,000	31,000	74,000	30,000	1080
1891	396,000	39,000	42,700	56,700	182,500	4000
1892	365,000	62,000	49,100	74,600	81,800	30
1893	403,000	41,000	62,900	95,100	284,200	20
1894	242,300	25,100	52,400	77,600	99,600	5
1895	286,300	9,000	23,200	86,800	17,500	30
1896	473,000	12,600	48,400	121,500	59,700	10
1897	141,700	13,500	19,600	127,900	61,400	100
1898	283,500	15,600	46,100	151,400	9,400	400
1899	355,559	26,422	103,822	83,043	121,150	..
1900	455,000	21,000	104,000	45,000	285,000	1000

Austria-Hungary is the chief customer for Servia's exports, but the suspension of the "Mahlverkehr" has seriously curtailed it. The imports, as might be expected, are, as a rule, insignificant ; the only year when they were worth reporting was in 1898, when 105,000 quarters of maize were received from neighbouring countries.

Turkey in Europe.—No official returns of production or exportation are published at Constantinople, but in

commercial circles it is known that the country grows just about what it needs for its own consumption. Constantinople imports weekly about 4000 quarters of wheat and 10,000 bags of Russian flour, but other parts of the empire export small quantities of wheat, and occasionally substantial shipments of maize, barley, and oats are made at Salonica. The crops of the province of Salonica for the year 1900 were as follows:—Wheat acreage 861,000, yield 800,000 qrs.; barley acreage 343,000, crop 460,000 qrs.; oats acreage 104,300, crop 209,000 qrs.; rye acreage 172,000, crop 117,000 qrs. The port of Dedeagatch also occasionally exports certain quantities of cereals.

Austria-Hungary (population—Austria, 26,107,304; Hungary, 19,203,531: census 1900).—The dual monarchy now plays a far less important part in the international grain trade than formerly, as will be seen from the subjoined summary of the exports and imports of the chief cereals. It is not because Hungarian wheat has deteriorated in quality, for it still holds a high place in the estimation of millers everywhere; but it would seem that it cannot compete in price with the product of the prairies of North and South America. The ordinary area under the premier cereal in Hungary is 7,500,000 acres, in Austria 2,500,000 acres, and in Croatia-Slavonia 600,000 acres; the yield per acre in Hungary averaging 17 bushels, in Austria 16, and in Croatia-Slavonia 15 bushels. The annual consumption of wheaten bread stuffs in the empire amounts roundly to 24,000,000 qrs., or 4½ bushels per caput. The chief customers for the small quantities of wheat now exported are Germany, Switzerland, and Italy; but the United Kingdom is the best customer for flour, followed at a great interval by Germany and France. The bulk of the barley exports goes to Germany. The chief ports of shipment are Fiume for Hungarian produce, and Trieste for Austrian. The imports into Austria-Hungary chiefly come from Russia, Rumania, and Servia, mainly by way of the Danube. It should be noted that for many years a large trade was carried on in manufacturing imported wheat in bond into flour, and exporting it to the United Kingdom, Germany, and other countries; but at the end of June 1900 the trade was abolished at the instance of the Austrian millers and the Hungarian agriculturists. The annual exports from bond ranged between 700,000 and 1,000,000 sacks (280 lb).

PRODUCTION (including Croatia and Slavonia).

(*From "Statistisches Jahrbuch" of Ministry of Agriculture.*)

Year.	Wheat.	Rye and Spelt.	Barley.	Oats.	Maize.	Potatoes.
	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.	Tons, 2240 lb.
1885	19,761,100	14,657,800[c]	12,885,800	18,073,100	15,625,144	11,100,000
1886	17,867,700	13,855,800	11,038,300	20,318,900	12,558,500	10,200,000
1887	24,018,000	17,290,900	13,820,000	20,180,300	10,862,600	10,700,000
1888[a]	22,739,300	15,036,500	12,412,400	19,592,900	13,563,700	10,500,000
1889	15,978,739	13,087,499	9,728,100	15,091,400	14,399,300	11,600,000
1890	23,269,300	15,907,200	13,005,600	19,080,590	13,220,100	10,100,000
1891	21,848,422	13,023,732	13,331,000	21,121,050	19,998,800	8,300,000
1892	24,278,000	16,153,200	14,051,600	22,249,800	18,321,300	12,300,000
1893	25,475,700	16,809,200	14,107,200	19,519,700	20,026,900	11,700,000
1894	24,085,700	17,374,700	14,479,900	22,420,600	11,427,500	12,500,000
1895	25,250,400	13,813,300	13,804,900	22,635,900	21,673,600	16,600,000
1896	24,660,100	15,576,200	14,013,250	21,679,760	19,863,500	16,200,000
1897	15,229,200	12,575,500	11,288,600	18,514,900	15,887,900	11,000,000
1898	23,400,000	15,500,000	14,900,000	23,000,000	19,100,000	15,400,000
1899[b]	23,600,000	14,900,000	13,500,000	22,900,000	12,250,000	14,400,000
1900[b]	24,200,000	12,700,000	14,400,000	21,370,000	17,000,000	..
1901[b]	22,100,000	16,500,000	12,500,000	20,600,000	18,100,000	..

[a] Excluding Croatia and Slavonia.
[b] Commercial estimate.
[c] Excluding spelt in Austria.

The following statement will show how the export trade has declined since the years 1887–90, the trade in barley alone showing any vitality:—

EXPORTS.

(*From "Statistik des auswärtigen Handels des österreichisch ungarischen Zollgebiets."*)

Year.	Wheat.	Rye.	Barley.	Oats.	Maize.	Flour.
	Qrs. 480.	Qrs. 480.	Qrs. 400.	Qrs. 304.	Qrs. 480.	Sks. 280.
1885	732,500	33,200	1,816,100	612,600	89,400	1,180,800
1886	962,600	6,500	1,316,000	451,500	115,600	1,145,000
1887	1,072,600	5,100	2,120,200	286,500	33,500	1,010,500
1888	1,902,300	26,100	2,365,000	253,800	80,500	1,622,800
1889	1,175,700	15,600	1,774,600	219,300	223,800	1,387,600
1890	1,088,000	15,100	2,101,800	70,300	61,500	1,074,800
1891	711,000	171,200	1,831,600	256,500	381,000	782,500
1892	344,700	142,200	1,788,000	782,000	494,500	357,200
1893	350,000	3,200	2,824,000	663,300	155,000	329,200
1894	297,000	1,500	2,303,400	79,100	50,800	206,600
1895	311,700	2,000	1,474,200	18,100	20,500	89,500
1896	258,000	800	2,357,300	9,400	103,800	86,700
1897	129,400	400	1,974,800	11,000	86,500	82,500
1898	13,300	1,800	1,829,500	66,700	13,900	27,300
1899	3,293	2,921	2,278,386	455,532	15,947	864,500
1900	37,500	1,700	1,651,900	241,100	9,800	369,400
1901	97,600	1,100	1,787,900	27,100	59,700	664,500

N.B.—In addition to the above specified exports, the dual empire sends away annually about 400,000 quarters of beans, and formerly sent away 700,000 to 1,000,000 sacks of flour manufactured in bond. Since the year 1897, when there was a crop failure throughout the empire, the tide has turned, and large quantities of wheat, rye, and maize are being imported.

IMPORTS.

(*From "Statistik des auswärtigen Handels des österreichisch-ungarischen Zollgebiets."*)

Year.	Wheat.	Rye.	Barley.	Oats.	Maize.	Flour.
	Qrs. 480.	Qrs. 480.	Qrs. 400.	Qrs. 304.	Qrs. 480.	Sks. 280.
1885	634,400	405,500	257,200	360,700	1,347,000	12,000
1886	104,000	348,000	96,200	124,000	483,600	17,700
1887	36,100	318,600	53,300	141,500	385,000	5,900
1888	5,200	12,100	21,100	82,200	257,700	500
1889	8,200	16,800	31,800	182,000	216,600	300
1890	19,700	77,300	71,800	255,200	444,300	400
1891	43,800	10,200	35,200	183,200	233,300	1,000
1892	60,000	33,300	25,300	104,000	249,700	800
1893	95,100	31,500	132,400	350,800	344,000	1,300
1894	128,000	15,300	440,700	1,012,400	1,028,700	2,900
1895	86,300	127,000	194,000	495,000	986,300	6,600
1896	61,000	234,700	53,200	472,000	555,400	6.000
1897	585,400	803,300	241,500	449,600	1,062,000	21,500
1898	876,000	1,034,100	261,600	167,100	3,035,700	26,600
1899	337,530	94,487	57,618	64,256	712,770	8,200
1900	165,000	34,700	120,300	48,800	839,000	3,200
1901	144,500	169,500	116,800	306,300	1,007,100	3,200

The average result of the trading for the three years ending 1899 is shown as follows:—

IMPORTS.

Wheat. Qrs.	Rye Qrs.	Barley. Qrs.	Oats. Qrs.	Maize. Qrs.	Flour. Sacks.
600,000	670,000	186,000	226,000	1,603,000	17,000

EXPORTS.

Qrs.	Qrs.	Qrs.	Qrs.	Qrs.	Sacks.
50,000	1,000	2,000,000	180,000	40,000	324,000

As the provinces of Bosnia and Herzegovina are under the dominion of Austria, we include their agricultural statistics in this section.

PRODUCTION

(*From "Die Landwirthschaft in Bosnien und Herzegovina."*)

Year.	Wheat.	Rye.	Barley.	Oats.	Maize.	Spelt.
	Qrs. 480.	Qrs. 480.	Qrs. 400.	Qrs. 304.	Qrs. 480.	Qrs. 480.
1890	370,400	68,900	430,000	290,300	1,075,300	78,100
1891	325,500	47,400	396,900	304,700	1,120,700	68,800
1892	441,200	54,200	430,000	279,200	1,235,700	79,000
1893	303,100	49,300	435,500	254,000	1,263,200	64,000
1894	359,000	47,600	452,000	377,300	877,100	55,000
1895	326,000	46,500	398,900	268,400	1,186,600	46,400
1896	303,100	45,900	436,000	276,500	1,272,400	45,900
1897	183,700	37,000	343,000	312,000	960,100	23,000
1898	293,500	45,900	441,000	440,000	1,378,000	36,000
1899	250,000	..	..	..	..	..
1900	300,000	..	..	..	..	..

Canada (population officially estimated in 1900 at 5,522,500).—The progress of agriculture in the Dominion seems slow in comparison with that of the United States, for there are many single states in the Union which alone

produce a far greater crop than all the provinces of the Dominion combined. The climate and soil are not to be blamed for this state of things, for in many parts of Canada they are magnificent; the real cause being the lack of immigrants of the class which will endure the drudgery of raising crops of wheat and maize in a new and sparsely settled country. Such agricultural progress as is being made seems solid and safe, the cultivation is more careful, thorough, and scientific, with the result that the average product of an acre of land in Canada is at least 25 per cent. higher than in the States. The chief agricultural districts are Ontario and Manitoba. In the former the average yield of winter wheat is 20 bushels; of spring wheat 16 bushels, barley 26 bushels, oats 35 bushels. In Manitoba the average yield is 18 bushels of spring wheat, 30 bushels of barley, and 35 bushels of oats. The average per caput consumption of wheat in the Dominion on the data for 1897–1900 apparently reached 7 bushels, or a mean between the French and English rate.

Crop of 1901.

	Ontario.	Manitoba.	North-West.	Nova Scotia.
	Bushels	Bushels.	Bushels.	Bushels.
Crop.	21,500,000	50,500,000	12,500,000	180,000

The harvest of spring wheat in Canada in 1900 was very deficient, owing to a severe spring drought. The crop of wheat raised in 1901 creates a record.

The following tabular statement gives the production during a number of years :—

Production.

(*From the Statistical Year-Book.*)

Year.	Wheat.	Rye.	Barley.	Oats.	Pease.
	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.
1885	2,069,900	159,000	2,206,000	7,700,000	1,751,000
1886	1,926,500	138,000	2,602,000	7,840,000	2,005,000
1887	4,053,000	112,000	2,382,000	7,139,000	1,522,000
1888	2,535,000	162,000	2,920,000	8,183,000	1,783,000
1889	3,240,000	180,000	3,054,000	8,470,000	1,688,000
1890	4,452,000	195,000	2,208,000	7,785,000	1,923,000
1891	6,972,000	142,000	2,420,000	11,222,000	2,300,000
1892	5,404,600	141,600	1,888,200	9,551,500	1,811,800
1893	4,668,400	124,300	1,544,200	8,551,100	1,771,100
1894	4,631,600	173,300	1,745,300	10,260,000	1,752,900
1895	6,175,400	237,500	2,216,900	13,406,700	1,946,000
1896	4,121,200	278,900	1,980,200	11,935,300	2,186,600
1897	5,889,800	422,700	1,900,700	12,118,500	1,733,400
1898	7,986,900	334,200	2,206,000	14,387,600	1,690,200
1899	7,070,000	260,000	2,600,000	14,800,000	1,890,000
1900	4,800,000	298,000	2,510,000	13,100,000	1,710,000
1901	10,500,000	400,000	3,000,000	14,600,000	..

From 1885 to 1897 inclusive the production of provinces of Ontario and Manitoba only is given.

For a long period Canada has been a shipper of grain to the mother country, the product of the wheat fields of the North-West being held in high estimation by millers. Pease also are shipped in large quantities. The following tabular statement shows the progress of trade between 1885 and 1899 :—

Exportation (Domestic Produce).

(*From Statistical Year-Book.*)

Year ended June 30.	Wheat.	Rye.	Barley.	Oats.	Pease.	Wheat Flour.
	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.	Sacks, 280 ℔.
1885	292,600	35,900	1,133,400	294,900	337,300	86,800
1886	427,400	21,300	1,069,300	518,700	402,400	270,200
1887	704,000	15,500	1,182,100	256,000	497,000	364,000
1888	270,400	..	1,171,300	70,800	270,500	245,000
1889	61,300	..	1,243,500	42,100	247,800	91,700
1890	52,800	54,400	1,247,000	94,700	341,000	80,500
1891	263,500	42,500	611,500	32,600	344,300	207,900
1892	1,089,300	27,700	650,300	76,800	580,000	266,700
1893	1,159,000	7,400	255,100	909,200	426,800	287,000
1894	1,160,000	7,900	74,700	352,300	422,300	300,000
1895	1,103,200	7,800	213,500	115,800	282,400	156,000
1896	1,239,900	..	105,100	121,000	219,600	130,700
1897	982,000	27,100	228,900	818,400	501,000	295,000
1898	2,370,400	142,400	55,500	1,234,500	404,500	874,300
1899	1,290,000	40,000	30,000	1,289,000	347,000	554,000
1900	2,100,000	60,000	260,000	86,000	360,000	538,000

Canadian produce during the winter is shipped from American ports, and American produce during the summer is shipped through Montreal, so that the trade statistics of the two countries are rather mixed up.

Importation for Home Consumption.

(*From Statistical Year-Book.*)

Year ended June 30.	Wheat.	Flour.	Barley.	Indian Corn.	All other Grain.	Other Bread-stuffs.
	Qrs. 8 bushels.	Sacks 280 ℔.	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.	℔.
1885	46,600	378,000	1800	187,300	33,700	62,387,360
1886	8,300	140,900	1000	228,200	13,700	51,121,881
1887	2,800	118,700	600	253,600	4,600	58,374,378
1888	1,500	43,800	900	289,000	15,100	53,641,884
1889	1,900	181,300	900	361,900	23,300	61,040,815
1890	23,600	119,000	1600	405,300	46,200	81,499,100
1891	18,400	40,200	.	348,600	12,300	55,030,624
1892	8,300	25,600	200	210,700	2,600	47,502,608
1893	1,100	24,200	300	253,900	8,700	46,646,257
1894	7,600	22,800	400	201,400	24,800	39,313,689
1895	62,500	33,500	1300	185,700	29,900	48,625,402
1896	17,800	29,000	6400	345,500	27,600	48,606,983
1897	10,400	18,500	1600	220,400	10,600	[illegible]0,931,785
1898	7,300	24,900	1100	25,600	14,100	57,498,956
1899	4,000	40,350	500	82,000	..	..
1900	3,500	35,000	..	60,000	..	.

Corn imported free for ensilage not included in 1890–96.

Note.—Flour computed at $4\frac{1}{2}$ bushels of grain to the barrel 1873 to 1897, and 4 bushels and 35 ℔ in 1898.

British India (including the native states: population, 295,252,700; census 1901).—This great dependency, with an area less than half the size of the United States, raises a wheat crop of about 30,000,000 qrs.—of which 10 per cent. is available for exportation to Europe, the remaining 27,000,000 qrs. being consumed, it is estimated, by the 60,000,000 wheat-eating population, at the rate of about $3\frac{1}{2}$ bushels per head. Once in every five years since 1885 the crop has proved a failure, more or less complete. The Central Provinces and Sind usually suffer most severely in this respect. The exportation of wheat on a wholesale scale commenced in the year 1873, and by the year 1877 the shipments had assumed material proportions, being returned as 1,500,000 qrs. During the famine of 1878–79 they fell away again, but in the year 1881 they reached the big total of 4,600,000 qrs., and were the means of breaking the level of prices in Europe to the extent of something like 10s. per quarter between the years 1882 and 1884, the old minimum price of 45s. giving place to one of 35s. In 1891 India's exports reached the high-water mark, for not less than 7,000,000 qrs. were shipped to Europe to help fill the gap caused by crop failures in France and Russia. Since that time India has played a less important part in the international grain trade; but once more, namely in 1898, the year of the Leiter corner and of France's big requirements, India came opportunely to the rescue and shipped 4,500,000 qrs., the bulk of it in a surprisingly short space of time.

The following shows the normal area, product, and yield per acre of each of the chief provinces :—

	Average five years 1895–99.		Yield per acre in bushels 60 ℔.
	Area in acres.	Product in tons.	
Punjab	7,540,000	2,163,908	10·7
North-West Prov. and Oudh	4,332,252	1,418,972	12·2
Bengal	1,513,500	476,400	11·7
Central Province . . .	2,846,187	461,492	6·0
Bombay	2,175,523	575,521	9·8
Sind	503,160	148,311	11·0
Berar	669,864	52,735	2·9
Nizam's Territory . .	1,491,683	93,829	2·3
Rajputana	1,400,722	331,775	8·8
Central India . . .	1,853,789	316,517	6·3
Mysore	4,556	353	2·8
Average	24,331,236	6,039,813	9·3

Before the failure of 1899–1900 there had been a constant growth of the area under wheat in the Punjab, the average acreage of the previous five years being 7,540,000, as compared with 7,100,000 acres, the area of the decade 1890–99, and it is probable that a further growth may occur in these parts. On the other hand, it would seem as if wheat-growing were doomed in the Central Provinces, for failure after failure has happened, until we find the acreage for 1898 and 1899 only averaged 2,000,000 in comparison with a mean of 2,800,000 for the five years 1895–99, and 3,400,000 the mean of the ten years 1890–99. In Central India the situation is as bad, for the acreage of 1898 and 1899 only averaged about 1,000,000 compared with 1,850,000, the mean of the preceding five years. The most fertile land is to be found in the north-west parts of Bengal, Punjab, Sind, and Bombay, but the average yield even in these tracts only amounts to about 11 bushels per acre.

The port of Kurrachee (Karachi) is now far and away the most important wheat port of India, having wrested the palm from Bombay, which about 1880 wrested it from Calcutta, where the trade originated. The produce of the fields of Bengal, and largely of the North-West Provinces and Oudh, reaches the port of Calcutta for shipment by sea. The port of Bombay gets all the produce of the Presidency of Bombay, the Central Provinces, Berar, Rajputana, and Central India, with a share of that from the North-West Provinces and Oudh, and the Punjab. Kurrachee gets the produce of Sind and the bulk of the Punjab surplus. In the record season of 1891–92 the three ports shipped the quantities placed against their names—Bombay, 3,380,000 qrs.; Kurrachee, 2,437,000 qrs; Calcutta, 1,184,000 qrs. In addition to wheat, India ships about 30,000,000 cwt. of rice or paddy per annum, 15,000,000 cwt. of oil-seeds, and 2,000,000 cwt. of pulse, &c.

The sowing season in the Punjab may extend from September to late in January; in the North-West Provinces, Oudh, Bengal, Central Provinces, Berar, and Rajputana from September to December; in the Nizam's Territory from September to November; and in Bombay and Sind from October to December. The harvest usually takes place in the month of March, excepting in the Punjab and parts of the North-West, where it falls six or eight weeks later.

PRODUCTION (WHEAT).

(*From the Reports of the Revenue and Agriculture Department of the Government of India.*)

(Harvested March/April.)

Year.	Qrs 480.	Year.	Qrs 480.	Year.	Qrs. 480.
1885	35,900,000	1890	28,778,000	1895[d]	29,516,000
1886	36,100,000	1891[a]	32,317,000	1896	25,897,000
1887	29,800,000	1892	26,014,000	1897	22,992,400
1888	33,100,000	1893[b]	33,807,000	1898	31,424,000
1889	29,901,000	1894[c]	31,823,000	1899	29,793,000
				1900	22,983,000

[a] Believed to have been under-estimated by 2,000,000 qrs.
[b] Believed to have been over-estimated by 4,000,000 qrs.
[c] Believed to have been over-estimated by 3,000,000 qrs.
[d] Subsequently amended to 32,070,000 qrs.

Of rice India produces about 500,000,000 cwt., and of oil-seeds about 40,000,000 cwt.

In the following tabular statement will be found the annual exports of India of grain by sea between 1885 and 1901, the exports by land being inconsiderable :—

EXPORTS BY SEA.

(*From the Statistical Abstract.*)

Fiscal year (April to March).	Wheat.	Rice and Paddy.	Grain and Pulse, other than Wheat or Rice.	Oil Seeds.	Flour.
	Qrs. 480	Cwt.	Cwt.	Cwt.	Sks 280.
1885–86	4,916,079	28,222,000	1,068,334	17,319,000	67,425
1886–87	5,194,840	26,879,000	1,762,226	15,906,000	127,655
1887–88	3,158,904	28,533,000	2,463,645	16,081,000	128,865
1888–89	4,109,014	23,144,000	1,605,512	15,572,000	129,608
1889–90	3,219,818	27,098,000	1,673,718	15,798,000	173,471
1890–91	3,341,443	34,963,000	1,777,900	14,800,000	167,985
1891–92	7,070,798	33,166,000	2,825,838	19,165,000	217,956
1892–93	3,493,805	27,938,000	1,910,051	16,510,000	206,929
1893–94	2,836,596	24,747,000	2,139,900	24,238,000	244,448
1894–95	1,610,879	34,301,000	2,020,100	20,890,000	235,304
1895–96	2,334,010	35,161,000	2,426,000	13,674,000	264,691
1896–97	445,795	28,270,000	1,634,000	11,397,000	239,916
1897–98	558,271	26,730,000	1,244,800	12,553,000	202,113
1898–99	4,555,537	37,930,000	3,275,000	19,280,000	273,064
1899–1900	2,263,500	32,271,393	2,138,300	15,876,237	211,500
1900–1901	12,000	31,342,000	925,551	10,997,000	199,500

The export of wheat during the season 1900–1 was practically nil.

As would be expected, India imports only trifling quantities of agricultural products; even during famines the quantities do not amount to anything material. In the year 1877, 101,000 qrs of wheat was entered, and in 1896, 140,000 qrs. of the same cereal was imported, some of which was re-exported in the succeeding season.

Australian Commonwealth, and *New Zealand* (population 4,513,399, estimated 1900).—That wheat raising should be successfully carried on in a country where the average return is so low as in the two chief states, South Australia and Victoria, where the average value per acre is valued at from 8s. to 13s. 6d., compared with 40s. in America and £6 or £7 in England (the straw being included in the latter case), is wonderful. A total area under wheat of 5,884,116 in 1899 giving a total yield of 48,580,000 bushels or 6,070,000 qrs. is from a British standpoint a very poor return for labour and capital, although the season was a highly satisfactory one. The average yield per acre works out at rather over 8 bushels per acre, ranging from under 5 bushels in South Australia to 32 bushels in New Zealand. The following shows the area, product, and average yield per acre for the year 1899, the crops being sown in June and reaped in November and December in the Australian Commonwealth, and about two months later in New Zealand.

	Acreage	Production (bushels).	Yield per acre (bushels)
New South Wales . .	1,426,166	13,604,166	9·5
Victoria	2,165,693	15,237,948	7·03
Queensland	52,527	641,314	12·2
South Australia . . .	1,821,137	8,453,135	4·6
West Australia . . .	84,516	987,329	11·6
Tasmania	64,328	1,101,303	17·1
New Zealand . . .	269,749	8,581,898	31·8
Total	5,884,116	48,607,093	8·3[a]

[a] Average.

The indicated per caput consumption of the whole of Australasia works out at about 6½ bushels for all purposes. The averages for 1890–99 were:—Wheat crop, 4,600,000 qrs.; exports, 1,550,000 qrs.; wheat and flour imports, 250,000 qrs.; net quantities consumed or seeded in the colonies 3,300,000 qrs., or 6½ bushels per head, of which one bushel is used for seeding, and the balance for human food.

AUSTRALIA AND NEW ZEALAND: PRODUCTION

(*From Colonial Blue-Books.*)

Year (crop harvested December)	Wheat.	Rye.	Barley.	Oats.	Maize.	Potatoes.
	Qrs. 480	Qrs. 480.	Qrs. 400.	Qrs. 304.	Qrs. 8 bush.	Tons
1885	2,937,825[a]	22,000	292,500	1,760,325	900,050	396,000
1886	4,139,175[a]	22,600	269,400	2,230,550	855,500	456,600
1887	5,794,700[a]	28,900	228,100	1,948,100	1,021,820	475,300
1888	3,860,600[a]	37,300	322,900	1,830,050	1,110,820	399,700
1889	5,300,000	33,400	387,200	2,282,200	1,052,050	475,600
1890	4,100,000	44,600	355,600	2,066,200	1,197,820	547,700
1891	4,490,000	71,700	325,000	2,149,200	1,833,960	542,900
1892	5,100,000	57,700	238,400	2,954,400	1,143,200	401,600
1893	5,200,000	46,600	248,011	2,312,544	1,282,197	474,610
1894	3,930,000	22,500	308,622	2,089,221	1,212,817	541,524
1895	3,160,000	36,800	361,753	2,401,076	1,282,975	482,017
1896	3,373,000	44,000	232,871	2,520,000	1,282,659	497,733
1897	4,240,000	71,800	241,360	2,068,383	1,436,028	388,493
1898	6,778,000	66,500	417,000	3,128,000	1,235,630	646,000
1899	5,410,000	73,300	460,000	3,065,000	1,450,000	629,275
1900	6,536,000	.	353,500	3,877,500	1,212 170	489,576
1901	6,200,000	.	.	..		.

[a] Partly estimated.

Australia and New Zealand: Exports.

(From Colonial Blue-Books.)

Year.	Wheat.	Rye.	Barley.	Oats.	Maize.	Potatoes.
	Qrs. 480.	Qrs. 480.	Qrs. 400.	Qrs. 304.	Qrs. 8 bush.	Tons.
1885	1,582,065	73,104	30,732	382,232	626,622	288,544
1886	323,562	61,632	28,748	286,422	470,606	279,347
1887	603,732	170,547	27,263	438,396	657,583	338,364
1888	1,716,941	156,230	22,230	361,573	587,002	365,126
1889	537,890	156,171	68,936	395,187	519,277	223,717
1890	1,634,003	200,405	33,717	411,594	514,931	325,201
1891	1,581,411	107,338	17,839	530,351	474,033	384,310
1892	965,370	37,713	13,492	531,205	476,612	238,361
1893	1,485,749	20,499	10,937	318,792	340,439	309,004
1894	1,514,069	14,964	6,061	294,611	426,094	336,721
1895	875,404	22,004	9,922	357,645	514,954	215,582
1896	205,109	184,223	15,647	336,698	465,527	35,202
1897	286,532	276,025	8,340	262,110	200,056	23,272
1898	413,514	136,634	3,477	224,544	249,007	150,513
1899	1,890,000	..	..	..	..	..
1900	[a] 1,500,000	..	..	..	..	..

[a] Approximate.

Australia and New Zealand: Imports.

Year.	Wheat.	Rye.	Barley.	Oats.	Flour.	Potatoes.
	Qrs. 480.	Qrs. 480.	Qrs. 400.	Qrs. 304.	Sacks.	Tons.
1885	103,473	10	17,800	290,708	725,917	76,841
1886	202,103	..	21,384	248,655	809,906	79,394
1887	94,192	6	38,025	360,587	948,042	68,459
1888	235,610	.	51,400	334,771	568,235	68,141
1889	398,445	..	75,752	402,668	891,265	77,105
1890	125,681	.	9,996	292,170	810,488	66,322
1891	190,584	..	12,010	248,493	809,960	69,100
1892	207,102	..	15,559	225,936	737,899	70,092
1893	166,501	..	11,923	199,063	534,362	49,071
1894	150,890	40	9,269	150,678	609,142	47,068
1895	168,179	50	5,103	212,122	407,628	67,570
1896	536,972	2	15,213	298,663	715,288	80,335
1897	480,086	..	32,014	126,172	507,184	76,410
1898	232,991		60,545	131,066	287,619	42,635
1899	[a] 200,000	.	.	.	..	..

[a] Partly estimated.

The two foregoing tables include inter-colonial exchanges.

New South Wales: Production.

(From Victorian Year-Book.)

Year.	Wheat.	Barley.	Oats.	Maize.	Potatoes.
	Qrs. of 8 meas. bush.	Qrs. of 8 meas. bush.	Qrs. of 8 meas. bush.	Qrs. of 8 meas. bush.	Tons, 2240.
1885	341,600	10,700	34,900	542,000	38,700
1886	733,600	16,600	75,100	478,100	45,800
1887	586,900	10,500	49,300	619,100	61,500
1888	181,300	4,600	13,700	613,800	36,800
1889	821,300	14,100	67,900	669,300	50,100
1890	456,100	10,100	32,100	714,100	52,800
1891	495,400	11,600	34,500	715,200	61,300
1892	852,100	11,400	58,300	629,600	52,100
1893	812,839	14,284	87,725	883,447	83,838
1894	880,172	22,418	70,340	703,191	86,170
1895	649,414	12,014	46,774	710,878	56,179
1896	1,106,680	13,792	104,329	719,277	84,214
1897	1,320,013	12,438	67,993	839,132	55,332
1898	1,160,700	8,010	34,000	758,000	61,900
1899	1,100,000	16,500	78,000	747,000	81,300
1900	1,700,000	14,000	70,000	767,000	64,337

New South Wales: Exports.

(From New South Wales Statistical Register.)

Year.	Wheat.	Flour.	Barley.	Oats.	Maize.	Potatoes.
	Qrs. of 8 bush.	Sacks, 280.	Qrs. of 8 bush.	Qrs. of 8 bush.	Qrs. of 8 bush.	Tons.
1885	5,900	73,104	1000	17,400	49,940	7,100
1886	15,000	61,432	700	8,200	24,624	6,200
1887	16,900	169,640	4600	16,300	42,150	9,100
1888	18,700	153,648	9100	19,200	42,761	6,600
1889	17,200	144,496	3700	22,900	45,757	9,900
1890	27,400	164,400	300	5,500	3,851	10,700
1891	40,200	101,896	200	3,900	2,203	5,600
1892	1,000	25,512	80	5,700	2,415	3,700
1893	1,800	14,272	400	6,500	1,533	3,600
1894	750	13,216	250	3,500	1,466	2,900
1895	198	15,224	676	537	5,255	551
1896	40,583	182,416	547	1,617	6,450	1,746
1897	157,518	273,088	657	4,953	11,635	3,620
1898	157,523	124,547	34	918	21,391	7,506

New South Wales: Imports.

(Same authority as Exports.)

Year.	Wheat.	Flour.	Barley.	Oats.	Maize.	Potatoes.
	Qrs. of 8 bush.	Sacks, 280.	Qrs. 400.	Qrs. of 8 bush.	Qrs. 480.	Tons.
1885	68,177	427,360	5,500	192,708	14,500	59,848
1886	138,134	491,936	7,600	145,285	11,800	62,923
1887	34,763	547,368	8,500	190,552	34,000	54,140
1888	192,321	527,112	17,700	152,671	19,000	52,239
1889	354,106	526,144	16,600	133,203	29,700	58,933
1890	44,060	441,856	6,000	187,953	70,400	50,200
1891	112,509	511,928	7,700	183,843	36,300	56,678
1892	116,425	390,456	4,300	171,222	40,600	58,316
1893	58,973	214,512	7,700	165,281	20,800	36,181
1894	32,068	265,064	4,500	89,357	7,200	33,346
1895	44,894	154,224	1,479	102,005	311	50,175
1896	312,809	450,328	7,925	123,610	13,877	52,779
1897	113,741	447,952	9,726	103,662	42,455	59,075
1898	65,470	146,691	12,092	114,432	28,232	32,344

Victoria: Production.

(From Statistical Abstract of Victoria.)

Years.	Wheat.	Maize.	Barley.	Oats.	Potatoes	Rye.
	Qrs. of 8 meas. bush.	Qrs. of 8 meas. bush.	Qrs. of 8 meas. bush.	Qrs. of 8 meas. bush.	Tons, 2240.	Qrs. of 8 meas. bush.
1884–85	1,304,100	22,000	135,300	549,000	161,100	1900
1885–86	1,146,300	22,000	162,800	585,200	163,200	1000
1886–87	1,312,500	28,900	103,400	532,000	170,700	1400
1887–88	1,666,100	37,300	119,500	570,300	198,200	1800
1888–89	1,081,000	33,400	141,400	350,400	131,100	1300
1889–90	1,437,000	44,600	203,900	705,600	157,100	2100
1890–91	1,593,900	71,700	196,400	614,900	204,200	2200
1891–92	1,710,000	57,700	105,500	556,900	200,500	1000
1892–93	1,851,800	46,600	96,700	571,800	142,600	..
1893–94	1,906,900	22,500	129,200	618,900	144,700	..
1894–95	1,430,700	36,800	190,600	704,200	196,700	..
1895–96	708,500	44,000	89,500	360,000	117,200	..
1896–97	861,400	70,800	102,000	852,100	146,000	1600
1897–98	1,322,500	64,400	94,800	601,200	67,300	2070
1898–99	2,447,000	73,300	139,000	690,000	161,142	3800
1899–1900	1,905,000	78,000	183,000	764,000	173,000	..
1900–1901	2.230,000	75,000	152.000	1.197,000	123,000	..

Victoria: Exports.

(Same authority as Production.)

Year.	Wheat.	Rye.	Barley.	Oats.	Maize.	Flour.
	Qrs. 480.	Qrs. 480.	Qrs. 400	Qrs. 304.	Qrs. 480.	Sacks, 280.
1885	272,083	..	1300	9,207	3,200	267,400
1886	101,031	.	2000	7,190	100	265,160
1887	263,600	.	1400	9,759	4,500	313,176
1888	330,900		1200	5,500	1,400	341,888
1889	50,900	..	1500	2,000	60	192,208
1890	75,200	..	800	4,500	500	255,621
1891	593,100	.	7000	7,400	600	343,100
1892	462,400	20	7700	12,400	11,800	205,700
1893	578,800	..	5300	44,000	13,800	299,600
1894	696,700	..	3000	30,000	600	331,920
1895	432,500	..	3700	54,400	5,400	211,008
1896	50,300	..	6300	10,700	300	29,568
1897	117,800	.	3100	37,000	1,100	11,800
1898	226,400	400	3000	80,400	23,000	109,500

From the years 1877–90 inclusive, and from the years 1894–97 inclusive for flour; biscuits are included.

Victoria: Imports.

(Same authority as Production.)

Year.	Wheat.	Maize.	Barley.	Oats.	Flour.
	Qrs. 480.	Qrs. 480.	Qrs. 400.	Qrs. 304.	Sks. 280.
1885	2,200	4,100	12,100	91,200	9,785
1886	17,745	11,100	6,400	68,000	3,310
1887	12,100	4,500	25,800	120,400	13,030
1888	15,000	7,200	20,200	153,000	10,478
1889	27,200	23,200	55,100	248,000	4,497
1890	17,100	1,500	80	71,000	8,960
1891	38,800	1,000	100	38,000	11,100
1892	24,200	250	75	15,000	11,600
1893	30,800	25	350	600	7,600
1894	49,900	70	3,200	1,500	9,892
1895	50,000	20	1,700	3,500	14,892
1896	49,700	500	11,000	43,000	14,808
1897	118,000	3,400	10,600	12,000	10,163
1898	83,300	20	2,600	1,000	14,600

Queensland: Production.

(From Victorian Year-Book.)

Year.	Wheat.	Barley.	Oats.	Maize.	Potatoes.
	Qrs. of 8 meas. bush.	Qrs. of 8 meas. bush.	Qrs. of 8 meas. bush.	Qrs. of 8 meas. bush.	Tons 2240.
1885	6,400	1,200	125	196,700	19,000
1886	2,600	2,300	150	213,700	27,000
1887	22,800	3,900	1,600	203,900	30,700
1888	1,000	900	450	272,700	20,700
1889	16,800	3,300	1,800	217,800	25,900
1890	25,900	1,500	1,100	296,700	28,800
1891	49,000	2,600	2,100	384,700	25,000
1892	57,800	800	1,600	291,600	20,500
1893	51,636	1,049	1,511	228,013	17,165
1894	68,148	4,728	3,807	335,615	28,185
1895	15,453	969	1,360	298,922	19,027
1896	75,156	2,417	4,022	383,166	18,451
1897	126,161	6,230	3,937	350,396	18,520
1898	75,800	4,358	506	281,560	16,413
1899	76,000	14,800	1,000	246,000	22,675
1900	150,000	15,900	1,000	307,000	20,014

Queensland: Imports.

(From Statistics of the Colony.)

Year.	Wheat.	Flour.	Barley.	Oats.	Beans and Pease.	Potatoes.
	Qrs. 8 bus.	Sks. 280.	Qrs. 8 bus	Qrs. 8 bus.	Qrs. 8 bus.	Tons.
1885	1,287	270,560	...	...	...	16,993
1886	2,420	291,600	...	...	...	15,339
1887	6,637	353,616	. .	..	...	13,025
1888	2,089	319,960	...	...	...	15,902
1889	13,698	330,968	...	...	...	17,372
1890	40,810	328,976	...	...	...	15,186
1891	32,635	267,464	...	...	...	12,421
1892	33,686	290,592	...	...	...	9,697
1893	46,569	273,504	...	...	...	10,843
1894	51,966	272,032	...	...	...	10,513
1895	45,567	262,032	...	. .	...	12,454
1896	107,933	263,968	...	...	...	19,271
1897	45,052	253,600	...	...	...	15,756
1898	39,411	...	2,103	12,679	1,308	10,232

South Australia: Production.

(From the Agricultural Returns and Australian Statistics.)

Year.	Wheat.	Barley.	Oats.	Potatoes.
	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.	Tons 2240.
1885	645,125	no returns.	no returns.	no returns.
1886	1,354,375	no returns.	no returns.	no returns.
1887	2,376,500	no returns.	no returns.	no returns.
1888	773,300	no returns.	no returns.	no returns.
1889	1,822,000	30,800	16,700	23,900
1890	1,174,900	21,900	14,500	24,000
1891	804,500	13,400	10,100	27,800
1892	1,155,000	21,900	20,800	20,000
1893	1,702,257 [a]	25,697 [a]	21,575 [a]	22,958 [a]
1894	972,652 [a]	...	...	...
1895	741,162 [a]	...	...	...
1896	350,561	13,474	23,714	16,139
1897	501,856	20,258	25,555	9,308
1898	1,097,362	29,266	38,000	14,445
1899	1,056,000	23,600	27,300	19,716
1900	1,406,000	25,000	45,700	14,566

[a] Estimated.

South Australia: Exports.

(From Statistical Register of South Australia.)

Year.	Wheat.	Maize.	Barley.	Oats.	Flour.
	Qrs. 8 bush.	Qrs. 480.	Qrs. 400.	Qrs. 304.	Sks. 280.
1885	1,134,193	...	...	...	551,848
1886	51,078	200	100	3,400	414,336
1887	244,456	900	900	8,600	575,144
1888	1,078,845	500	2,000	10,100	529,232
1889	133,023	50	1,900	4,700	430,048
1890	971,975	20	200	5,600	475,952
1891	775,640	...	...	...	447,568
1892	194,074	...	...	...	426,464
1893	577,725	...,	...	...	295,704
1894	788,006	..	366	640	384,376
1895	440,880	. .	94	6,530	456,160
1896	57,006	...	289	1,180	409,680
1897	2,182	...	27	110	140,096
1898	12,130	. .	9	190	182,000

South Australia: Imports.

(From Statistical Register of South Australia.)

Year.	Wheat.	Barley.	Oats.	Maize.	Flour.
	Qrs. 480.	Qrs. 8 bush.	Qrs 304.	Qrs. 480.	Sks. 280.
1885	.	...	. .	...	.
1886	9,600	6,800	28,900	3,400	. .
1887	500	3,100	23,800	1,500	..
1888	800	7,400	14,900	700	100
1889	1,500	3,400	14,800	300	...
1890	30	3,500	20,500	100	...
1891	.		...	...	.
1892	...	...	...	...	..
1893	...	...	...	...	..
1894	...	..	...	...	...
1895	...	...	..	...	...
1896	..	.	...	...	. .
1897	...	...	...	...	..
1898	...	. .	...	...	..
1899	...	...	...	...	...

West Australia: Production.

(From Victorian Year-Book.)

Year.	Wheat.	Barley.	Oats.	Maize.	Potatoes.
	Qrs. of 8 meas. bush.	Qrs. of 8 meas. bush.	Qrs. of 8 meas. bush.	Qrs of 8 meas. bush.	Tons, 2240 ℔.
1885	42,400	11,200	2,900	250	1100
1886	36,100	10,300	3,500	500	1100
1887	33,700	8,700	3,100	220	1100
1888	40,300	9,200	5,200	220	2000
1889	62,100	11,600	5,200	150	1400
1890	58,100	11,000	4,700	120	1700
1891	36,900	6,100	2,000	60	1600
1892	53,600	7,100	3,700	100	1600
1893	65,000	5,900	6,000	70	2300
1894	21,300	1,900	2,500	200	2500
1895	23,500	2,300	2,400	75	2300
1896	30,500	1,600	2,400	60	2100
1897	51,100	2,900	3,700	600	4300
1898	108,100	3,700	7,000	170	5700
1899	120,000	7,070	9,200	280	8173
1900	97,000	3,600	10,800	170	4755

West Australia: Imports.

(From Annual Report of the Collector of Customs.)

Year.	Wheat.	Potatoes.	Barley.	Oats.	Flour (excluding Meal).	Maize and Gram.
	Qrs. of 8 meas. bush.	Tons, 2240 ℔.	Qrs. of 8 meas. bush.	Qrs. of 8 meas. bush.	Sacks, 280.	Qrs. of 8 meas. bush.
1885	...	...	..	...	13,312	...
1886	104	1132	584	5,870	11,460	1000
1887	2,986	1294	615	14,235	36,228	396
1888	...	...	..	...	36,776	...
1889	1,541	800	652	6,665	29,656	882
1890	381	936	416	12,517	22,276	520
1891	...	...	...	...	15,288	...
1892	11,584	2067	1682	28,400	38,656	962
1893	1,459	2047	953	26,982	36,896	65
1894	3,356	3209	869	56,121	58,204	593
1895	14,718	4941	1665	102,377	80,760	800
1896	22,730	8285	1486	124,813	119,108	1668
1897	26,593	...	...	. .	127,860	...
1898	36,446	...	...	. .	118,928	...
1899	...	..	...	...	..	...

Tasmania: Production.

(From Victorian Year-Book.)

Year.	Wheat.	Rye.	Barley.	Oats.	Pease.	Potatoes.
	Qrs. of 8 meas. bush.	Qrs. of 8 meas. bush.	Qrs. of 8 meas. bush.	Qrs. of 8 meas. bush.	Qrs. of 8 meas. bush.	Tons, 2240 ℔.
1885	68,000	. .	22,000	98,000	..	53,500
1886	79,000	...	7,600	70,000	...	75,800
1887	84,300	..	6,500	48,100	. .	42,500
1888	102,400	. .	13,700	118,300	...	66,700
1889	94,500	. .	13,200	131,100	...	72,300

TASMANIA: PRODUCTION (*continued*).

Year.	Wheat.	Rye.	Barley.	Oats.	Pease.	Potatoes.
	Qrs. of 8 meas. bush.	Qrs of 8 meas. bush.	Qrs. of 8 meas. bush.	Qrs. of 8 meas. bush.	Qrs. of 8 meas. bush.	Tons, 2240 lb.
1890	80,400	...	12,400	64,900	..	73,200
1891	117,200	...	8,900	109,500	...	63,000
1892	127,300	...	10,000	78,900	..	60,200
1893	104,200	...	13,800	104,800	...	76,800
1894	109,000	...	25,300	116,000	...	90,800
1895	145,600	...	17,400	113,400	..	81,500
1896	160,800	...	9,400	121,500	...	72,300
1897	208,500	1,000	8,800	137,800	17,600	49,100
1898	287,900	2,100	23,000	283,900	27,000	88,200
1899	137,600	...	17,800	143,000	...	101,670
1900	137,900	...	13,000	168,000	...	93,862

TASMANIA: EXPORTS.
(*From Statistics of the Colony of Tasmania.*)

Year.	Wheat.	Rye.	Barley.	Oats.	Flour.	Potatoes.
	Qrs. of 8 meas. bush.	Qrs. of 8 meas bush.	Qrs. of 8 meas. bush.	Qrs. of 8 meas. bush.	Sacks, 280 lb.	Tons, 2240 lb.
1885	...	...	25	3,500	8	21,634
1886	1	...	7600	27,300	64	31,546
1887	...	7	3400	5,000	400	35,789
1888	...	...	500	400	40	13,003
1889	...	...	...	33,600	...	41,390
1890	1,050	...	2300	18,600	...	33,386
1891	600	...	70	4,200	...	23,213
1892	300	25	140	30,900	. .	35,362
1893	...	12	130	22,700	. .	29,144
1894	...	...	180	15,200	.	39,520
1895	5	2	2700	42,700	.	48,068
1896	80	2	3000	38,100	200	48,276
1897	12	.	160	17,200	160	45,998
1898	16,200	3	100	39,300	11,000	22,535
1899	.	...	...	...	...	...

TASMANIA: IMPORTS.
(*Same authority as Exports.*)

Year.	Wheat.	Rye.	Barley.	Oats.	Flour.	Maize.
	Qrs. 480.	Qrs. 480.	Qrs. 400.	Qrs. 304.	Sacks, 280 lb.	Qrs. 480.
1885	31,800	10	200	6,800	4900	100
1886	34,100	..	...	600	1600	100
1887	37,200	6	10	2,600	8000	60
1888	26,800	...	6100	14,200	8600	250
1889	...	...	...	...	...	...
1890	23,300	...	5200	200	8400	60
1891	2,200	...	1800	3,800	3800	200
1892	16,800	...	900	10	6500	200
1893	5,800	...	20	100	1200	100
1894	10,900	40	100	...	3200	130
1895	5,900	50	9	140	4700	150
1896	12,200	2	2	40	1400	200
1897	2,200	. .	2400	50	5	250
1898	4	..	4100	20	...	150

NEW ZEALAND: PRODUCTION.
(*From Victorian Year-Book.*)

Year.	Wheat.	Barley.	Oats.	Maize.	Potatoes.
	Qrs. of 8 meas. bush.	Qrs. of 8 meas. bush.	Qrs. of 8 meas. bush.	Qrs. of 8 meas. bush.	Tons, 2240.
1885	530,200	112,100	1,075,400	...	113,800
1886	787,200	69,800	1,496,600	...	134,900
1887	1,178,000	95,100	1,314,000	27,900	138,100
1888	1,096,200	175,000	1,122,100	25,900	133,700
1889	1,056,100	167,800	1,709,100	33,700	159,700
1890	715,400	94,800	1,243,300	29,800	178,100
1891	1,282,100	86,000	1,376,100	29,800	162,000
1892	1,047,200	81,700	1,234,200	21,400	104,200
1893	611,461	90,581	1,519,133	28,067	126,540
1894	451,629	125,076	1,277,674	29,111	139,869
1895	855,471	129,470	1,532,942	76,400	207,011
1896	740,815	102,688	1,404,100	62,956	157,529
1897	708,752	88,734	1,217,298	81,700	180,333
1898	1,634,000	209,000	2,064,000	101,600	298,561
1899	1,070,000	198,000	2,040,000	83,000	222,124
1900	815,000	128,000	2,385,000	63,000	169,042

NEW ZEALAND: EXPORTS.
(*From Statistics of the Colony of New Zealand.*)

Year.	Wheat.	Maize.	Barley.	Oats.	Flour.	Potatoes.
	Qrs. of 8 bush.	Qrs. of 8 bush.	Qrs. of 8 bush.	Qrs. of 8 bush.	Qrs. of 6 bush.	Tons, 2240.
1885	169,889	...	28,307	352,125	...	14,036
1886	156,452	...	17,388	240,332	...	7,923
1887	78,776	...	16,963	398,737	..	15,688
1888	288,496	2,082	9,430	326,373	606	16,598
1889	336,767	11,625	61,836	331,987	2,022	21,609
1890	558,378	35,985	30,117	377,394	1,242	28,877
1891	181,871	5,427	10,469	506,551	448	35,610
1892	307,596	12,081	5,447	478,805	571	28,961
1893	327,424	6,208	5,067	243,192	258	5,804
1894	28,613	1,740	2,231	245,411	132	1,901
1895	1,821	6,698	2,746	250,408	71	4,023
1896	56,640	1,685	5,500	280,881	821	3,688
1897	9,020	2,337	4,373	200,057	1,227	7,692
1898	1,261	11,384	333	102,026	81	22,507
1899	363,000	23,000	16,000	440,000	12,000	25,396

NEW ZEALAND: IMPORTS.
(*Same authority as Exports.*)

Year.	Wheat.	Potatoes.	Barley.	Oats.	Maize.	Flour.
	Qrs. 480.	Tons, 2240.	Qrs. 400.	Qrs. 304.	Qrs. 480.	Sacks, 280.
1891	40	1	10	50	10	380
1892	7	12	2	11	4	80
1893	...	...	...	...	...	...
1894	...	...	...	...	...	...
1895	...	...	...	...	...	...
1896	...	...	...	...	...	...
1897	600	589	388	60	...	15
1898	760	59	3960	35	...	3800
1899	...	...	...	...	...	1000

Argentina (population, 4,794,149; census 1900).—This South American republic, with an area nine times that of the United Kingdom, in 1899 took second place in the international grain trade as a shipper of wheat. The wheat and linseed crops are mostly grown in the provinces of Santa Fé, Buenos Aires, Cordoba, and Entre Rios; the maize crop being raised chiefly in Buenos Aires, and moderately in Santa Fé. The wheat area now amounts to 9,000,000 acres, a growth of 3,000,000 since 1895. The area under maize is given as 2,500,000 acres, against 3,000,000 in 1895. The wheat exports commenced in 1871 with 9 tons; in 1900 they reached 8,862,300 quarters, besides 403,000 sacks of flour. Maize exports commenced in 1864 with 14 tons, and reached in 1896 a total of 7,214,000 quarters. The exportation of linseed has now reached an annual total of 200,000 tons. The area, production, and yield per acre of the chief provinces was officially estimated as follows for the year 1899:—

Wheat crop planted about June; reaped December.

PRODUCTION.

	Acres.	Bushels	Yield per Acre.
Santa Fé . .	3,991,000	45,897,000	11·5
Buenos Aires . .	1,849,000	29,581,000	16·0
Cordoba . . .	1,154,000	12,691,000	11·0
Entre Rios . .	580,000	6,612,000	11·4
Others . . .	173,000	1,903,000	11·0
	7,747 000	96,684,000	12·5

The average yield per acre for the whole country ranges from 18 bushels in a good year like 1893 to 7 bushels in a bad year like 1896, the highest yield now, as a rule, being obtained in the province of Buenos Aires off virgin soil. The average per caput consumption of wheat during the decade ending the 19th century was nearly 6 bushels for all purposes, of which about 1¼ bushel was used for seed.

The production of wheat and maize during the period 1887–1901, and of the minor crops for the year 1899, is given in the following tabular statement:—

PRODUCTION.

(From the Corn Trade Year-Book and other Sources.)

Year.	[a] Wheat.	Linseed.	[b] Maize.
	Qrs. 480.	Tons.	Qrs. 480.
1887	4,000,000	..	4,100,000
1888	3,800,000	...	3,200,000
1899	3,000,000	...	4,500,000
1890	4,100,000	...	5,500,000
1891	4,600,000	...	2,500,000
1892	6,900,000	...	4,500,000
1893	11,000,000	...	2,700,000
1894	7,500,000	...	2,000,000
1895	5,500,000	...	9,000,000
1896	3,100,000	...	10,000,000
1897	6,200,000	...	5,000,000
1898	13,600,000	200,000	7,000,000
1899	12,700,000	200,000	9,000,000
1900	9,000,000	250,000	7,000,000
1901	6,000,000		8,000,000

[a] Reaped in December. [b] Reaped in March.

The average yield per hectare of linseed is stated to be 660 kilos, of rye 790, of barley 860 kilos.

Previous to 1899 there were no statistics of the production of rye, barley, and linseed, but in that year the quantities raised were respectively 5000 qrs. (of 480 ℔), 30,000 qrs. (of 400 ℔), and 200,000 tons.

EXPORTS.

(From "Anuario de la direccion general de Estadistica, Buenos Aires.")

Year	Wheat.	Rye.	Barley.	Linseed.	Maize.	Flour.
	Qrs. 480.	Qrs. 480.	Qrs. 400.	Tons, 2240 ℔.	Qrs. 480.	Sks. 280.
1885	360,500	...	11,600	...	909,000	58,600
1886	174,000	...	4,800	...	1,064,200	41,400
1887	1,092,600	...	4,600	81,200	1,662,100	42,600
1888	822,000	...	1,300	40,223	744,300	50,300
1889	104,700	...	1,300	28,200	1,987,000	26,500
1890	1,506,100	...	7,200	30,700	3,249,000	94,700
1891	1,817,000	...	700	12,000	302,800	55,200
1892	2,159,500	...	5,500	43,000	2,050,000	148,400
1893	4,630,300	6,800	6,200	72,100	388,200	298,600
1894	7,387,000	13,700	3,700	104,000	252,100	321,000
1895	4,640,000	13,300	49,600	276,000	3,547,700	424,700
1896	2,402,400	2,400	20,000	229,000	7,214,000	407,300
1897	467,800	100	2,800	164,100	1,722,300	326,300
1898	2,963,500	...	2,400	158,000	3,293,800	251,300
1899	7,880,000	...	...	220,000	5,130,000	470,000
1900	8,862,300	...	...	227,000	3,276,000	403,000
[a]1901	4,500,000	...	...	370,000	5,242,000	579,000

[a] Cereal year.

The imports of agricultural products are insignificant, but in the year 1897, owing to the crop failure, and for the sake of getting some new seed, a few cargoes of American and Russian grain were imported, amounting in all to 66,000 quarters.

The chief customers for Argentina's wheat are the United Kingdom, Belgium, France, and Germany; the last country getting its supply through Hamburg, Rotterdam, and Antwerp. Brazil takes annually about 300,000 qrs. of wheat, 250,000 sacks of flour, and 200,000 qrs. of maize. Uruguay and Paraguay also take certain quantities when their own crops are bad. A great deal is described in the official returns as shipped to Portugal, but this means simply that it is shipped to St Vincent for orders, as it is to Las Palmas and Falmouth. The chief wheat ports are Rosario, Buenos Aires, and Bahia Blanca. Maize is shipped chiefly from Buenos Aires and La Plata.

Uruguay (population, 930,680; census 1900).—In the early 'nineties it seemed as if this republic were going to join Argentina in supplying Europe with wheat, but the export proved to be a mere flash in the pan, and after raising 1,100,000 qrs. in 1894–95, the production fell off. In September 1900 at Montevideo there was issued an official estimate of the production, which gave it as 894,000 quarters grown on an acreage of 836,000, equalling a yield of a fraction over 8 bushels per acre—a great falling off since the previous estimates of 1893 and 1894, when the yields were 11 and 17 bushels respectively. Taken upon a ten years' average, the consumption per caput for all purposes appears to have been nearly 4½ bushels. The chief crop after wheat is maize, of which half a million to a million quarters are raised in good years, the yield per acre in a good season averaging 17 bushels; the total annual exports amounting to 300,000 or 400,000 quarters. The shipments are made from the port of Montevideo, the principal purchasers being the United Kingdom, Antwerp, and Brazil.

PRODUCTION.

(From British Official Returns and other Sources.)

Year.	Wheat.	Rye.	Barley.	Oats.	Maize.	Potatoes.
Harvested 1st Jan.	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.	Tons, 2240.
1890	510,000	...	...	...	...	...
1891	310,000	...	...	...	...	...
1892	398,900	16,100	5,800	300	424,000	5000
1893	690,800	13,000	15,500	30	384,700	5500
1894	1,080,000	19,300	14,000	170	636,400	4300
1895	1,100,000	...	...	...	730,000	...
1896	620,000	...	...	...	700,000	...
1897	400,000	...	...	...	500,000	...
1898	500,000	...	...	...	500,000	...
1899	[a] 894,138	...	...	...	500,000	...
1900	800,000	...	...	...	370,000	...
1901	600,000	...	...	...	870,000	...

[a] Official.

EXPORTS.

(From Anuario Estadistico de la Republica Oriental del Uruguay.)

Year	Wheat.	Potatoes.	Barley.	Oats.	Maize.	Flour.
	Qrs. 480.	Tons, 2240.	Qrs. 400.	Qrs. 304.	Qrs. 480.	Sks. 280.
1890	83,963	...	16	..	19,927	4,384
1891	2,304	...	15	30	6,440	3,768
1892	5	19	50	...	2,934	1,042
1893	27,130	5	9	...	3,795	91,150
1894	509,463	118	1265	...	223,100	267,636
1895	461,039	86	3613	22	311,171	152,967
1896	29,398	184	935	7	413,521	139,940
1897	57,725	76	60	...	6,338	90,486
1898	354,700	57	1700	...	57,700	88,900
1899	288,638	24	2000	...	49,000	163,200
1900	184,000	35	1000	...	2,000	140,000

IMPORTS.

(Same authority as Exports.)

Year.	Wheat.	Potatoes.	Barley.	Oats.	Maize.	Flour.
	Qrs. 480.	Tons, 2240.	Qrs. 400.	Qrs. 304.	Qrs. 480.	Sacks, 280.
1885	83	1601	135	...	...	188
1886	6,112	102	2180	...	...	226
1887	...	465	517	...	...	83
1888	...	118	1728	...	..	7
1889	170,297	3060	768	300	45,700	29,283
1890	91,247	5168	1566	500	16,100	26,065
1891	6,100	4300	100	80	200	4,500
1892	5,200	7800	15	60	600	1,300
1893	3,300	5400	900	110	100	200
1894	100	800	1700	120	30	80
1895	150	2400	80	40	5	10
1896	30	2400	1000	10	1,800	10
1897	2,000	3300	200	100	95,800	10
1898	100	4200	1200	100	7,600	30

Paraguay (population, 635,571; census 1900).—No official statements for either acreage or production are available for this country. The trade is very small.

WHEAT IMPORTS.

1885, 6476 bushels; 1886, 77,794 bushels; 1887, 69,760 bushels

FLOUR IMPORTS.

1881, 1,290,344 ℔; 1882, 1,680,802 ℔; 1883, 2,177,016 ℔; 1884, 2,047,456 ℔; 1885, 1,908,419 ℔; 1886, 385,225 ℔; 1887, 1,338,862 ℔.

In addition, a small trade in maize and potatoes is carried on.

Chile (population, 3,110,000; census, November 1899).—This country, after being a steady exporter of a moderate quantity of wheat and barley for many years, seems as if it were being beaten out of the field by other growers. The wheat product formerly was about 2,000,000 qrs., and the annual exportation about 500,000 qrs.; but the production has now fallen off so seriously that importation of Californian and Australian wheat has commenced on a large scale. The indicated per caput consumption on a ten years' average was 5½ bushels for all purposes.

Wheat (Production) Harvested January-February.

(*From the Corn Trade Year-Book.*)

	Qrs. 480.		Qrs. 480.
1891	2,100,000	1897	1,600,000
1892	1,900,000	1898	1,500,000
1893	2,100,000	1899	1,400,000
1894	1,700,000	1900	1,000,000
1895	1,600,000	1901	1,000,000
1896	1,900,000		

There are no official estimates of the area or average yield issued, but there are complete returns of the exports and imports published regularly, as will be seen from the following:—

Exports.

(*From Estadistica Comercial de la Republica de Chile.*)

Year.	Wheat.	Barley.	Maize.	Flour of all kinds.
	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 480 lb.	Sacks, 280 lb.
1885	493,036	43,872	...	44,404
1886	560,808	52,921	...	54,498
1887	572,100	22,200	250	24,000
1888	427,258	133,523	200	24,908
1889	228,574	38,599	500	24,806
1890	133,032	33,891	100	17,103
1891	819,020	76,736	300	45,259
1892	670,689	73,485	1300	30,707
1893	855,429	148,967	...	17,229
1894	534,681	210,199	...	24,616
1895	361,468	309,501	...	30,407
1896	632,799	285,048	...	32,405
1897	332,500	103,985	250	42,040
1898	364,000	101,000	1000	47,800
1899	210,000	143,000	2000	53,000

The imports are only important in the case of flour and maize, and these only occasionally. The great port for wheat shipments is Talcahuano. Almost the entire exportation of wheat and barley comes to the United Kingdom.

Algeria (population, 4,824,000; census 1901).—The progress of agriculture in this part of North Africa, as well as in the neighbouring countries of Tunis and Tripoli, is kept in check by the twin evils, droughts and locusts. The following figures show the average yield per acre of wheat, barley, and oats:—

	Acreage.	Product.	Yield per Acre.
		Bushels.	Bushels.
Wheat	3,219,848	22,240,000	7
Barley	3,446,966	32,000,000	9¼
Oats	209,036	3,600,000	17¼

The general production between 1891 and 1900 was as follows:—

Year.	Wheat.	Barley.	Oats.	Maize.
	Qrs.	Qrs.	Qrs.	Qrs.
1891	3,270,000	5,009,000	360,000	46,000
1892	2,500,000	4,500,000	275,000	39,000
1893	2,510,000	3,950,000	305,000	40,000
1894	3,880,000	5,750,000	532,000	49,000
1895	3,246,000	4,630,000	533,000	60,000
1896	2,860,000	3,730,000	543,000	54,500
1897	2,470,000	3,004,000	415,000	35,000
1898	3,380,000	4,956,000	630,000	40,000
1899	2,780,000	4,000,000	450,000	40,000
1900	2,200,000	6,600,000	720,000	40,000
1901	2,900,000	4,000,000	470,000	...

The trade with Algeria in grain is of no consequence to any nation beside France. In the last two years for which official returns are obtainable we have as follows:—

	Importations.		Exportations.	
	1898.	1897.	1898.	1897.
	Quintals.	Quintals.	Quintals.	Quintals.
Cereals, grain and flour	968,575	722,067	1,558,209	2,108,411
Rice, its flour, and semolina	6,476,212	5,381,310	...	...
Bran	...	...	2,770,747	2,869,850

Tunis (population, 1,906,000; estimate 1889).—Of this country very few agricultural or trade statistics are published. The area under crops in 1898 and 1899 was believed to be as follows, in hectares:—

Year.	Wheat.	Rye.	Barley.	Maize.
1898	358,462	370,684	6933	19,738
1899	367,690	403,409	6480	6,285

For the year 1898 the following figures represent the imports and exports:—

	Wheat.	Barley.	Wheat Flour.
Imports: quintals	88,750	137,635	77,448
Exports: quintals	671,377	495,181	146

Tripoli (population, 800,000; estimate 1899).—This vilayet grows certain quantities of barley, and exports, chiefly to the United Kingdom, 20,000 qrs. and occasionally 50,000 qrs. annually. It also imports from Italy and France about 40,000 sacks of flour annually.

Egypt (population, 9,734,405; census 1897).—Notwithstanding the general prosperity of the Khedive's dominions under British protection, it cannot be said that agriculture is prospering. There are but few data obtainable as to the production, but the record of exports and imports is very complete, and these will be found annexed.

Production.

(*Commercial estimates.*)

Year.	Wheat.	Maize.	Beans.	Year.	Wheat.	Maize.	Beans.
	Qrs. 480.	Qrs. 480.	Qrs. 480.		Qrs. 480.	Qrs. 480.	Qrs. 480.
1890	1,250,000	4,000,000	900,000	1896	900,000	4,250,000	770,000
1891	1,300,000	4,000,000	1,000,000	1897	750,000	4,300,000	725,000
1892	840,000	3,700,000	800,000	1898	1,000,000	4,000,000	650,000
1893	1,000,000	3,800,000	850,000	1899	1,300,000	4,400,000	.
1894	950,000	4,000,000	980,000	1900	1,200,000	4,300,000	..
1895	1,000,000	4,200,000	750,000	1901	1,100,000	3,800,000	..

Imports.

(*From "Le Commerce Extérieur."*)

Year.	Wheat.	Beans.	Barley.	Rice.	Maize.	Flour of Wheat and Maize.
	Qrs. 480.	Qrs. 480.	Qrs. 400.	Cwt.	Qrs. 480.	Sacks, 280.
1885	106,200	69	35,200	224,400	12,400	77,900
1886	137,300	165	60,000	298,600	40,300	117,800
1887	32,400	119	7,500	393,000	5,000	76,400
1888	30,300	42,000	21,400	274,300	6,100	69,500
1889	111,200	814	52,800	275,900	109,000	68,200
1890	141,100	473	22,100	310,300	17,300	68,100
1891	25,300	230	1,700	285,900	250	55,900
1892	61,200	262	36,800	319,700	29,500	60,500
1893	111,200	128	36,000	338,600	10,800	145,100
1894	31,400	124	21,000	324,800	500	159,200
1895	59,800	299	72,200	349,800	18,900	287,900
1896	119,400	220	99,100	425,700	174,000	523,600
1897	57,400	179	47,900	353,200	199,400	440,800
1898	33,300	372	3,100	420,400	284,700	278,600

EXPORTS.

(*From "Le Commerce Extérieur."*)

Year.	Wheat.	Beans.	Barley.	Cotton Seed.	Maize.	Flour of Wheat and Maize.
	Qrs. 480.	Qrs. 480.	Qrs. 400.	Tons, 2240 lb.	Qrs. 480 lb.	Sacks, 280 lb.
1885	127,200	676,100	17,000	244,800	34,500	8,800
1886	55,200	421,000	200	269,500	1,700	2,100
1887	89,700	466,200	25,200	270,000	8,000	35,000
1888	285,500	453,100	30,000	244,900	126,200	48,000
1889	141,800	295,000	23,200	245,200	2,400	3,100
1890	185,900	707,200	55,200	294,600	27,300	5,000
1891	416,300	793,400	170,300	324,900	490,600	21,400
1892	189,400	642,400	36,900	393,600	147,700	9,600
1893	71,500	671,000	37,300	342,100	6,100	1,800
1894	121,700	855,900	37,900	333,200	106,800	5,300
1895	102,600	560,300	10,200	342,300	185,600	2,000
1896	50,900	473,800	33,700	361,400	5,200	550
1897	26,600	426,400	9,300	444,000	39,600	2,100
1898	37,500	317,300	48,700	424,100	4,800	8,300
		Qrs. of 8 bush.				
1899	14,000	426,600	90,000	370,900	12,000	7,000
1900	..	194,000	..	..	..	..

Turkey in Asia and *Syria.*—The production of cereals in this part of the Sultan's empire has shrunk into insignificance. Small quantities of barley, wheat, beans, and dari are occasionally shipped; but the only port which maintains any real importance is Smyrna, whençe a considerable quantity of excellent barley is shipped annually, mostly finding its way to the United Kingdom. In 1900 the exports amounted to 974,000 qrs. of barley, 58,000 qrs. of beans, 26,000 qrs. durra; or of all cereals, expressed in tons, to 196,756, or 110,000 tons in excess of 1899; the increase being due to the exceptionally fine barley crop. The United Kingdom received 188,626 tons, leaving 8130 tons only for all other countries.

Cyprus (population, 227,900; census 1899).—The agricultural and trade statistics are very complete and satisfactory. In the following tabular statements will be found details of exports and imports from 1890 to 1899:—

PRODUCTION.

(*From Board of Trade Returns.*)

Year.	Wheat.	Barley.	Oats.
	8 bush.	8 bush.	8 bush.
1890	233,900	331,900	14,400
1891	267,900	309,000	16,100
1892	258,800	245,400	23,300
1893	173,200	233,700	24,100
1894	291,900	299,600	35,500
1895	295,700	229,100	49,900
1896	222,200	211,800	52,700
1897	260,900	231,300	42,700
1898	166,000	207,700	31,300
1899	269 000	305 000	33,800

EXPORTS.

(*From Statistical Abstract for the several Colonial and other Possessions of the United Kingdom.*)

Year.	Wheat.	Barley.	Oats.
	8 bush.	8 bush.	8 bush.
[a] 1890	64,600	115,200	5,800
[a] 1891	50,000	119,000	8,200
[b] 1892	17,500	41,900	9,400
[b] 1893	13,500	72,700	13,200
[b] 1894	50,600	56,800	14,100
[b] 1895	38,200	65,300	23,100
[b] 1896	16,200	55,200	14,300
[b] 1897	6,600	31,300	10,800
[b] 1898	26,250	97,100	9,700
[b] 1899	3,000	46,800	7,700

[a] Year ended 31st March. [b] Year ended 31st December.

The imports of wheat into Cyprus are unimportant, but a small amount of flour and a moderate quantity of rice are landed annually. In 1898, 16,800 cwt., and in 1899, 11,800 cwt. of rice were imported.

Malta (population, 181,648; estimated 1899).—The area under wheat in 1899 was 8308 acres, and under barley 2771 acres. The yield of wheat was 153,416 bushels, or 18 bushels per acre; and of barley 70,000 bushels, or 24 bushels per acre. The production in 1899 was 19,000 quarters of wheat and 8700 quarters of barley. The imports consist chiefly of flour from France and Italy, and certain quantities from the United Kingdom.

Persia (population estimated at 8,000,000).—This kingdom is credited with raising 2,000,000 quarters of wheat and barley, but the figures are untrustworthy. Occasionally the United Kingdom gets a few thousand quarters of wheat, and somewhat larger quantities of barley; but often enough the exportation of foodstuffs is prohibited. The ports from which they are shipped are Bushire, Lingah, Bander Abbási, Bahrein, Arab coast ports, and Mohammerah.

Japan (population, 46,540,744, including Formosa and the Pescadores; census, December 1898).—Agricultural and trade statistics are very complete for this kingdom, and go back for a number of years. The figures for the 1898 crops are as follows:—

	Acreage.	Production.	Yield. per Acre.
		Bushels.	Bushels.
Wheat .	1,140,740	20,742,164	18
Barley .	1,616,255	44,211,258	27
Rye . .	1,669,342	36,538,361	22

The production and exports and imports since 1890 are shown in the following three statements:—

PRODUCTION.

Year.	Wheat.	Rye.	Barley.	Beans and Pease.	Potatoes.	Rice.
	Qrs. 480.	Qrs. 480.	Qrs. 400.	Qrs. 8 bush.	Tons, 2240.	Cwt. 112 lb.
1890	1,503,000	1,768,000	3,354,000	..	..	106,733,000
1891	2,169,000	3,963,000	5,031,000	..	..	94,546,000
1892	1,883,000	3,755,000	4,221,000	..	149,100	102,619,000
1893	2,014,000	3,810,000	4,462,000	..	..	92,250,000
1894	2,429,000	4,467,00	5,223,000	2,200,000	183,900	102,446,000
1895	2,434,000	4,297,000	5,228,000	2,320,000	163,400	99,804,000
1896	2,175,600	3,629,000	4,808,000	1,859,000	162,900	89,337,000
1897	2,334,600	3,776,000	4,917,000	1,922,000	216,300	81,930,000
1898	2,592,000	4,567,000	5,526,000	..	..	116,102,000
1899	2,500.000	4.100,000	5,260,000	.	..	97,600,000

N.B.—The sweet potato crop is ten or fifteen times as big as the other potato crop.

EXPORTS.

(*From the Returns of Foreign Trade.*)

Year.	Wheat.	Barley.	Flour.	Pulse.	Rice.	Potatoes.
	Qrs. 480.	Qr. 400.	Sacks, 280 lb.	Qrs. 480.	Cwt. 112 lb.	Tons, 2240 lb.
1890	18,305	54	6,272	235	456,800	2169
1891	8,241	77	3,000	188	2,374,400	2408
1892	186	53	11,738	703	1,445,400	2400
1893	5,767	559	4,010	1160	1,887,183	2624
1894	6,851	1724	15,720	1106	1,811,847	1771
1895	..	..	..	..	3,000,000	..
1896	1,258	9200	15,450	5400	3,070,000	435[a]
1897	502	2490	14,365	3800	2,039,000	405[a]
1898	258	160	15,761	4060	1,691,000	880[a]

[a] Exported by Japanese merchants alone.

N.B.—In the years 1889, 1892, 1893, and 1894 there were considerable quantities of rye exported.

IMPORTS.

(*From the Returns of Foreign Trade.*)

Year.	Wheat.	Barley.	Flour.	Pulse.	Rice.
	Qrs. 480.	Qrs. 400.	Sacks, 280 lb.	Qrs. 480.	Cwt. 112 lb.
1890	10,213	13,897	31,631	250,040	5,460,754
1891	7,749	27,717	42,870	297,000	1,994,000
1892	5,931	5,146	35,513	429,000	980,000
1893	313	1,468	42,600	456,000	1,662,000
1894	5,146	237	73,534	382,600	3,926,000
1895	1,031	..	51,500	300,000	1,850,000
1896	10,700	..	113,900	435,800	2,200,000
1897	44,300	..	111,200	651,000	7,480,000
1898	13,300	..	184,500	666,800	13,850,000

The imports of oats and maize are unimportant.

On the average for the ten years ending 1898 the consumption of wheat for all purposes amounted to only 0·4 of a bushel—rice and sweet potatoes forming the chief food crops of Japan.

United Kingdom (population, 41,454,578; census 1901).—Regular official estimates of crop production in the United Kingdom were first made in 1884. The figures relating to the production of wheat between the years 1884 and 1900 inclusive are from the agricultural produce statistics of Great Britain, with additions from the returns of the registrar-general for Ireland. The statistics for years prior to 1884 are from a statement published by the late Sir J. B. Lawes. The returns of acreage are available for a much longer period from the Board of Agriculture. The trade returns are taken from the statistical abstracts (or the annual statements) for each year.

The wheat crop of the United Kingdom becomes annually smaller, and consequently of less importance as a factor in the international grain trade. The decline in production is due to the abandonment of wheat growing, and not to a falling off in the productiveness of the soil or to inferior farming. The yield per acre for the whole kingdom during the years 1896–1900 was as follows:—

Bushels per Acre.

1900.	1899.	1898.	1897.	1896.
28·61	32·76	34·75	29·07	33·63

This gives an average for the quinquennium of 31·79 compared with 29·63 bushels per acre for the first five years of the period when official returns were first collected (1884–88). The rise in the acreage yield is probably due to the fact that the less fertile wheat land is being abandoned, and only the better class kept under cultivation. The only other countries, making current returns, which come near the British average are New Zealand, with about an equal return; Belgium, 28·10; Holland, 28·08; Germany, 24·17; and Sweden, 24·03. All other countries return a yield of less than 20 bushels. Also in the cultivation of barley and oats no other nation raising these cereals on a large scale comes anywhere near the British average yield of 34 bushels of the former and 40 bushels of the latter per acre.

The consumption of wheat per head of the population for all purposes during the period 1891–1900 averaged 5 bushels and 54 ℔ (or including what has been used for seeding, 6 bushels 2 ℔). Taken on a five years' basis, the consumption works out at 5 bushels 51 ℔ per head; so that it would appear as if prosperous trade had the effect of lessening the consumption of bread-stuffs.

PRODUCTION.

(*From the Agricultural Returns and other Sources.*)

Year.	Wheat.	Potatoes.	Barley.	Oats.	Beans.	Peas.
	Qrs. 8 bush.	Tons 2240.	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.
1870	14,105,464	..	..	..	..	..
1871	11,456,544	..	..	..	..	..
1872	11,481,438	..	..	..	.	.
1873	10,290,417	..	..	..	..	.
1874	13,972,926	..	..	..	..	..
1875	10,018,418	..	..	..	..	..
1876	9,732,984	..	..	..	..	..
1877	10,970,533	..	..	..	..	..
1878	12,647,213	..	..	..	..	..
1879	5,905,020	..	..	..	..	..
1880	9,364,464	..	..	..	..	..
1881	8,880,198	..	..	..	..	..
1882	10,115,225	..	..	..	..	..
1883	9,477,822	..	..	..	..	..
1884	10,258,370	6,783,555	9,989,639	20,175,468	1,467,283	710,037
1885	9,950,000	6,374,242	10,715,000	20,005,500	1,140,000	542,000
1886	7,918,480	5,835,487	9,786,200	21,172,000	1,311,000	734,000
1887	9,528,100	7,134,296	8,743,500	18,848,000	1,059,000	703,000
1888	9,311,600	5,582,331	9,318,000	19,747,000	1,230,000	732,000
1889	9,485,400	6,435,387	9,337,900	20,519,000	1,171,000	740,000
1890	9,499,000	4,622,214	10,099,200	21,412,000	1,482,000	789,000
1891	9,342,800	6,090,047	9,944,000	20,809,000	1,337,000	722,000
1892	7,596,900	5,633,954	9,617,000	21,022,000	881,000	628,000
1893	6,364,000	6,540,593	8,218,000	21,073,000	608,000	594,000
1894	7,588,000	4,662,147	9,825,000	23,857,000	900,000	778,000
1895	4,785,600	7,064,634	9,378,500	21,809,000	703,000	591,000
1896	7,281,000	6,263,235	9,728,000	20,357,000	811,000	622,000
1897	7,037,000	4,106,609	9,077,000	20,444,000	831,000	656,000
1898	9,360,600	6,224,780	9,341,000	21,572,000	908,000	607,000
1899	8,407,500	5,837,387	9,315,700	20,936,500	945,000	553,300
1900	6,790,000	4,576,812	8,570,000	20,640,000	933,000	509,000
1901	6,700,000	.	8,450,000	20,250,000	..	..

From 1870 to 1883 inclusive are unofficial estimates.

Between 1885 and 1899 the respective proportions of native and foreign bread-stuffs consumed for all purposes in Great Britain were as follows, shown in three periods of five years each:—

	English Wheat.	Foreign Wheat.	Foreign Flour.	Total Native and Foreign.
	Qrs.	Qrs.	As qrs. Wheat.	Qrs.
1885–89	9,260,000	13,100,000	5,400,000	27,760,000
1890–94	8,840,000	15,200,000	6,200,000	30,240,000
1895–99	7,360,000	16,200,000	6,800,000	30,360,000

N.B.—Allowance has not been made for re-exports, which amount to 300,000 quarters annually.

It is worthy of note that the proportion which the flour imports bear to the total quantity of wheat used is growing larger, the percentage in the first period being 24 per cent., in the second 25 per cent., and in the third 29 per cent. Divided up among the population, it appears that the per caput consumption of the manufactured article imported from abroad averaged 1·17 bushels in 1885–89; 1·29 bushels in 1890–94; and 1·35 bushels in 1895–99. This is a matter for disappointment to the British millers, who seemed for a while to have stemmed the imports of foreign-made flour; for after the great importation of the year 1891 the quantity declined steadily, until in 1897 it had fallen off to 16 per cent.; but only to rise again in 1898 and 1899 to a higher level than ever before:—

IMPORTS.

(*From the Statistical Abstract.*)

Year.	Wheat.	Beans.	Barley.	Oats.	Maize.	Flour.	Potatoes.
	Qrs. 480.	Qrs. 480.	Qrs. 400.	Qrs. 304.	Qrs. 480.	Sks. 280.	Tons.
1870	7,210,286	351,352	2,020,863	3,990,232	3,909,916	1,921,563	38,592
1871	9,190,954	697,840	2,399,323	4,021,015	3,925,838	1,591,175	42,391
1872	9,829,802	688,080	4,213,038	4,250,593	5,724,289	1,755,254	299,371
1873	10,234,000	662,460	2,587,480	4,387,100	4,392,120	2,484,960	275,330
1874	9,689,782	550,922	3,173,910	4,195,493	4,128,512	2,494,417	199,333
1875	12,104,520	807,047	3,093,853	4,581,642	4,768,978	2,454,433	234,806
1876	10,372,753	1,075,096	2,736,424	4,130,375	9,324,786	2,383,928	301,196
1877	12,662,953	1,070,847	3,628,667	4,756,328	7,111,490	2,950,921	398,242
1878	11,644,846	436,842	3,963,937	4,706,365	9,723,911	3,131,231	437,291
1879	13,904,752	540,343	3,232,967	4,963,243	8,434,621	4,291,300	467,858
1880	12,894,448	601,331	3,277,481	5,094,059	8,685,771	4,223,332	487,725
1881	13,334,517	485,980	2,745,664	3,803,632	7,812,197	4,542,961	201,733
1882	14,989,508	487,849	4,351,228	5,021,405	4,264,337	5,222,961	149,535
1883	14,965,680	837,076	4,609,164	5,576,988	7,405,791	6,531,724	257,475
1884	11,038,103	821,466	3,626,840	4,760,687	5,782,108	6,038,120	122,208
1885	14,349,734	820,863	4,302,480	4,810,543	7,356,238	6,333,137	114,996
1886	11,068,354	655,234	3,839,808	4,968,243	7,236,031	5,875,824	135,394
1887	13,020,587	580,757	3,987,200	5,328,452	7,272,375	7,225,293	138,167
1888	13,360,984	703,261	5,965,400	6,915,515	5,919,704	6,764,176	119,190
1889	13,662,106	835,235	4,872,280	5,891,261	8,444,875	5,868,832	93,221
1890	14,110,642	780,480	4,669,840	4,688,963	10,168,827	6,309,334	97,005
1891	15,473,024	856,896	4,930,396	6,115,934	6,259,312	6,689,201	159,641
1892	15,143,753	1,033,651	3,997,644	5,769,987	8,255,618	8,842,403	150,416
1893	15,274,463	920,963	6,396,460	5,141,310	7,677,250	8,163,267	141,406
1894	16,362,787	1,227,308	8,747,592	5,518,644	8,251,843	7,653,842	135,190
1895	19,074,989	963,792	6,609,320	5,720,956	7,920,348	7,347,364	187,907
1896	16,339,395	724,031	6,293,650	6,479,321	12,080,156	8,528,080	112,231
1897	14,639,373	662,676	5,308,436	5,937,772	12,549,922	7,472,264	196,000
1898	15,219,848	535,108	6,847,960	5,739,226	13,330,501	8,406,840	337,000
1899	15,548,624	438,018	4,813,004	5,757,179	14,629,916	9,178,280	257,890
1900	16,009,400	400,804	4,775,400	7,408,400	12,635,100	8,616,400	445,500
1901	16,267,000	436,700	6,124,000	8,280,000	11,986,000	9,029,000	353.800

EXPORTS.

(*From the Statistical Abstract.*)

(Including re-exports.)

Year.	Wheat.	Maize.	Barley.	Oats.	Flour.	Potatoes.
	Qrs. 480.	Qrs. 480.	Qrs. 400.	Qrs. 304.	Sks. 280.	Tons 2240.
1870	..	..	22,428	464,238	..	5,300
1871	768,460	12,054	32,228	456,071	262,916	33
1872	124,355	6,300	3,780	35,760	15,172	64
1873	263,249	27,590	11,592	19,308	18,484	110
1874	80,416	22,967	91,924	54,300	38,084	40
1875	22,631	5,908	21,140	57,857	10,736	1,188
1876	107,527	56,497	6,944	114,273	10,924	294
1877	48,517	83,797	16,828	32,627	11,600	527
1878	163,366	71,176	25,228	65,953	15,760	375
1879	162,477	174,937	16,156	40,360	26,308	521
1880	157,549	167,356	4,452	103,220	42,886	955
1881	294,854	38,143	22,708	275,097	63,212	1,345
1882	312,788	29,855	55,888	179,515	108,160	20,880
1883	148,981	192,311	14,224	50,068	90,216	87,600
1884	285,908	89,040	23,856	84,062	96,120	53,600
1885	182,266	81,752	12,600	53,914	90,656	18,180
1886	279,916	63,756	16,436	78,293	112,392	17,060
1887	159,411	17,164	19,712	35,679	180,580	2,488
1888	106,512	12,012	17,192	58,308	151,868	2,510
1889	109,627	77,595	17,500	62,963	154,972	949

EXPORTS—*continued.*

Year.	Wheat.	Maize.	Barley.	Oats.	Flour.	Potatoes.
	Qrs. 480.	Qrs. 480.	Qrs. 400.	Qrs. 480.	Sks. 280.	Tons 2240.
1890	110,453	110,817	18,984	45,405	151,256	1,118
1891	152,173	56,413	18,480	42,729	158,708	1,996
1892	208,320	52,969	19,544	14,976	171,320	30,887
1893	162,722	17,087	9,800	94,498	183,636	87,622
1894	85,600	28,000	32,200	102,000	181,000	55,800
1895	70,700	14,000	21,400	91,700	191,000	13,800
1896	68,600	142,800	53,200	53,800	280,000	19,000
1897	70,700	172,200	43,800	92,400	240,000	24,000
1898	155,400	241,500	43,600	87,000	322,000	11,900
1899	169,500	178,000	22,300	34,000	367,400	19,800
1900	66,800	123,900	18,900	44,900	448,500	13,900

A reference to the annual statement showing the exportation of grain and flour affords little cause for gratification. There is a steady but small increase in the exports of flour, but they do not yet amount to 5 per cent. of the imports.

The chief ports which handle foreign grain are Liverpool, London, Hull, and Bristol, followed at a considerable distance by Manchester, Cardiff, Gloucester, Plymouth, Newcastle, and Southampton. Of wheat alone Liverpool is far ahead as an importer, followed by Hull and London. The five chief ports importing the largest proportion of each cereal and flour in 1900 were :—

Wheat, quarters.

Liverpool.	Hull.	London.	Bristol.	Leith.
4,776,000	2,766,700	2,200,000	909,000	645,000

Flour, sacks.

London.	Liverpool.	Glasgow.	Belfast.	Leith.
3,116,000	1,700,000	1,625,000	507,000	405,000

Maize, quarters.

Liverpool.	London.	Bristol.	Glasgow.	Belfast.
3,699,000	1,587,000	987,000	954,000	825,000

Barley, quarters.

Bristol.	London.	Hull.	Leith.	Liverpool.
988,000	655,000	654,000	472,000	346,000

Oats, quarters.

London.	Hull.	Bristol.	Liverpool.	Leith.
4,623,000	645,000	275,000	268,000	231,000

The favourite wheats imported into Great Britain are North American, Canadian, Argentine, Australian, and Indian ; Russian and Rumanian sorts being less in demand as a general rule.

ANNUAL IMPORTS IN CEREAL YEARS OF DIFFERENT SORTS.

	1899-90.	1898-99.	1897-98.	1896-97.
	Qrs.	Qrs.	Qrs.	Qrs.
North American	8,763,000	10,232,000	9,403,000	8,450,000
Argentine .	3,905,000	1,630,000	898,000	390,000
Australian .	930,000	464,000	16,000	...
Indian . .	870,000	2,069,000	1,322,000	150,000
Russian . .	435,000	787,000	2,476,000	3,615,000
Rumanian .	...	8,000	70,000	1,085,000
Other sorts .	294,000	201,000	649,000	1,978,000
Total .	15,197,000	15,391,000	14,834,000	15,668,000

France (population, 38,595,500 ; census 1901).—Prior to 1874 France raised the biggest crop of wheat of any country in the world, but America has now taken the lead, followed by Russia. There has been very little change in the area under wheat in France. For a long time it has stood at 17,000,000 acres, but of late years there has been a distinct improvement in the standard of farming, with the result that the yield per acre has been increased by 2 bushels. But it is still a long way below the British standard, being about one-third less. The acreage, production, and yield per acre, according to the harvest of 1899, were as follows :—

	Acreage.	Total Crop.	Yield per Acre.
		Bushels.	Bushels.
Wheat and Spelt . .	17,142,000	353,152,000	20·6
Barley	1,991,000	43,905,000	22·1
Oats	9,730,000	262,078,000	27·0
Rye	3,677,000	64,836,000	17·6
Maize	1,385,000	24,785,000	10·9
Potatoes	3,864,000	485,966,000	126·0

The production over a series of years of the chief crops was as follows :—

PRODUCTION.

(*From the Bulletin du Ministère de l'Agriculture.*)

Year	Wheat.	Rye.	Barley	Oats.	Maize.	Potatoes.	Maslin.
	Qrs. of 8 meas. bush.	Qrs. of 8 meas. bush.	Qrs. of 8 meas. bush.	Qrs. of 8 meas. bush.	Qrs. of 8 meas. bush.	Tons, 2240 lb.	Qrs. 480.
1885	39,128,200	7,987,700	6,005,300	29,493,200	3,113,100	11,020,937	1,782,600
1886	37,831,000	7,453,700	6,170,100	30,789,200	3,072,300	11,062,009	1,751,000
1887	40,005,500	7,782,000	5,830,400	27,625,300	3,581,300	11,471,546	1,746,200
1888	34,438,000	7,256,800	5,448,700	29,295,800	3,403,200	10,138,196	1,473,400
1889	38,231,000	7,617,700	5,450,200	29,399,800	3,155,400	10,485,845	1,550,000
1890	41,217,100	7,961,500	5,916,300	32,288,000	2,894,100	10,819,003	1,620,800
1891	26,669,000	7,072,600	8,765,700	36,601,800	3,224,200	10,943,813	1,245,200
1892	38,845,000	7,827,000	5,602,900	28,962,500	3,232,900	13,264,559	1,403,300
1893	34,722,800	7,508,400	4,221,000	21,573,000	3,167,800	11,604,662	1,268,300
1894	43,027,500	8,740,800	5,887,700	31,682,300	3,331,900	12,563,692	1,512,200
1895	42,454,300	3,381,600	5,867,200	32,716,500	3,179,200	12,666,416	1,505,000
1896	42,537,600	8,140,500	5,600,500	31,725,300	3,697,200	12,686,432	1,419,000
1897	30,281,200	5,570,000	5,001,200	27,656 600	3,694,200	11,091,262	1,040,000
1898	45,618,400	7,808,400	5,696,400	33,815,200	2,855,200	11,595,517	1,444,000
1899	45,685,000	8,050,000	5,806,000	32,060,000	3,700,000	..	1,350,000
1900	40,695,000	6,930,000	4,963,000	30,451,000	..	..	1,092,000
1901	38,000,000	7,300,000	4,700,000	26,000,000	..	..	

Average yield crops of wheat in 1898, 1899, 1900, 20 bushels per acre.

The principal wheat port of the republic is Marseilles, for there trade is always active, even when such important ports as Havre and Dunkirk are quite idle. The first mentioned port is the great entrepôt for the trade in bonded wheat milling, and all the year round, and every season alike, fifty or sixty thousand quarters per week are taken in at Marseilles and manufactured into " paste," or re-exported in the shape of flour to French colonial possessions. When there is a serious crop failure in France such ports as Havre and Dunkirk become of great importance, as it is in the north of France wheat is mainly produced :—

EXPORTS (COMMERCE SPECIAL).

(*From the Bulletin du Ministère de l'Agriculture.*)

Year.	Wheat.	Rye.	Barley.	Oats.	Maize.	Flour.	Potatoes.
	Qrs. 480.	Qrs. 480.	Qrs. 400.	Qrs. 304.	Qrs. 480.	Sacks, 280 lb.	Tons, 2240 lb.
1885	34,100	164,100	642,800	78,500	24,800	68,000	102,200
1886	13,000	121,700	569,100	65,600	37,700	60,200	99,400
1887	4,300	73,100	343,300	61,400	42,800	38,000	99,900
1888	6,200	9,300	211,500	17,100	27,200	72,500	114,100
1889	5,100	28,500	293,500	19,000	60,000	89,400	107,800
1890	2,700	35,100	293,300	21,800	38,300	67,300	118,600
1891	3,300	186,200	677,000	131,400	4,300	52,300	216,200
1892	3,800	376,700	669,500	585,900	2,100	100,400	178,800
1893	8,100	51,000	77,600	24,600	8,400	154,900	116,700
1894	14,600	4,600	123,500	18,800	8,700	193,300	137,000
1895	10,000	13,400	173,100	21,900	900	105,200	155,400
1896	5,100	41,800	113,100	22,600	3,800	141,800	128,600
1897	2,600	700	70,000	16,100	6,400	151,400	137,800
1898	8,000	2,300	189,500	17,700	26,400	320,300	151,500
1899	8,860	37,871	223,600	18,545	1,485	161,768	162,597
1900	7,000	26,800	224,500	20,300	6,400	311,000	198,000
1901	2,900	1,100	189,500	14,500	1,100	146,000	181,200

IMPORTS (COMMERCE SPECIAL).

(*Same authority as Exports.*)

Year	Wheat	Rye.	Barley.	Oats.	Maize.	Flour.	Potatoes.
	Qrs. 480.	Qrs. 480.	Qrs. 400.	Qrs. 304.	Qrs. 480.	Sacks 280 lb.	Tons, 2240 lb.
1885	2,966,300	11,700	588,000	1,541,500	1,472,800	234,900	17,700
1886	3,264,800	4,100	369,000	1,048,900	2,204,600	198,900	18,000
1887	4,119,000	85,000	765,300	1,539,700	1,687,000	150,100	53,900
1888	5,217,100	219,800	672,800	2,842,000	1,464,100	218,600	55,600
1889	5,245,700	98,300	643,000	1,485,400	2,396,600	241,600	63,700
1890	4,846,500	4,800	937,200	1,083,500	2,978,100	250,800	22,500
1891	9,002,400	1,400	754,200	710,200	289,000	584,200	22,700
1892	8,654,700	300	597,600	286,700	948,700	335,100	12,900
1893	4,607,500	3,700	1,358,700	2,232,000	1,252,800	125,200	25,500
1894	5,740,000	30,900	1,584,000	3,980,400	1,144,300	159,100	35,500
1895	2,070,400	900	791,000	1,916,000	625,200	274,600	35,400
1896	728,000	6,600	768,700	1,404,000	1,514,700	170,900	36,400
1897	2,400,000	220,000	1,053,500	1,430,000	1,821,400	144,700	44,700
1898	8,976,600	198,300	938,200	2,240,700	2,530,700	300,300	70,700
1899	600,281	1,421	748,049	849,627	2,401,489	155,306	46,368
1900	593,400	130	472,100	1,596,500	1,534,600	163,800	54,000
1901	727,000	7,500	1,043,400	3,032,700	1,353,800	147,800	61,200

N.B.—In addition to the above imports there is a substantia quantity taken surreptitiously. France also uses a good deal o foreign wheat in the manufacture in bond of flour, semolina, biscuits and bread for exportation. These figures are shown in the "*Tableau Général du Commerce.*"

The consumption of wheat for all purposes in France is very great, as will be seen from the following figures, which give th

average for the period 1885–99, divided into three equal periods of five years each :—

	1885–89.	1890–94.	1895–99.
Total quarters	41,900,000	43,400,000	[a] 44,300,000
Per caput bushels	8·9	9·0	[a] 9·1

[a] Probably an over-estimate.

The favourite foreign wheat in France is Russian, but when a crop failure occurs all sorts are imported—Australian and Californian being well liked. North African wheat is nearly all taken in at Marseilles.

Germany (population, 56,345,014 ; census 1901).—The statistics of this country both for production and for exports and imports are from *Statistisches Jahrbuch für das Deutsche Reich.* There has been a rapid growth in the production of wheat, proceeding from a higher acreage yield and an increasing area. The area under crops, the out-turn, and the yield per acre are shown in the following statement for the year 1900 :—

	Acreage.	Total Crop.	Yield.
			Bushels per Acre.
Wheat	5,061,000	17,645,000 qrs.	27·9
Rye	14,708,000	39,277,000 ,,	21·3
Barley	4,125,000	16,550,000 ,,	32·1
Oats	10,183,000	51,465,000 ,,	40·3
Potatoes	7,950,000	40,585,000 tons [a]	5·1 tons

[a] 2·205 lb.

German agriculture, it will be seen, is now of a high standard, closely resembling the British. During 1885–1900 the total production of wheat and rye in Germany increased 50 per cent.; barley and oats, 30 per cent.; and potatoes, 40 per cent. The chief breadstuff in the Fatherland is rye ; the per capita consumption for all purposes amounts to 5·6 bushels, compared with 3·1 bushels of wheat, both taken on a five years' average. Notwithstanding the increased productiveness of German farms, it is a fact that the importation of foreign grain is becoming yearly more important. During 1885–1900 wheat imports trebled ; barley also ; while at the same time enormous quantities of maize were imported. The following tabular statements show the production, imports, and exports :—

PRODUCTION.

Year.	Wheat.	Rye.	Barley.	Oats.	Spelt.	Potatoes.
	Qrs. 480.	Qrs. 480.	Qrs. 400.	Qrs. 304.	Qrs. 480.	Tons, 2240.
1885	11,980,900	26,838,000	12,484,900	31,625,200	2,142,600	27,456,300
1886	12,249,200	27,987,600	12,884,200	35,238,100	2,027,700	24,640,000
1887	13,003,500	29,287,000	12,158,200	31,214,200	2,099,600	24,767,500
1888	11,623,800	25,368,500	12,461,700	33,726,300	1,543,500	21,472,800
1889	10,897,700	24,636,300	10,685,700	30,433,100	1,376,600	26,071,800
1890	13,004,000	26,954,800	12,587,800	35,656,500	2,264,400	22,854,600
1891	10,720,100	21,970,400	13,877,300	38,311,200	1,713,700	18,187,200
1892	14,527,800	31,363,300	13,344,700	34,429,100	2,268,800	27,427,800
1893	13,757,700	34,270,400	10,732,700	23,528,400	1,943,700	31,632,300
1894	13,836,300	32,500,000	13,432,200	38,099,300	1,959,800	28,468,300
1895	12,896,700	30,298,000	13,294,800	38,117,300	1,720,600	31,150,900
1896	13,818,500	33,222,500	12,774,300	36,053,600	1,483,000	28,692,600
1897	13,383,000	31,845,300	12,359,000	35,133,400	1,592,800	29,205,100
1898	14,745,000	34,601,000	13,858,800	41,949,500	1,958,700	31,155,000
1899	17,698,300	39,908,600	16,411,300	49,899,500	2,190,000	38,486,200
1900	17,645,000	39,277,000	16,550,000	51,465,000	2,142,000	39,951,000
1901	11,500,000	37,500,000	18,200,000	52,400,000	1,975,000	47,000,000

EXPORTS OF NATIVE GROWN AND DUTY PAID FOREIGN GRAIN.

Year.	Wheat.	Rye.	Barley.	Oats.	Maize.	Flour.[a]
	Qrs. 480.	Qrs. 480.	Qrs. 400.	Qrs. 304.	Qrs. 480.	Sacks, 280.
1885	64,700	18,500	136,400	93,000	..	1,016,100
1886	38,000	14,600	320,000	119,600	..	1,049,100
1887	13,000	14,400	114,400	60,200	..	1,040,800
1888	5,100	10,400	128,100	13,100	..	1,190,000
1889	3,500	2,800	122,000	2,300	300	1,084,000
1890	1,000	500	35,300	3,300	300	915,000
1891	1,500	600	21,500	2,700	200	820,400
1892	1,100	4,100	52,700	3,400	400	828,300
1893	1,300	1,200	45,400	2,000	300	1,154,400
1894	363,800	228,400	107,000	165,000	500	1,483,300
1895	321,200	165,300	270,000	373,000	300	1,312,800
1896	345,500	176,100	115,600	220,500	300	1,180,800
1897	787,300	489,000	102,100	155,000	300	1,277,300
1898	619,200	595,800	69,800	345,100	200	1,082,200
1899	904,000	566,700	77,540	495,900	133	260,500
1900	1,355,100	349,200	177,000	767,400	196	252,000
1901	426,400	422,900	207,000	1,060,200	300	227,800

[a] Prior to 1899 rye-meal and flour were counted in with the flour exports.

IMPORTS (COMMERCE SPECIAL).

Year.	Wheat.	Rye.	Barley.	Oats.	Maize.	Flour.
	Qrs. 480.	Qrs. 480.	Qrs. 400.	Qrs. 304.	Qrs. 480.	Sacks, 280 lb.
1885	2,629,500	3,535,600	2,414,700	1,582,600	901,700	218,000
1886	1,255,300	2,596,500	1,950,900	588,000	778,000	156,800
1887	2,513,800	2,933,000	2,819,800	1,216,000	733,200	192,600
1888	1,560,500	2,998,800	2,451,900	1,315,400	433,000	104,100
1889	2,374,000	4,898,000	3,591,200	1,872,300	1,445,000	109,600
1890	3,089,500	4,041,700	4,053,300	1,361,800	2,581,300	112,900
1891	4,158,600	3,870,600	4,005,500	869,900	1,875,700	110,000
1892	5,954,000	2,875,500	3,215,400	637,000	3,295,000	209,600
1893	3,231,300	1,030,000	4,695,200	1,763,200	3,496,000	211,800
1894	5,300,200	3,002,500	6,014,700	2,921,200	2,678,800	242,200
1895	6,146,600	4,630,200	5,121,300	1,732,400	1,487,500	256,200
1896	7,591,000	4,734,000	5,667,300	3,586,400	3,772,800	382,200
1897	5,418,200	3,935,900	5,862,100	3,975,900	5,816,600	303,100
1898	6,786,800	4,198,700	6,356,400	3,310,500	7,260,200	237,700
1899	6,298,900	2,574,600	6,088,100	1,878,800	7,472,200	331,000
1900	5,943,500	4,103,100	4,307,300	3,354,600	6,357,900	265,900
1901	9,803,100	3,967,000	4,959,900	2,993,700	5,481,500	303,000

The chief grain port of Germany is Hamburg, followed at a long interval by Bremen and Stettin. In addition to the imports of foreign grain through these seaports, there is a very large trade carried on at Mannheim—the Rotterdam imports finding their way into Germany by the Rhine and other rivers and canals. German millers are beginning to take to all kinds of foreign wheat, but the most favoured sorts are Russian and Rumanian, red American following next, and sharing third place with Argentine.

Belgium (population, 6,815,504 ; census 1900).—The acreage and yield are taken from the official annual publication, *Annuaire Statistique de la Belgique.* The import figures are from the *Tableau Général du Commerce,* &c.

The following statement shows the acreage for 1895, but the crops for 1897 :—

	Acreage.	Total Crop.	Yield per Acre.
		Bushels.	Bushels.
Wheat and Spelt	528,000	15,300,000	29·0
Rye	699,939	19,770,400	28·2
Barley	100,000	3,513,000	35·1
Oats	614,000	28,676,000	46·7
Potatoes	457,187	108,556,000	238·0

Owing to the peculiar method adopted in arriving at the foregoing results, we are inclined to doubt the accuracy of the figures as to the yield per acre. The probability is the acreage was larger upon which the crop of 1897 was grown, and the average yield per acre somewhat less. The total consumption of wheat and rye in Belgium per annum is as follows :—Wheat, 7·1 ; rye, 3·0 bushels per caput.

PRODUCTION.

(*From the Annuaire Statistique de la Belgique.*)

Year.	Wheat.	Rye.	Barley.	Oats.	Spelt.	Potatoes.
	Qrs. 480.	Qrs. 480.	Qrs. 400.	Qrs. 304.	Qrs. 480.	Tons.
1890	2,695,122	2,395,512	534,559	3,734,882	684,888	2,714,537
1891	2,050,692	1,679,169	429,719	3,930,418	498,034	2,439,751
1892	2,348,563	2,695,190	480,539	3,279,493	548,578	4,321,347
1893	2,096,221	2,325,842	403,050	2,510,146	505,447	4,041,733
1894	2,134,161	2,527,218	438,548	3,440,723	530,382	2,923,477
1895	2,268,876	2,517,549	450,495	3,651,695	620,520	4,394,777
1896	2,286,763	2,636,972	463,273	3,183,441	721,609	2,914,438
1897	1,449,667	2,471,304	439,214	3,584,535	441,628	2,938,904
[a]1898	1,650,000	2,450,000	500,000	3,900,000	600,000	4,400,000
[a]1899	1,500,000	2,250,000	460,000	3,200,000	500,000	..
[a]1900	1,600,000	2,375,000	375,000	3,375,000	..	..
[a]1901	1,500,000	2,700,000	380,000	3,000,000	..	..

[a] Commercial estimate.

EXPORTS.

(*From the Tableau Général du Commerce avec les Pays Étrangers.*)

Year.	Wheat.	Rye.	Barley.	Maize, Oats, Buckwheat.	Maize.	Flour and Meal.
	Qrs. 480.	Qrs. 480.	Qrs. 400.	Cwt.	Qrs.	Sacks, 280.
1890	1,025,500	266,400	[b]198,800	3,541,300	..	732,000
1891	[a]2,108,212	340,114	[b]248,391	2,135,300	..	870,000
1892	[a]1,726,000	313,200	[b]175,500	2,524,500	..	732,000
1893	[a]1,502,300	231,200	[b]388,400	2,610,000	..	147,700
1894	[a]1,496,500	134,500	[b]306,700	2,303,000	..	176,700
				Oats, Qrs. 304.		
1895	[a]1,502,898	85,435	[b]213,933	30,482	306,810	175,208
1896	[a]1,311,188	117,083	[b]276,661	17,110	557,524	91,755
1897	[a]1,316,621	174,317	[b]409,337	6,626	657,045	128,544
1898	[a]1,614,876	277,140	[b]400,421	7,025	649,805	266,498
1899	[a]1,649,077	140,304	[b]294,107	6,488	702,203	156,728
1900	[a]1,103,000	101,200	[b]214,800	3,830	706,800	136,400
1901	[a]1,646,000	134,200	[b]193,700	9,100	539,700	146,400

[a] Including spelt. [b] Including winter barley.

IMPORTS.

(*From the Tableau Général du Commerce avec les Pays Étrangers.*)

Year.	Wheat, including Spelt.	Rye.	Barley.	Maize, Oats, Buckwheat.	Maize.	Flour and Meal.
	Qrs. 480.	Qrs. 480.	Qrs. 400.	Cwt.	Qrs. 480.	Sacks, 280.
1890	4,119,300	418,700	1,207,900	7,838,700	..	749,092
1891	6,516,755	491,744	1,165,818	5,028,900	..	785,000
1892	4,740,800	172,600	1,003,400	5,191,000	.	670,000
1893	4,750,000	135,700	1,284,400	6,897,000	..	457,200
1894	5,574,200	141,700	1,469,600	6,233,000	..	571,800
				Oats, Qrs. 304.		
1895	6,244,408	154,905	1,341,169	701,684	948,414	532,758
1896	6,082,814	315,366	1,548,602	484,662	1,521,509	114,196
1897	5,052,189	380,815	1,623,512	495,994	1,812,754	48,960
1898	5,874,940	386,317	1,768,826	207,429	2,110,254	70,926
1899	6,301,885	131,509	1,706,782	333,899	2,387,128	189,829
1900	5,069,500	225,400	1,328,800	525,100	2,318,300	183,000
1901	6,858,500	296,000	1,308,000	327,700	1,743,700	163,000

Antwerp is the one port of Belgium monopolizing the grain trade—Ghent alone getting a little of the oats imported from Libau and Riga. Considerable quantities of grain are exported to the north of France and Germany. Frequently Antwerp has taken the lead of all the wheat-importing centres of the world, receiving over 6,000,000 quarters of wheat in a twelvemonth, as in 1899, 1895, and 1891.

Holland (population, 5,179,138; estimate 1900).—The production of cereals in the Netherlands is on a very small scale, and the agricultural statistics are not very closely up to date. Figures for 1897:—

	Acreage.	Total Crop.	Yield per Acre.
		Bushels.	Bushels.
Wheat and Spelt . .	154,000	4,174,000	27·1
Rye	527,000	11,561,000	21·9
Barley	90,000	3,621,000	40·2
Oats	331,000	15,625,000	47·2
Potatoes	373,000	75,517,000	202·0

The consumption of wheat and rye for all purposes during the five years ending 1900 averaged about $4\frac{3}{4}$ bushels of the former and $4\frac{1}{2}$ bushels of the latter; in the five years 1885–89 the quantities averaged $3\frac{4}{5}$ bushels of wheat and $4\frac{3}{4}$ bushels of rye.

PRODUCTION.

(*From Jaarcijfers voor het Koningrijk der Nederlanden.*)

Year.	Wheat.	Rye.	Barley.	Oats.	Spelt.	Potatoes.
	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.	Measured bushels.
1890	659,000	1,350,000	504,000	1,609,000	3,000	52,087,700
1891	426,000	1,006,000	543,000	2,252,000	700	44,002,800
1892	654,000	1,511,000	606,000	1,823,000	1,400	91,205,500
1893	604,000	1,504,000	580,000	1,498,000	2,100	86,838,800
1894	506,000	1,497,000	440,000	1,835,000	2,100	57,359,500
1895	520,000	1,555,000	521,000	1,886,000	2,500	72,341,500
1896	613,000	1,650,000	554,000	1,864,000	2,500	81,312,000
1897	521,000	1,450,000	455,000	1,959,000	2,100	75,517,800
1898[a]	750,000	1,375,000	625,000	2,125,000	..	..
1899[a]	700,000	1,438,000	500,000	2,000,000	..	..
1900[a]	700,000	1,875,000	437,000	2,000,000	..	..
1901[a]	600,000	1,300,000	460,000	2,060,080	..	..

[a] Estimated.

The average yield per acre of wheat in 1898–1900 was 28·7 bushels.

EXPORTS.

(*From Koningrijk der Nederlanden Statistiek.*)

Year.	Wheat.	Rye.	Barley.	Oats.	Maize.	Wheaten Flour.
	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 480.	Sacks, 280.
1890	1,481,800	1,167,000	739,100	1,010,800	132,800	181,100
1891	1,918,800	1,039,300	630,400	659,600	76,300	180,700
1892	1,965,000	611,600	601,700	404,000	313,500	127,700
1893	2,117,800	574,200	962,200	1,111,300	635,800	123,300
1894	1,969,000	948,000	1,247,500	1,704,100	240,000	125,800
1895	3,005,600	1,064,500	980,800	1,368,200	183,100	73,000
1896	2,973,000	1,413,600	1,262,700	2,182,400	546,400	76,700
1897	4,016,600	1,429,000	1,810,300	1,846,000	690,200	97,300
1898	5,497,600	1,548,200	1,843,500	2,037,800	1,828,600	119,300
1899	5,780,900	1,155,200	1,710,100	2,048,400	1,964,900	128,400
1900	4,883,300	1,518,800	1,265,800	2,531,300	1,401,800	163,300
1901	6,804,000	1,340,000	1,389,000	2,336,000	1,027,000	103,000

IMPORTS.

Year.	Wheat.	Rye.	Barley.	Oats.	Maize.	Wheaten Flour.
	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 480.	Sacks, 280 lb.
1890	2,494,900	1,906,200	1,280,700	1,117,000	957,800	697,800
1891	3,417,300	2,144,800	1,221,000	722,600	858,400	712,300
1892	3,032,800	884,400	1,043,000	246,200	1,278,000	817,700
1893	3,039,500	1,321,100	1,719,300	1,167,700	1,455,600	854,700
1894	3,732,800	2,201,400	2,442,300	1,758,300	945,800	853,900
1895	4,397,400	2,225,000	1,919,700	1,550,900	896,800	738,600
1896	4,750,400	2,478,000	1,713,400	2,627,800	2,034,400	994,300
1897	5,101,000	2,325,300	1,809,000	2,122,400	2,351,700	904,600
1898	6,285,400	2,262,100	1,886,400	2,253,100	3,647,900	1,033,000
1899	6,464,800	1,896,500	2,094,000	2,343,300	3,846,500	1,356,600
1900	5,873,400	2,349,300	1,594,700	2,864,300	3,155,300	1,207,900
1901	8,091,800	2,432,700	1,891,500	2,462,000	2,464,500	1,369,300

The great wheat port of Holland is Rotterdam, through which and its extensive ramifications of rivers and canals large areas of northern Europe are fed with imported grain. This port, along with Liverpool and Antwerp, disputes the claim for first place as the chief wheat-importing port of the world. Holland, as will be seen from a glance at the foregoing table, re-exported about 12,000,000 quarters of grain out of the 16,000,000 quarters which she imported in 1899. Large quantities of all sorts of grain go up the Maas to the Rhine, to supply Germany and Switzerland.

Italy (population, 32,449,754; census 1901).—The statistics as to production are taken from the *Annuario Statistico Italiano*, and those for the trade in foreign grain from the *Movimente Commerciale del Regno St Italie.*

The cultivation of wheat, in virtue of a high protective duty, is maintained, and indeed slightly enlarged, but not in proportion to the increase in the population, neither does the importation increase, so that it would appear as if the standard of living was not being raised as it is in most other countries—Germany in particular. The only article which Italy is taking more freely now than in, say, 1890 is maize, of which also more is being produced.

The total amount of wheat and maize used annually in the two periods 1885–89 and 1895–99 was as follows:—

Years.	Wheat.	Maize.	Consumption per Head of Population.	
			Wheat.	Maize.
	Qrs.	Qrs.	Bushels.	Bushels.
1885–89	17,600,000	9,300,000	4·6	2·4
1895–99	18,100,000	10,000,000	4·5	2·5

N.B.—A good deal of pulse is consumed in Italy.

The following table shows the present acreage, crop, and yield per acre:—

	Acreage.	Total Crop.	Yield per Acre.
		Bushels.	Bushels.
[a]Wheat .	11,315,000	140,752,000	12·4
[a]Maize . .	4,831,000	77,440,000	16·0
[b]Oats . .	1,171,000	18,601,000	15·9
[a]Barley .	761,000	9,744,000	12·8
[b]Pulse . .	2,097,000	11,220,000	5·3

[a] Year 1896. [b] Year 1895.

The standard of farming must be very low in Italy, judging from the poor yields per acre:—

PRODUCTION.

(*From Annuario Statistico Italiano.*)

Year	Wheat.	Rye.	Barley.	Oats.	Maize.	Potatoes.
	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 480.	Tons, 2240 lb.
1890	15,922,000	536,000	1,328,000	2,303,000	9,081,000	739,000
1891	17,137,000	545,000	1,133,000	2,094,000	8,031,000	..
1892	14,014,000	515,000	961,000	2,088,000	8,738,000	754,000
1893	16,381,000	545,000	959,000	2,210,000	10,026,000	795,000
1894	14,729,000	522,000	1,009,000	2,062,000	7,220,000	611,000
1895	14,265,000	486,000	901,000	2,201,000	8,538,000	690,000
1896	17,594,000	500,000	1,218,000	2,450,000	9,680,000	..
1897	10,529,000	500,000	962,000	2,375,000	8,004,000	..
1898	16,689,000	500,000	1,100,000	2,250,000	9,677,000	..
1899	16,758,000	337,500	1,000,000	2,000,000	10,758,000	..
1900	14,500,000	400,000	812,000	2,000,000	10,500,000	..
[a]1901	15,700,000	400,000	1,000,000	1,900,000	10,700,000	..

[a] Unofficial.

Exports.

(*From Movimente Commerciale del Regno St Italie.*)

Year.	Wheat.	Coarse Grains, including Barley, Maize, and Rye.	Barley.	Oats.	Maize.	Flour.
	Qrs. 8 bush.	Qrs. 480.	Qrs. 400.	Qrs. 8 bush.	Qrs. 480.	Sacks, 280 lb.
1890	2000	..	34,800	1700	42,000	2,500
1891	3200	..	12,200	1000	55,900	4,700
1892	2300	..	600	200	33,800	1,900
1893	3100	4600 [a]	11,600	4100	60,000	2,300
1894	1700	3800 [a]	56,500	3100	112,000	4,400
1895	1300	1100 [a]	32,800	900	52,000	75,900
1896	1500	300 [a]	5,300	1100	47,800	63,700
1897	2000	300 [a]	35,000	3000	45,500	71,100
1898	1400	400 [a]	5,600	1800	36,800	68,100
1899	1200	..	300	800	30,100	91,300
1900	1400	..	1,900	1000	56,800	80,400
1901	1300	..	1,100	800	35,200	69,500

[a] Rye, Qrs. 480.

Imports.

(*From Movimente Commerciale del Regno St Italie.*)

Year.	Wheat.	Rye.	Barley.	Oats.	Maize.	Flour.
	Qrs. 8 bush.	Qrs. 480.	Qrs. 400.	Qrs. 304.	Qrs. 480.	Sacks, 280 lb.
1890	3,010,000	..	53,800	207,700	733,200	7,400
1891	2,165,000	..	66,600	87,100	205,700	6,300
1892	3,252,000	..	85,100	47,300	334,500	7,300
1893	4,018,000	37,700	92,500	19,000	115,000	9,600
1894	2,306,000	26,000	153,000	13,600	29,500	7,300
1895	3,070,000	12,200	248,500	65,000	726,000	10,500
1896	3,257,000	33,700	56,000	43,000	831,000	22,200
1897	2,128,000	47,900	19,200	22,400	589,300	17,600
1898	4,354,400	60,800	38,200	268,000	1,426,000	39,200
1899	2,175,400	2,300	30,000	357,500	1,054,300	17,000
1900	3,162,900	20,400	25,900	251,300	381,500	6,600
1901	4,614,600	54,000	32,000	328,400	1,154,900	9,000

The chief grain ports of Italy are Genoa and Venice, the former being the receiving port for much of the wheat destined for Switzerland. The wheats imported into Italy in greatest quantities are those of Russia and Rumania, the hard wheat of Taganrog being in great demand for making maccaroni.

Spain (population, 18,826,000; census 1897).—Only in 1899 for the first time were Spanish agricultural statistics issued. Foreign Office returns:—

	Acreage under Crops, year 1899.	Estimated Total Crops.	Yield per Acre.
		Bushels.	Bushels.
Wheat . . .	9,048,662	97,680,582	10·8
Barley . . .	3,463,710	51,796,024	15·0
Oats . . .	931,578	12,386,000	13·3
Rye . . .	1,848,062	19,891,000	10·8
Maize . . .	1,159,720	23,913,000	20·6
Beans . . .	633,202	7,032,000	11·1

The consumption per head of wheat in the years 1896–97 appears to have been about $5\frac{1}{2}$ bushels. During the ten years ending 1899 the gross annual supply of wheat, native and imported, was as follows, in two periods of five years each:—

Period.	Native.	Foreign.	Total.
	Qrs.	Qrs.	Qrs.
1890–94	10,200,000	1,060,000	11,260,000
1895–99	11,700,000	700,000	12,400,000

The wheats of which Spain imports most are Russian and Rumanian, the chief receiving port being Barcelona. Formerly a good trade was done by Spanish millers in exporting flour to Cuba and Costa Rica, but this has now ceased.

Production.

(*From British Board of Agriculture.*)

Year.	Wheat.	Rye.	Barley.	Oats.	Maize.
	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.	Qrs 8 bush.
1890	9,000,000	..	..	..	..
1891	9,000,000	..	..	.	..
1892	9,300,000	..	..	.	..
1893	10,700,000	..	..	..	..
1894	13,000,000	..	..	..	..
1895	[a] 9,842,000	2,125,000	..	..	..
1896	10,500,000	1,875,000	..	..	..
1897	12,500,000	2,250,000	..	..	..
1898	13,600,000	2,750,000	.	..	..
1899	12,210,000	2,486,000	6,474,000	1,548,000	2,989,000
1900	11,200,000	2,700,000	..	..	..
1901	14,500,000	3,000,000	..	..	..

[a] Does not agree with the *Corn Trade Year-Book.*

Exports.

(*From Estadistica general del comercis exterios de España.*)

Year.	Wheat.	Rye.	Barley.	Flour.	Maize.
	Qrs. 480.	Qrs. 480.	Qrs. 400.	Sacks, 280 lb.	Qrs. 480.
1885	..	..		169,628	
1886	2,800	2,100	1,400	165,078	.
1887	3,459	7,157	1,562	120,317	9
1888	933	8,004	7,023	141,323	142
1889	700	4,200	3,100	184,828	450
1890	3,200	3,000	800	250,769	150
1891	2,500	62,000	20	290,427	200
1892	100	114,400	20	14,101	200
1893	150	700	2,900	7,204	150
1894	1,500	1,300	700	104,161	5,200
1895	500	25,100	400	291,999	4,100
1896	2,300	16,000	200	456,849	26,600
1897	300	1,000	100	392,163	48,700
1898	12,200	1,100	293,300	125,500	2,500
1899	250	5,400	54,700	12,800	40
1900	250	400	800	13,300	50
1901	40	40	800	3,500	50

Imports.

Year.	Wheat.	Rye.	Barley.	Maize.	Flour.
	Qrs. 480.	Qrs. 480.	Qrs. 400.	Tons, 2240.	Sacks, 280.
1885	515,609	..	..	..	..
1886	689,319	..	..	..	89,300
1887	1,444,818	..	..	..	190,658
1888	1,119,060	..	.	..	281,405
1889	668,435	..	..	..	241,300
1890	737,784	..	..	..	200,600
1891	713,469	..	..	..	33,100
1892	638,493	..	..	..	39,800
1893	1,925,868	..	..	..	56,400
1894	1,954,199	..	.	..	59,300
1895	932,305	..	..	..	14,900
1896	862,288	..	..	..	2,300
1897	651,953	..	..	..	13,500
1898	273,100	13,200	11,500	459,500	22,000
1899	1,714,500	3,700	3,900	241,500	173,900
1900	1,022,400	3,500	54,500	232 400	39.300
1901	674,100	263 000	77,000	312,000	22.500

Portugal (population, 5,428,800, including the Islands; census 1900).—Agricultural statistics are not easily obtainable for this country, and we have to take an estimate of M. Louis Grandeau of the year 1892 as our authority for the acreage and the average yield per acre.

	Acreage.	Total Crop.	Yield per Acre.
		Bushels.	Bushels.
Wheat	642,000	8,512,000	13·1
Maize	1,285,000	20,225,000	15·9
Rye	667,000	6,640,000	10·0
Barley	143,000	1,986,000	13·7
Oats	30,000	425,000	14·1
Potatoes . . .	74,000	8,211,700	111·0

All these yields are meagre in comparison with those of Northern Europe, but they seem about correct in relation to Spanish and Italian. The consumption of wheat in Portugal is small, working out at only $2\frac{1}{2}$ bushels per head; the cereal constituting the people's chief food being maize, of which it is estimated that between 6 and 8 bushels per head are used annually. The following tabular statements show the production, exports, and imports of the chief

cereals for a number of years. The chief ports of entry for wheat are Oporto and Lisbon, and the principal source of supply the United States of America.

PRODUCTION.

(*From the Corn Trade News.*)

Year.	Wheat.	Year.	Wheat.
	Qrs. 480.		Qrs. 480.
1890	810,000	1896	750,000
1891	875,000	1897	1,200,000
1892	800,000	1898	1,100,000
1893	750,000	1899	800,000
1894	1,250,000	1900	1,000,000
1895	800,000		

The exports of wheat are unimportant, but some flour is shipped annually.

IMPORTS.

(*From the Estatistica de Portugal.*)

Year.	Wheat.	Maize.	Barley.	Flour.
	Qrs. 480.	Qrs. 480.	Qrs. 400.	Sks. 280.
1890	436,300	75,403	3,982	20,700
1891	517,900	162,978	2,007	30,100
1892	516,900	18,064	150	20,100
1893	665,400	33,823	...	11,300
1894	490,700	72,800	...	...
1895	635,400	45,700	...	...
1896	547,400	28,900	...	...
1897	650,600	63,480	10,320	...
1898	320,620	134,320	10,150	114,000
1899	461,400	376,100	...	...
1900	628,700	328,100	...	...

Portugal imported of oleaginous seeds 322,400 cwts. in 1900, and 263,500 in 1899 ; besides rice 344,900 cwts. in 1900, and 322,300 cwts. in 1899 ; and about 40,000 to 50,000 qrs. beans on an average enter this country.

Sweden (population, 5,136,441 ; census 1900).—Very complete and up-to-date statistics are issued by the Swedish Government, as will be seen from the annexed tabular statements. The acreage under crops is for 1898, the produce statistics being for the following year :—

	Acreage.	Total Crop.	Yield per Acre.
		Bushels.	Bushels.
Wheat	182,000	4,293,000	23·6
Barley	545,000	11,329,000	20·8
Oats	2,033,000	52,038,000	25·6
Rye	1,013,000	20,773,000	20·5
Potatoes	390,000	32,877,000	84·0

The consumption per head of wheat works out at only 1¼ bushels, but of rye it amounts to almost 5 bushels. The great crop, however, is oats, of which nearly 13 bushels per head are raised. The following tabular statements show the production of native, and the trade in foreign cereals for certain years. The largest quantities of wheat come from America, Russia, and Germany. The principal ports for grain are Stockholm and Calmar.

PRODUCTION.

(*From the Jordbruk och Boskapsskötsel.*)

Year.	Wheat.	Rye.	Barley.	Oats.	Potatoes.
	Qrs. 480.	Qrs. 480.	Qrs. 400.	Qrs. 304.	Tons, 2240.
1890	506,000	2,696,000	1,842,000	7,927,000	884,000
1891	551,300	2,754,000	1,681,000	7,164,000	1,279,000
1892	552,400	2,855,000	1,724,000	8,412,000	1,439,000
1893	485,300	2,957,000	1,592,000	6,895,000	1,534,000
1894	541,100	2,301,000	1,788,000	8,469,000	1,092,000
1895	460,000	2,447,000	1,771,000	8,509,000	1,355,000
1896	565,900	2,910,000	1,743,000	6,794,000	1,540,800
1897	553,800	2,858,000	1,732,000	7,083,000	1,359,000
1898	550,100	2,600,000	1,793,000	8,530,000	933,000
1899	500,000	2,375,000	1,625,000	8,125,000	...
1900	650,000	3,000,000	1,875,000	7,250,000	...
a 1901	550,000	2,760,000	1,660,000	7,100,000	...

a Commercial estimate.

EXPORTS.

(*From Utrikes Handel och Sjöfart.*)

Year.	Wheat.	Rye.	Barley.	Oats.	Potatoes.	Flour.
	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.	Tons.	Sks. 280.
1890	70	480	23,200	586,000	30	20,054
1891	92	694	36,000	1,276,000	90	12,221
1892	179	427	22,400	777,000	400	11,698
1893	161	1476	26,100	1,536,000	180	1,394
1894	105	400	22,000	982,000	90	690
1895	40	230	600	545,000	60	745
1896	200	200	30	451,000	200	6,400
1897	60	200	60	149,000	60	17,512
1898	80	200	400	286,900	600	10,880
1899	140	230	870	273,000	..	3,310
1900	155	126	1,400	90,600	...	3,800

IMPORTS.

(*From Utrikes Handel och Sjöfart.*)

Year.	Wheat.	Rye.	Barley.	Oats.	Potatoes.	Wheat Flour.
	Qrs. 8 bush.	Qrs 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.	Tons.	Sks. 280.
1890	263,100	578,300	20,000	37,760	7,680	121,300
1891	330,700	402,500	16,000	14,000	5,300	122,600
1892	543,000	348,200	54,000	10,450	3,400	171,800
1893	557,500	368,900	59,000	11,240	3,600	251,600
1894	708,600	622,000	62,200	20,000	1,760	291,400
1895	494,600	559,000	4,100	23,000	3,200	72,300
1896	551,300	418,800	3,400	41,100	3,400	78,000
1897	509,100	206,100	66,200	101,000	4,020	41,400
1898	608,800	424,800	16,100	60,200	32,200	44,000
1899	721,000	615,700	1,820	146,400	83,471	121,000
1900	704,500	619,700	56,800	383,000	50,000	66,700

Norway (population, 2,231,395 ; census 1901).—As would be expected, this northern kingdom plays but a small part in the international grain trade. In 1890 the areas and yields of the chief crops were as follows :—

	Acreage.	Crop.	Yield per Acre.
		Bushels.	Bushels.
Wheat . .	10,833	256,800	23·8
Rye . . .	33,985	920,800	27·3
Barley . .	127,896	4,104,800	32·0
Oats . .	256,198	9,541,000	37·5

The two years for which complete estimates of the produce are available are 1890 and 1900 :—

	Wheat and Rye combined.	Barley.	Oats.	Potatoes.	Other Corn.
	Qrs.	Qrs.	Qrs.	Bushels.	Qrs.
1890	147,000	513,100	1,192,700	23,212,800	174,600
1900	145,000	475,000	1,154,000	22,216,000	176,000

The imports comprise substantial quantities of rye, barley, wheat flour, and rye meal, and a little wheat. The exports are small, comprising about 5000 quarters of oats and 6000 sacks of rye meal. The chief ports are, Moss (for Christiania), Stavanger, and Bergen. Wheat is imported from Russia and Germany ; rye from Russia, Germany, and United States of America ; flour and rye meal from Germany.

IMPORTS.

(*From Tabeller vedkommende Norges Handel.*)

Year.	Wheat.	Rye.	Barley.	Maize.	Wheat flour.	Rye Meal.
	Qrs. 8 meas. bush.	Qrs. 8 meas. bush.	Qrs. 8 meas. bush.	Qrs. 480.	Sks. 280.	Sks. 280.
1890	31,724	760,000	281,724	4,000	171,430	194,656
1891	54,483	832,069	333,104	9,300	226,700	143,306
1892	37,586	550,690	425,517	12,400	275,868	167,480
1893	10,000	741,379	480,000	7,300	312,050	193,550
1894	20,000	827,586	476,552	1,900	268,600	274,130
1895	42,758	868,965	427,586	5,000	247,112	248,850
	Qrs. 480.	Qrs. 480.	Qrs. 400.			
1896	40,400	908,000	478,800	11,600	281,100	345,600
1897	44,600	873,000	495,000	29,000	243,000	329,300
1898	48,200	921,200	470,400	89,700	270,100	220,100
1899	42,000	885,700	527,500	101,000	260,000	350,000
1900	32,000	836,400	543,600	120,000	340,000	427,000
1901	30,000	927,000	507,000	..	..	..

Denmark (population, 2,464,770; census 1901).—The produce statistics are from *Hosten i Danmark*, and give the yield for 1900, and acreage and yield for 1896 :—

	Acreage.	Crop.	Yield per Acre.
		Bushels.	Bushels.
Wheat . .	84,812	3,550,290	41·9
Barley . .	689,660	20,453,158	29·7
Oats . .	1,083,458	37,078,120	34·2
Rye . . .	716,648	19,328,472	27·0
Potatoes . .	129,185	20,888,942	162·0

This remarkably heavy yield per acre of wheat has always been questioned, for there is no other country in the world that has succeeded in raising its yield per acre, over a wide area, above 34 bushels; and it is thought that some mistake has crept in among the area or the produce statistics for the year 1896. The consumption of cereals per head in Denmark during recent years has averaged about $2\frac{1}{3}$ bushels of wheat and $8\frac{1}{2}$ bushels of rye.

The following tabular statement shows the production of native, and the trade in foreign, grain and flour for a number of years.

PRODUCTION.

(*From Hosten i Danmark.*)

Year.	Wheat.	Rye.	Barley.	Oats.	Potatoes.
	Qrs. of 8 bush.	Qrs. of 8 bush.	Qrs. of 8 bush.	Qrs. of 8 bush.	Tons, 2240 lb.
1890	454,100	2,046,400	2,821,900	4,489,200	299,800
1891	502,000	2,351,000	2,724,700	4,142,800	346,000
1892	512,800	2,452,000	2,974,900	4,902,700	453,500
1893	464,100	2,363,400	2,081,200	3,350,500	518,100
1894	392,500	2,002,000	2,579,100	4,611,300	397,300
1895	417,100	2,213,700	2,622,200	4,841,200	497,200
1896	443,800	2,420,100	2,556,600	4,634,800	522,200
1897	418,000	2,180,000	2,306,000	4,238,000	485,400
1898	359,000	1,941,000	2,631,000	4,990,000	398,900
1899	439,000	2,250,000	2,625,000	4,375,000	..
1900	400,000	2,375,000	2,370,000	3,911,000	..
1901	300,000	2,200,000	2,570,000	4.500,000	..

EXPORTS.

(*From Danmark's Vareindforsel og udforsel.*)

Year.	Wheat.	Rye.	Barley.	Oats.	Maize.	Flour.
	Qrs. 480.	Qrs. 480.	Qrs. 400.	Qrs. 304.	Qrs. 480.	Sacks, 280.
1890	130,800	23,500	202,300	6,200	50,000	139,700
1891	115,200	71,500	227,200	17,900	25,700	137,000
1892	181,000	149,000	175,300	10,300	73,600	116,600
1893	122,000	64,300	205,000	60,100	41,000	82,200
1894	65,600	75,300	297,500	5,600	37,100	57,200
1895	44,400	41,700	123,300	3,800	14,200	33,800
1896	66,700	21,700	223,000	1,800	27,400	38.900
1897	100,400	11,600	204,100	10,800	257,000	47,600
1898	110,600	32,700	264,700	11,000	278,000	53,500
1899	36,400	19,100	283,100	9,500	244,400	20,000
1900	105,500	17,400	233,000	25,000	102,000	51,600

IMPORTS.

Year.	Wheat.	Rye.	Barley.	Oats.	Maize.	Flour.
	Qrs. 480.	Qrs. 480.	Qrs. 400.	Qrs. 304.	Qrs. 480.	Sacks, 280.
1890	188,700	353,200	83,000	201,800	605,700	23,700
1891	358,000	436,000	79,500	183,600	187,700	48,300
1892	218,000	130,000	76,500	172,700	699,600	62,200
1893	331,000	224,400	254,600	126,600	388,000	72,400
1894	367,000	526,800	1,159,700	141,200	278,000	104,000
1895	333,200	638,400	992,100	192,800	226,600	115,600
1896	288,400	440,600	250,900	185,200	1,011,700	112,400
1897	268,000	349,600	308,200	139,700	2,310,700	97,400
1898	344,000	413,600	300,000	95,200	2,514,200	135,600
1899	344,500	412,600	131,100	99,300	2,362,700	187,000
1900	281,600	429,200	57,000	215,400	2,020,000	145,300

The chief port for grain is Copenhagen, and the principal sources of supply are Germany, Russia, and the United States of America, for wheat and flour; Russia and Germany for rye; Russia for barley; and America for maize, of which immense quantities are annually imported.

Switzerland (population, 3,313,817; census 1900).—There are no official returns for the areas under crops, but the trade statistics are quite complete and up to date. The consumption per head of wheat during the period 1896–1900 averaged nearly 6 bushels, and of rye rather over 6 bushels; but probably the great number of tourists who visit Switzerland in the summer disturbs these calculations slightly. The crops of Switzerland are usually estimated at between 500,000 and 600,000 qrs. of wheat, 2,500,000 qrs. of rye, 1,800,000 qrs. of barley, and 8,500,000 qrs. of oats. The exports are only trifling, but the imports are considerable, as will be seen from the following statement :—

IMPORTS.

(*From Official Trade Statistics.*)

Year.	Wheat.	Rye.	Barley.	Oats.	Maize.	Flour.
	Qrs. 480.	Qrs. 480.	Qrs. 400.	Qrs. 304.	Qrs. 480.	Sks. 280.
1890	1,516,924	21,200	79,204	350,905	160,442	165,643
1891	1,574,565	14,700	74,697	402,424	156,050	181,509
1892	1,414,952	11,700	76,262	406,586	178,652	188,226
1893	1,534,652	21,400	91,428	452,789	240,390	210,973
1894	1,651,043	26,800	74,011	455,210	137,932	225,917
1895	1,728,354	36,000	69,273	557,725	127,105	268,005
1896	1,940,367	45,000	62,292	640,003	201,688	343,497
1897	1,622,357	33,100	53,500	642,540	276,703	319,071
1898	1,583,400	27,000	59,100	627,800	202,300	276,700
1899	1,751,100	..	49,800	675,300	293,300	335,400
1900	1,646,200	..	49,400	650,600	230,300	234,800
[a] 1901	1,700,000	.	43,000	700,000	220,000	240,000

[a] Cereal year.

As Switzerland has no seaboard, the foreign grain is brought from the ports of other countries in bond, and received at Basel, Zürich, and other frontier towns from Rotterdam, Marseilles, Genoa, &c. The chief sources of supply are Russia for wheat and oats, and France for flour.

Greece (population, 2,433,806; census 1896).—According to the estimates of the *Corn Trade Year-Book*, the wheat crop has steadily diminished. in size, until it amounted in 1900 to only about one-third of what it was in 1890 :—

Wheat Crop in Quarters.

1890.	1891.	1892.	1893.	1894.	1895.
850,000	1,000,000	940,000	900,000	620,700	450,000
1896.	**1897.**	**1898.**	**1899.**	**1900.**	**1901.**
600,000	400,000	400.000	200,000	300,000	400,000

The imports of wheat now amount to about 700.000 quarters annually, so that the indicated per capita consumption is $3\frac{1}{3}$ bushels. The exports are insignificant.

The Piræus is the port where most of the foreign grain arrives. The plains of Thessaly are where the major part of the native wheat crop is raised.

Mexico (population, 13,545,462; census 1900).—The production is estimated as follows :—

PRODUCTION.

Year.	Wheat.	Barley.	Maize.	Year.	Wheat.	Barley.	Maize.
	Qrs. 480.	Qrs. 8 bush.	Qrs. 8 bush.		Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.
1890	1,500,000	..	..	1895	1,700,000	..	..
1891	1,500,000	..	..	1896	1,900,000	.	..
	Qrs. 8 bush.			1897	1,212,000	1,074,600	14,812,600
1892	1,705,500	631,700	9,112,600	1898	2,000,000	..	..
1893	2,100,000	..	..	1899	2,000,000	.	..
1894	2,500,000	..	..	1900	2,000,000	.	.

The imports chiefly consist of maize from America, amounting occasionally to 1,000,000 quarters. The exports are only trifling.

South Africa.—The cultivation of cereals is not carried on in any of the South African colonies with great success. The statistics for Cape Colony and Natal are as follows :—

Cape Colony (population, 2,265,556; estimated December 1899).—

PRODUCTION.

(*From Statistical Register of the Colony of the Cape of Good Hope.*)

Year.	Wheat.	Rye.	Barley.	Oats.	Maize.	Potatoes.
	Qrs. of 8 meas. bush.	Qrs. of 8 meas. bush.	Qrs. of 8 meas. bush.	Qrs. of 8 meas. bush.	Qrs. 480	Tons, 2240 lb.
1893	486,362	68,386	127,885	204,639	341,720	23,489
1894	374,817	70,049	96,300	171,568	201,194	22,763
1895	308,086	..	83,129	122,168	346,800	20,030
1896	266,463	75,787	82,774	203,667	81,147	17,872
1897	263,223	..	96,124	113,054	232,648	23,803
[a] 1898	243,853	35,959	113,490	180,919	257,593	27,079
[b] 1899	277,600	..	103,800	226,300	257,200	30,000
1900	500,000	..	..	..	..	..

[a] In this year is included the old colony and native territories.

[b] Estimated.

Natal (population, 902,365; census 1898).—

PRODUCTION.

(*From Statistical Year-Book of the Colony of Natal.*)

Harvested Dec.-Jan.	Wheat.	Barley.	Oats.	Maize.	Potatoes.
	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.	Qrs. 8 bush.	Tons, 2240.
1890–91	1,040	250	3,190	88,400	4,910 [a]
1891–92	770	410	2,650	97,040	8,290 [a]
1892–93	1,070	290	3,300	104,900	10,000 [a]
1893–94	1,300	460	6,600	73,800	14,100 [a]
1894–95	1,300	570	5,700	96,200	6,600 [a]
1895–96	770	740	3,000	51,200	6,600 [a]
1896–97	1,100	830	5,700	85,000	11,300 [a]
1897–98	760	1,100	4,100	77,600	6,400 [a]
1898–99	...	...	...	...	...
1899	..	...	...	...	...

[a] These figures relate to cultivation by European population only, and include sweet potatoes.

China (population, including dependencies, 400,000,000; estimate).—Very little has ever been published on the agricultural productions of this country. The cereal crops, whatever their quantity, are sufficient to provide for the populations of most of the Chinese provinces; but there are no reserves, and whenever a bad harvest occurs, famine immediately sets in. The following statistics are taken from *Returns of Trade* for 1898, printed at Shanghai:—Imports: wheat, 42,412 quarters; flour, 203,773 sacks; beans, 776,000 quarters. Exports: wheat, 40,749 quarters; flour, 22,778 sacks; beans, 1,805,781 quarters. In 1897 the imports of beans amounted to 568,611 quarters, but no figures are given for flour or wheat. Hong Kong is credited with importing about 800,000 sacks of flour per annum from America.

Korea (population, 17,000,000; census 1897).—In 1898 the exports amounted to £7000 worth of wheat, £111,000 worth of beans, and £278,000 worth of rice; the imports to £44,000 worth of millet and £39,000 worth of rice.

Trinidad.

IMPORTS.

(*From Statistical Abstract for the several Colonial and other Possessions of the United Kingdom.*)

Year.	Flour.	Year.	Flour.
	Sacks, 280.		Sacks, 280.
1885	75,047	1893	107,273
1886	79,351	1894	116,379
1887	72,902	1895	105,626
1888	78,263	1896	109,239
1889	81,994	1897	102,632
1890	84,816	1898	118,790
1891	86,106	1899	130,100
1892	95,313	1900	128,000

Newfoundland.

IMPORTS.

Year.	Oats.	Flour.
	Qrs. of 8 meas. bush.	Sacks, 280 lb.
1885	...	212,585
1886	...	261,795
1887	...	239,673
1888	16,900	273,762
1889	12,300	229,877
1890	10,100	221,659
1891	19,800	256,447
1892	No returns.	No returns.
1893	22,200	257,564
1894	20,300	236,500
1895	20,500	242,572
1896	18,200	254,046
1897	...	257,570
1898	...	255,850
1899	...	290,000

Mauritius.

IMPORTS.

(*From Statistical Abstract for the several Colonial and oth Possessions of the United Kingdom.*)

Year.	Wheat.	Oats.	Wheat Flour.
	Qrs. 8 bush.	Qrs. 8 bush.	Sacks 280.
1885	8,600	34,601	39,582
1886	18,100	41,869	46,755
1887	8,581	27,413	43,576
1888	2,102	21,200	49,000
1889	7,742	43,000	51,500
1890	2,150	32,000	56,800
1891	1,219	32,951	64,140
1892	300	32,190	55,252
1893	644	32,298	83,668
1894	1,300	29,900	77,100
1895	1,700	30,500	73,100
1896	500	55,400	77,300
1897	300	...	60,000
1898	600	...	56,000
1899	1,500	...	53,000
1900	2,300	...	50,000

Malta (including Gozo and Comino).

PRODUCTION.

(*From Returns of Board of Agriculture for Great Britai and Colonies.*)

Year.	Wheat.	Barley.	Mixed Grains.	Beans.
	Qrs. of 8 meas. bush.	Qrs. of 8 meas. bush.	Qrs. 480.	Qrs. 480.
1885	14,917	6368	11,200	3800
1886	13,347	4799	11,000	6200
1887	20,148	9588	13,500	5000
1888	20,500	7600	13,900	6800
1889	23,700	9100	12,700	6200
1890	24,000	7600	10,200	5100
1891	20,900	6200	11,100	4700
1892	19,900	6400	9,800	4600
1893	19,400	6500	10,800	4800
1894	21,500	6100	...	...
1895	19,000	5700	...	..
1896	21,600	6900	...	...
1897	16,300	5400	...	...
1898	20,800	7900	...	...

Jamaica.

IMPORTS.

(*From Statistical Abstract for the several Colonial and other Possessions of the United Kingdom.*)

Year.	Flour.	Maize or Indian Corn
	Sacks, 280.	Qrs. 8 bush.
[a] 1885	89,753	6,100
[a] 1886	93,625	7,800
[a] 1887	80,628	10,400
[a] 1888	93,773	11,300
[a] 1889	107,569	13,500
[b] 1890	125,379	26,600
[b] 1891	121,651	22,294
[b] 1892	124,057	23,585
[b] 1893	118,125	26,859
[b] 1894	128,956	31,200
[b] 1895	141,586	38,600
[b] 1896	120,200	40,100
[b] 1897	103,331	38,300
[b] 1898	94,360	36,600
[b] 1899	107,000	34,000
[b] 1900	103,000	30,000

[a] Year ended 30th September.
[b] Year ended 31st March.

Java.

Imports.

(*From Jaarboek der Kolonier Koningrijk der Nederlanden.*)

Year	Wheat.	Flour.	Year.	Wheat.	Flour.
	Qrs. of 8 bush.	Sacks, 280.		Qrs. of 8 bush.	Sacks, 280.
1885	102	39,147	1893	42	60,000
1886	372	31,029	1894	100	61,700
1887	446	36,761	1895	200	69,700
1888	49	30,840	1896	...	61,800
1889	49	35,722	1897	...	70,800
1890	14	39,848	1898	...	60,000
1891	7	41,000	1899	...	71,900
1892	15	60,500			

British Guiana.

Imports.

(*Statistical Abstract for the several Colonial and other Possessions of the United Kingdom.*)

Year.	Oats.	Flour.	Potatoes.
	Qrs. 8 bush.	Sacks, 280.	Tons, 2240.
1885	12,080	99,160	4518
1886	8,940	87,072	2293
1887	12,700	100,083	3168
1888	9,400	105,179	...
1889	13,200	116,450	...
1890	13,000	112,623	...
1891	15,119	118,882	...
1892	11,471	135,224	...
1893	12,647	143,783	...
1894	15,900	142,355	...
1895	12,900	122,826	...
1896	13,800	102,328	...
1897	10,000	107,919	...
1898	11,000	124,390	...
1899	11,300	144,000	...
1900	12,700	103,000	...

Barbadoes.

Exports.

(*Statistical Abstract for the several Colonial and other Possessions of the United Kingdom.*)

Year.	Flour, Wheat, or Rye.	Year.	Flour, Wheat, or Rye.
	Sacks, 280.		Sacks, 280.
1885	23,401	1893	13,000
1886	18,605	1894	16,248
1887	21,659	1895	12,635
1888	21,387	1896	9,643
1889	21,737	1897	10,840
1890	14,166	1898	16,240
1891	15,705	1899	14,000
1892	12,705	1900	13,800

Imports.

(*Same authority as Exports.*)

Year.	Oats.	Flour, Wheat, or Rye.	Grain and Corn.
	Qrs. 304.	Sacks, 280.	Qrs. of 8 bush.
1885	18,500	50,697	41,716
1886	17,400	51,851	34,200
1887	19,300	51,672	30,834
1888	14,300	49,587	27,677
1889	21,700	52,511	41,830
1890	17,500	50,747	34,756
1891	24,600	50,173	48,935
1892	20,100	51,989	34,529
1893	21,600	48,762	38,704
1894	25,400	63,690	53,213
1895	16,400	44,090	37,123
1896	19,300	39,557	37,750
1897	...	38,562	38,109
1898	...	47,390	45,900
1899	...	50,000	45,000
1900	...	51,000	38,000

Import Duties.

Statement showing the rates of import duty levied on grain and flour, and in force June 1901, *according to the Board of Trade.*

Tariff Classification.	Rates of Import Duty.			English Equivalents.			
RUSSIA—		Rbl.	cop.		£	s.	d.
Cereals of all kinds (except rice):—							
In the grain . . .	Free.			Free.			
Flour (except potato flour)	Poud gross	8	45	Cwt.	0	2	8
SWEDEN—		Kron.	ore.				
Rye, Wheat, Maize, Barley, not ground .	100 kilos	3	70	Cwt.	0	2	1
Oats ,, . . .	Free.			Free.			
Flour of all kinds, not ground	100 kilos	6	50	Cwt.	0	3	8
NORWAY—							
Cereals not ground :—		Kron.	ore.				
Buckwheat	Free.			Free.			
Barley	100 kilos	0	22	Cwt.	0	0	1⅓
Oats	Free.			Free.			
Wheat	100 kilos	0	60	Cwt.	0	0	4
Rye	Free.			Free.			
Cereals ground :—							
Groats : Buckwheat. .	100 kilos	0	50	Cwt.	0	0	3½
Barley, whole or split and pearled barley groats	,,	0	50	,,	0	0	3½
Oats	,,	0	60	,,	0	0	4
Wheat, including Semolina and Cabanca grits	,,	0	15	,,	0	0	1
Flour of Barley . . .	,,	0	50	,,	0	0	3½
,, Buckwheat and Rye	,,	[a] 0	30	,,	[a] 0	0	2
,, Maize, and Maize-meal of all kinds .	,,	0	30	,,	0	0	2
Flour of Oats . . .	,,	0	60	,,	0	0	4
,, Wheat . . .	,,	2	00	,,	0	1	1½
SPAIN—		Pes.	c.				
Wheat	100 kilos	8	00	Cwt.	0	3	3
Wheat-flour	,,	13	20	,,	0	5	4
Millet	,,	3	20	,,	0	1	3¼
Flour of millet . . .	,,	4	80	,,	0	1	11½
Other cereals (except rice) .	,,	4	40	,,	0	1	9½
Flour of the same . .	,,	7	15	,,	0	2	11
SWITZERLAND—		Frc.	c.				
Wheat, Barley, Oats, Rye .	100 kilos	0	30	Cwt.	0	0	1½
Flour of cereals . . .	,,	2	00	,,	0	0	9¾
ITALY—		Lire.	c.				
Wheat	100 kilos	7	50	Cwt.	0	3	0½
Rye	,,	4	50	,,	0	1	10
Oats	,,	4	00	,,	0	1	7½
Barley	,,	4	00	,,	0	1	7½
Maize	,,	7	50	,,	0	3	0½
Flour of Wheat . . .	,,	12	30	,,	0	5	0
,, Rye . . .	,,	6	50	,,	0	2	7¾
,, Barley or Oats .	,,	6	00	,,	0	2	5¼
,, Maize . . .	,,	9	50	,,	0	3	11½
AUSTRIA-HUNGARY—		Fl.	kr.				
Maize	100 kilos	0	50	Cwt.	0	0	6
Barley, Oats. . . .	,,	0	75	,,	0	0	9¼
Wheat, Spelt, and Rye .	,,	1	50	,,	0	1	6¼
Flour of cereals . . .	,,	3	75	,,	0	3	9½
UNITED STATES—		$	c.				
Barley	Bus. of 48 lb	0	30	Bus. of 48 lb	0	1	3
Barley pearled, patent or hulled	lb	0	02	Cwt.	0	4	8
Buckwheat	Bus. of 48 lb	0	15	Bus. of 48 lb	0	0	7½
Maize	Bus. of 56 lb	0	15	Bus. of 56 lb	0	0	7½
Corn-meal	Bus. of 48 lb	0	20	Bus. of 48 lb	0	0	10
Oats	Bushel	0	15	Bushel	0	0	7½
Oatmeal and Rolled Oats .	lb	0	01	Cwt.	0	4	8
Oat hulls	Per 100 lb	0	10	Cwt.	0	0	5½
Rye	Bushel	0	10	Bushel	0	0	5
Rye-flour	lb	0	00½	Cwt.	0	2	4
Wheat	Bushel	0	25	Bushel	0	1	0½
Wheat-flour	25 per cent. *ad. val.*			25 per cent. *ad. val.*			
GERMANY—		M.	pf.				
Wheat	100 kilos	3	50	Cwt.	0	1	9¼
Rye	,,	3	50	,,	0	1	9¼
Oats	,,	2	80	,,	0	1	5
Buckwheat	,,	2	00	,,	0	1	0¼
Barley	,,	2	00	,,	0	1	0¼
Maize	,,	1	60	,,	0	0	9¾
Flour of cereals . . .	,,	7	30	,,	0	3	8½
HOLLAND—							
Grain and Flour . . .	Free.			Free.			
BELGIUM—							
Wheat, Rye, Barley, Buckwheat, Maize . .	Free.	Frc.	c.	Free.			
Oats	100 kilos	3	00	Cwt.	0	1	2¾
Flour of Oats . . .	,,	4	00	,,	0	1	7½
,, other . . .	,,	2	00	,,	0	9	9½

[a] Rye flour imported through the custom-houses of Hammerfest, Vardö, and Vadsö is free.

IMPORT DUTIES (*continued*).

Tariff Classification.	Rates of Import Duty.	English Equivalents.
FRANCE—		
Wheat, Spelt, and Maslin:—	Frc. c.	
Grain	100 kilos, gross 7 00	Cwt. gross 0 2 10
Crushed and grist containing more than 10 per cent. of Flour	100 kilos, net 11 00	Cwt. net 0 4 6
Flour:—		
At the rate of extraction of 70 per cent. and above	„ 11 00	„ 0 4 6
At the rate of extraction between 60 and 70 per cent.	„ 13 50	„ 0 5 6
At the rate of extraction of 60 per cent. and below	„ 16 00	„ 0 6 6
Oats, Barley, Rye, and Maize:—		
Grain	100 kilos, gross 3 00	Cwt. gross 0 1 2½
Flour	„ 5 00	„ 0 2 0½
Buckwheat:—		
Grain	„ 2 50	„ 0 1 0¼
Flour	„ 4 00	„ 0 1 7

Note.—In the case of countries having a differential tariff the rates given are those leviable on imports of British produce from the United Kingdom. (G. J. S. B.)

Gramont, Antoine Agénor Alfred, DUC DE (1819–1880), French statesman, was born at Paris on the 14th of August 1819, and came of an old aristocratic family. After the usual educational course he entered upon a diplomatic career. In 1848 he married a Scottish lady, Miss Mackinnon. After the *Coup d'état* of 2nd December 1851 he began to rise with the fortunes of Louis Napoleon, who was his personal friend, and he was employed upon various diplomatic missions. In 1857 he was sent as ambassador to Rome. The creation of the kingdom of Italy, as the result of the campaign of 1859, caused his position at the Papal court to become extremely embarrassing. He was consequently recalled to France, and from 1861 to 1870 he was ambassador at Vienna. On 16th May 1870 he was appointed minister of foreign affairs in the Ollivier cabinet. In this capacity he incurred much obloquy by forcing on the war with Germany. The duc de Gramont first announced to the king of Prussia that the candidature of Prince Leopold of Hohenzollern for the throne of Spain could not be permitted; and then, after the prince withdrew, he insisted that no member of the Prussian family should be put forward in his stead. Germany refused to give any such pledge, which she described as an utterly unnecessary and humiliating demand, and this led to the declaration of war by France in July. In the French legislative body, on 11th July, the duc de Gramont said, "Up to the present all the European cabinets appear to admit the legitimacy of our complaints." This was promptly contradicted, so far as Great Britain was concerned, by Earl Granville, who added, however, that Great Britain had exerted her influence for the preservation of peace. On 15th July M. Ollivier in the legislative body, and the duc de Gramont in the Senate, announced that France was at war. After the revolution of September the duc de Gramont fled to England. In 1872 he published a defence of his conduct under the title of *La France et la Prusse avant la Guerre*. Soon afterwards he returned to France, where he devoted himself to financial undertakings. He died in Paris on 18th January 1880. (G. B. S.)

Granada, a maritime province of Southern Spain. Its area is 4937 square miles, divided into fifteen administrative districts and 205 parishes. The province is still badly off for means of communication, having only one railway from Granada to Bobadilla, the junction with the lines to Cordoba, Malaga and Ronda, Seville and Algeciras, in all 57 miles. The roads also are in a very incomplete and unsatisfactory condition. The sugar-cane and beetroot industries have been developed with excellent results, and they have further increased since the loss of the West Indian colonies and the Philippines. The sugar factories are at Loja, Antequera, Flora, Motril, Salobreña, and the Vega of Granada. There are also tanneries, foundries, and manufactories of woollen, linen, cotton, and rough frieze stuffs, cards, soap, liqueurs, gunpowder, brandy, and machinery. Its ports on the Mediterranean are Motril, Almuñecar, Albuñol. The official records show forty-three mines productive and 758 unproductive. The former give occupation to about one thousand hands, and in 1898 turned out 49,688 tons of coal. The province is one of the richest in live stock, especially mountain sheep and goats. The figures for 1897 are 10,052 horses, 38,314 mules, 38,630 asses, 18,466 cattle, 328,180 sheep, 108,272 goats, and 51,634 pigs. At the same time 111,000 acres were devoted to wheat, 76,000 acres to barley, 75,500 acres to rye and oats, 12,000 acres to pod fruit, 35,000 acres to beans and garbanzos, 13,000 acres to vines, and 52,000 acres to olives. Population (1887), 484,341; (1897), 477,768.

Granada, the capital of the above province. Few cities in Spain have more educational establishments. Besides the university there are an institute for higher instruction, a training school for teachers, a school of fine arts, and twenty-two primary schools. The provincial library is now practically empty. There are archæological and painting museums, besides that of the Alhambra; also a royal central seminary, an ecclesiastical college, twelve hospitals and orphanages for both sexes, and in one of the convents a leper hospital. Granada has some thriving local industries—manufactures of liqueurs, paper, soap, and coarse woollen and linen stuff—and an active trade in agricultural products from the fertile Vega. Population (1887), 73,000; (1897), 75,054.

Granada, a city of Nicaragua, Central America. It is situated on the north-west shore of Lake Nicaragua, 32 miles N.W. of Managua, the capital of the republic, with which it is now connected by rail. The journey to the Pacific port of Corinto now occupies only about twelve hours—by steamer on Lake Managua to Momotombo, and thence to Corinto by rail 58 miles. From the railway station of Granada at the wharves on Lake Nicaragua there is a tramway to the market buildings one mile distant. There is an ice factory established, but the special industry of the city is the manufacture of "Panama chains," made of gold wire. In the environs are large cacao plantations. Population, 19,000.

Grand Bassa. See LIBERIA.

Grand Forks, capital of Grand Forks county, North Dakota, U.S.A., on the western bank of the Red River, and on the Northern Pacific and the Great Northern railways, at an altitude of 830 feet. It is in the midst of the great Red River valley wheat region, and much of its business consists in the handling of wheat. Population (1880), 1705; (1890), 4979; (1900), 7652, of whom 2781 were foreign-born.

Grand Island, capital of Hall county, Nebraska, U.S.A., in 40° 56′ N. and 98° 21′ W., on the broad, level bottom-lands of the Platte river, at an altitude of 1866 feet. The plan is regular, the broad streets running at angles of 45° with the compass points. It has three railways, the Union Pacific, the Burlington and Missouri River, and the St Joseph and Grand Island. It is the seat of Grand Island College, a Baptist co-educational institution, founded in 1892. This had, in 1899, 10 instructors and 125 students. The city is in a rich agricultural region, and its principal business consists in handling grain and cattle. It contains works of the Union Pacific

Railway. Population (1880), 2963; (1890), 7536; (1900), 7554, of whom 1339 were foreign-born and 38 negroes.

Grand Junction, capital of Mesa county, Colorado, U.S.A., in the broad desert valley of Grand River, at the mouth of the Gunnison, at an altitude of 4579 feet. The Grand River valley, when irrigated, is extremely fertile, and produces vast quantities of fruit, which is handled here. It is also the meeting-point of the Colorado Midland, the Rio Grande Western, and two branches of the Denver and Rio Grande Railway. Population (1880), 859; (1890), 2030; (1900), 3503, of whom 358 were foreign-born and 52 negroes.

Grand Rapids, capital of Kent county, Michigan, U.S.A., in 42° 58′ N. and 85° 40′ W., at the rapids in Grand River, at an altitude of 610 feet. The city is regularly laid out, is divided into twelve wards, is well paved, largely with asphalt and wooden blocks, and has a municipal water supply. It is entered by six railways, affording communication in all directions and giving the city a large commerce. Grand Rapids is a manufacturing city of great importance, which is due in no small part to the water power in Grand River. In 1890 there were 869 manufacturing establishments, with a capital of $15,945,947, employing 13,282 hands, and with a product valued at $19,851,181. The leading products were furniture, valued at $5,638,916; flour, $1,558,845; and lumber, $2,319,495. In the manufacture of furniture this city is one of the foremost in the United States. The assessed valuation of real and personal property in 1900 was $43,264,021, the net debt of the city $1,889,824, and the rate of taxation $20·42 per $1000. Population (1880), 32,016; (1890), 60,278; (1900), 87,565, of whom 23,896 were foreign-born and 604 negroes. The death-rate in 1900 was 14·4.

Grangemouth, a police burgh and seaport of south-east Stirlingshire, Scotland, near the confluence of the rivers Carron and Forth, 3 miles east-north-east of Falkirk. Standing at the entrance to the Forth and Clyde Canal, it is one of the most important harbours in Scotland. The docks cover an area of 28 acres, and there are timber basins covering 32 acres, the total quayage being 2290 yards. A large extension is being carried out at an estimated cost of £1,000,000. The new docks will be 200 acres in extent, with an entrance 15 feet deep in the Forth. At the end of 1898, 55 vessels of 15,589 tons were registered. In 1888, 1962 vessels of 721,724 tons entered; in 1898, 2389 vessels of 1,089,166 tons entered. Imports rose in value from £1,902,753 in 1888 to £2,416,452 in 1898; and exports from £705,740 in 1888 to £2,153,368 in 1898. Timber, pig-iron, and iron ore are the principal imports, while 662,027 tons of coal were exported in 1888, and 1,479,946 in 1898. There is a shipbuilding yard and various accompanying industries. Grangemouth has regular steamer communication with London, Christiania, Hamburg, Rotterdam, and Amsterdam. There is a "classic" town hall, a public institute, a free library, and a public park. Population (1901), 7968.

Grant, Sir Alexander, 8th Bart. (1826–1884), British scholar and educationalist, was born in New York, 13th September 1826. After an early childhood spent in the West Indies, where his father owned property, he was educated at Harrow and Oxford. He entered Oxford as scholar of Balliol, and subsequently held a Fellowship at Oriel from 1849 to 1860. He made a special study of the Aristotelian philosophy, and in 1857 published an edition of the *Ethics* (4th ed. 1885) which became a standard text-book at Oxford. In 1855 he was one of the examiners for the Indian Civil Service, and in 1856 a Public Examiner in Classics at Oxford. In the latter year he succeeded to the baronetcy. About the same time he married the daughter of Professor Ferrier of St Andrews. In 1859 he went to Madras with Sir Charles Trevelyan, and was appointed Inspector of Schools; the next year he removed to Bombay, to fill the post of Professor of History and Political Economy in the Elphinstone College. Of this he became Principal in 1862; and, a year later, Vice-Chancellor of Bombay University, a post he held from 1863 to 1865 and again from 1865 to 1868. In 1865 he took upon himself also the duties of Director of Public Instruction for Bombay Presidency. In 1868 he was appointed a member of the Legislative Council. In the same year, upon the death of Sir David Brewster, he was offered and accepted the post of Principal of Edinburgh University, which had conferred an honorary LL.D. degree upon him in 1865. From that time till his death (which occurred in Edinburgh, 30th November 1884) his energies were entirely devoted to the well-being of the University, his zeal in connexion with which was fully recognized. The institution of the Medical School in the University was almost solely due to his initiative; and the Tercentenary Festival, celebrated in 1884, was the result of his wisely directed enthusiasm. In that year he published *The Story of the University of Edinburgh during its First Three Hundred Years*. He was created Hon. D.C.L. of Oxford in 1880, and Hon. Fellow of Oriel College in 1882.

(R. F. S.)

Grant, James (1822–1887), British novelist, was born in Edinburgh, 1st August 1822, being the son of a military officer. Between 1832 and 1839 his father was quartered in Newfoundland, and James Grant was with him. In 1839, however, he returned to England and entered the 62nd Foot as an ensign, but in 1843 he resigned his commission and left the service. He then devoted himself to writing, first magazine articles, but soon a profusion of novels, full of vivacity and incident, and dealing mainly with military scenes and characters. For many years he was a favourite author in this kind. His best stories, perhaps, were *The Romance of War* (his first, 1846), *Bothwell* (1851), *Frank Hilton; or, The Queen's Own* (1855), *The Phantom Regiment* and *Harry Ogilvie* (1856), *Lucy Arden* (1858), *The White Cockade* (1867), *Only an Ensign* (1871), *Shall I Win Her?* (1874). Grant also wrote *British Battles on Land and Sea* (1873–75), and other books of general reading, of which one to which permanent value attaches was his great work, in three volumes, on *Old and New Edinburgh*. In 1875 he became a Roman Catholic. He died on 5th May 1887.

Grant, James Augustus (1827–1892), British traveller and explorer, was born at Nairn in 1827. After a course of study at Marischal College, Aberdeen, he was appointed to the Indian army in 1846, and subsequently rose to be lieutenant-colonel. He served throughout the whole of the Mutiny, and for his services received the Mutiny medal with Lucknow clasp. From 1860 to 1863 he was in Egypt with Captain Speke, exploring the sources of the Nile. On his return he was created C.B., in September 1866. Two years later he served in the Intelligence Department of Lord Napier of Magdala's Abyssinian expedition; for this he was made C.S.I., and was awarded the Abyssinian medal. Shortly after his return from Abyssinia he married. He was awarded the gold medal of the Royal Geographical Society in 1884, and, at various times, distinctions from British and foreign learned societies. He was Justice of the Peace and Deputy-Lieutenant of his native county, and the later years of his life were spent at Nairn. He died at Nairn, 11th February 1892. Besides contributions

to the journals of various learned societies, he published *A Walk across Africa* (1864) and *Khartum as I Saw it in 1863* (1885). (R. F. S.)

Grant, Sir Patrick (1804–1895), British field marshal, was the second son of Major John Grant, 97th Foot, of Auchterblair, Inverness-shire, where he was born on 11th September 1804. He entered the Bengal Native Infantry as ensign in 1820, and became captain in 1832. He served in Oude from 1834 to 1838, and raised the Hariana Light Infantry. Employed in the adjutant-general's department of the Bengal army from 1838 until 1854, he became adjutant-general in 1846. He served under Sir Hugh Gough at the battle of Maharajpur in 1843 (bronze star and a brevet majority), was adjutant-general of the army at the battles of Mudki in 1845 (twice severely wounded), and of Firozshah and Sobraon in 1846 (medal with three clasps, a brevet lieutenant-colonelcy, and a C.B.). He took part in the battles of Chilianwala and Gujarat in 1849 (medal with two clasps, colonel, and aide-de-camp to the Queen). He served also in Kohat in 1851 under Sir Charles Napier (medal with clasp). Promoted major-general in 1854, he was commander-in-chief of the Madras army from 1856 to 1861. He was made K.C.B. in 1857, and on General Anson's death was summoned to Calcutta to take supreme command of the army in India. From Calcutta he directed the operations against the mutineers, sending forces under Havelock and Outram for the relief of Cawnpore and Lucknow, until the arrival of Sir Colin Campbell from England as commander-in-chief, when he returned to Madras. On leaving India in 1861 he was decorated with the G.C.B., and made colonel of the 104th Foot and later of the Seaforth Highlanders. He was promoted lieutenant-general in 1862, was governor of Malta from 1867 to 1872, was made G.C.M.G. in 1868, promoted general in 1870, field marshal in 1883, and colonel of the Royal Horse Guards and gold-stick-in-waiting to the Queen in 1885. He married as his second wife, in 1844, Frances Maria, daughter of Lord (then Sir Hugh) Gough. He was governor of the Royal Hospital, Chelsea, from 1874 until his death there on 28th March 1895. (R. H. V.)

Grant, Robert (1814–1892), British astronomer, was born at Grantown, Scotland, on 17th June 1814. In early youth he exhibited marked ability, but at the age of thirteen the promise of a brilliant career was clouded by a prolonged illness of such a serious character as to incapacitate him from all school-work for six years. At the age of twenty, however, his health greatly improved, and he set himself resolutely, without assistance, to repair the disadvantages of his earlier years, devoting himself to the study of Greek, Latin, Italian, and mathematics. Astronomy also occupied much of his attention at this time, and he was encouraged in the study of this subject by the interest attaching to the return of Halley's comet in 1835, and the annular eclipse of the sun of 15th May 1836, which he successfully observed. After a short course at King's College, Aberdeen, he obtained employment in his brother's counting-house in London, but still devoted his leisure hours to a systematic study of astronomy and mathematics. It was during this period that the idea occurred to him of writing a history of physical astronomy. For some time he had been accumulating materials suitable for such a history, but before definitely commencing the work he had to search, amongst other records, those of the French Academy, and for that purpose took up his residence in Paris in 1845, supporting himself by giving lessons in English. Returning to London in 1847, he devoted the next five years to the preparation of his classic work, *The History of Physical Astronomy from the Earliest Ages to the Middle of the Nineteenth Century*. This was first published in parts in *The Library of Useful Knowledge*, but after the issue of the ninth part this mode of publication was discontinued, and the work appeared as a whole in 1852. The main object of the work is, as expressed by the author, "to exhibit a view of the labours of successive inquirers in establishing a knowledge of the mechanical principles which regulate the movements of the celestial bodies, and in explaining the various phenomena relative to their physical constitution which observation with the telescope has disclosed." The lucidity and completeness with which a great variety of abstruse subjects were treated, the extent of research, and the maturity of judgment it displayed, were remarkable, the more so when we consider that this was the first published work of one who enjoyed no special opportunities, either of acquiring materials or of discussing the subjects it treats of with others engaged in similar pursuits. The book at once attracted the attention of astronomers, and took a leading place in astronomical literature. In 1856 the gold medal of the Royal Astronomical Society was awarded to Grant for his work. In 1859 he succeeded Nichol as professor of astronomy in the University of Glasgow, and took up his residence at the Glasgow Observatory during the following year. From time to time he contributed astronomical papers to the *Monthly Notices*, *Astronomische Nachrichten*, *Comptes Rendus*, and other scientific serials, but his principal work after his appointment to Glasgow consisted in determining the places of a large number of stars with the Ertel transit-circle of the Glasgow Observatory. The results of these labours, extending over a period of twenty-one years, are contained in the *Glasgow Catalogue of 6415 Stars*, published in 1883. This was followed in 1892 by the *Second Glasgow Catalogue of 2156 Stars*, published a few weeks after his death, which took place on the 24th October 1892. (A. A. R*.)

Grant, Ulysses Simpson (1822–1885), American soldier, and eighteenth President of the United States, was born at Point Pleasant, Ohio, 27th April 1822. He was a descendant of Matthew Grant, a Scotsman who settled in Dorchester, Mass., in 1630. His earlier years were spent in helping his father in the work upon his farm in Ohio. In 1839 he was appointed to a place in the military academy at West Point, and it was then that his name assumed the form by which it is generally known. He was christened Hiram, after an ancestor, with Ulysses for a middle name; in those days it was fashionable to call men by Greek and Roman names. As he was usually called by his middle name, the Congressmen who recommended him for West Point supposed it to be his first name, and generously added thereto the name of his mother's family, Simpson. Grant's career at West Point was not especially brilliant; he was the best horseman of his class, and took a respectable place in mathematics, but he only ranked twenty-first in a class of thirty-nine. In September 1854 he went with his regiment to join the forces of General Taylor in Mexico; there he took part in the battles of Palo Alto, Resaca de la Palma, Monterey, Cerro Gordo, and Churubusco, and was at the storming of Chapultepec. He was breveted captain for gallantry. After the close of the war he married, and was for a while stationed in California, but in 1854 he resigned his commission. He had acquired a taste for liquor, which impaired his usefulness and injured his reputation in the army. For the next six years he lived in St Louis, earning a scanty subsistence by dealings in real estate. In 1860 he moved

to Galena, Illinois, and became a clerk in a hardware store kept by his father. At that time his earning capacity seems not to have exceeded 800 dollars a year, and he was regarded by his friends as a broken and disappointed man.

After the outbreak of the Civil War, in the following year, he offered his services to the United States Government, but no heed was paid to him. After some vexatious delay, he obtained from the governor of Illinois a commission as colonel of volunteers, and about the 1st of August he was promoted to the rank of brigadier-general and placed in command of a district of the western department under General John Pope. The Confederate General Polk had occupied the bluffs at Columbus and was threatening to seize the town of Paducah, situated at the confluence of the Tennessee river with the Ohio. It was of the utmost importance that the latter step should be prevented, and Grant, acting on his own responsibility, moved rapidly forward and seized Paducah, 6th September 1861. In November he made a demonstration in Missouri, and fought at Belmont his first battle, in which both sides claimed the victory. Three months later came his first great achievement, when he captured Fort Henry on the Tennessee river and Fort Donelson on the Cumberland. This great victory, in which 15,000 Confederates were taken prisoners, broke through the enemy's first line of defence, and compelled them to fall back upon Corinth in Mississippi. His next military operation was directed against Corinth, where General Sidney Johnston had accumulated an army of about 40,000 men. On arriving at Pittsburg Landing on the Tennessee river, some 20 miles from Corinth, Grant occupied a very strong position on the left bank, intending to hold it until the arrival of General Buell with his army from Nashville. After the junction of the two armies, amounting to more than 70,000 men, it was intended to move in overwhelming force on Corinth.

Battle of Shiloh.

When Johnston learned of Grant's presence at Pittsburg Landing with no more than 40,000 men, he decided to advance suddenly and surprise him, in the hope of winning a victory before Buell's arrival. Circumstances so delayed the operation that Buell's advance division had arrived at Savannah, only 9 miles below Pittsburg Landing, on the evening before the attack was made. There has been much discussion as to whether Grant was really surprised on the Sunday morning, 6th April 1862, when the Confederates charged upon his camp. It is perfectly clear that he was not aware of the presence of Johnston's force in his neighbourhood, and did not expect any attack to be made before the middle of the week. When the firing began on Sunday morning Grant was 9 miles distant at Savannah. The division of Lew Wallace, 7000 men, was at Crump's Landing, 5 miles below the scene of the battle. The position at Pittsburg Landing, where the principal command was exercised by Generals M'Clernand and Sherman, was a strong one, protected on three sides by creeks, which were swollen with backwater from the great river. The open front towards the south-west, marked by a rude meeting-house known as Shiloh, ought to have been protected by earthworks; this precaution, however, had been neglected. Johnston's plan was to attack by his right flank and cut off the Union army from Pittsburg Landing, which would involve its destruction or capture; but his attack was not correctly planned for that purpose. His force was not sufficiently massed upon his right, and his main blow was directed too near the Federal centre. The attack was conducted with magnificent gallantry, but the resistance of the Federal troops was very obstinate, and although their organization was much impaired, it was with great slowness that they were pushed back. About the middle of the forenoon the Union general, Benjamin Prentiss, secured a difficult position, since known as the Hornet's Nest, and maintained it until late in the afternoon despite all the efforts of the Confederates. Early in the afternoon, while assaulting this position, Johnston was killed, and the command devolved upon General Beauregard. At nightfall it was manifest that the Confederate attack had failed. Lew Wallace's division had been greatly delayed in its march by imperfect information, and Nelson's division of Buell's army had been equally delayed by the detestable spring roads, but at nightfall both these divisions arrived upon the battlefield, adding 15,000 fresh men to the Union force; and so many steamboats had now been collected at Savannah that two more of Buell's divisions were comfortably brought up the river during the night. It was evident on Monday that Beauregard's battle was fought, not so much in the hope of victory, as in order to secure an unmolested retreat. This he accomplished. In the afternoon he withdrew his army with much skill, leaving the Federals too weary to pursue. In this great battle more than 20,000 men were killed and wounded, and the Federals lost besides 3000 prisoners. It was an important victory for the Federals, inasmuch as it decided the fate of Corinth; but those who blamed Grant for the surprise were perhaps quite as many as those who praised him for the victory. His position during the summer was a trying one, since Halleck came and took command of the entire force, thus placing Grant second in command, without assigning him any important duties. The campaign was conducted by Halleck with such feebleness that the advantages hitherto gained were in great part thrown away. For the loss of Corinth the Confederates consoled themselves by fortifying Vicksburg and Port Hudson on the Mississippi river, and Chattanooga on the mountainous confines of Tennessee and Georgia. The conquest of

General U. S. Grant.
(From a photograph by F. Gutekunst, Philadelphia.)

these two strongholds employed two great armies during the whole of the year 1863.

In the midsummer of 1862 Halleck was appointed general-in-chief of the armies of the United States, and in that capacity transferred his headquarters to Washington, leaving Grant in command at Corinth. His force had been so depleted by Halleck's scattered operations that the Confederates now made an attempt to drive him down the Tennessee river. The result was seen in the battles of Iuka and Corinth early in October 1862, when the Confederates were defeated by a portion of Grant's force under Rosecrans, for whom the victory won so much reputation that he was appointed to supersede Buell in command of the army in Tennessee. It was the prelude to Grant's first movement against Vicksburg. That city had been fortified and guarded by the Confederates in such wise that it was deemed impregnable, and it might well have been thought so. The place is situated on a steep and lofty bluff at the junction of the Yazoo river with the Mississippi. The latter flows in a serpentine course through a low flat basin about 40 miles in width. It is perpetually changing its course, and the land on either side is intersected in all directions by sluggish streams and stagnant lakes, the remnants of its abandoned channels. In such a country operations with an army are impossible. At long intervals, however, the river flows entirely on one side of its basin and washes the foot of the steep hills by which it is bounded. Wherever such a cliff occurred, as at Columbus, Memphis, and other points, it was defended by the Confederates, and when they lost it they lost the river down to the next similar point. Now the combination of circumstances at Vicksburg was peculiar. Its position was too lofty to be taken by the fleet unaided, but the only direction from which it could be safely approached by an army was from the rear, that is to say, from the east; and the correct line of approach was that of the Mississippi Central Railway, with Memphis for the Federal base of supplies. For an army coming either up or down the Mississippi the problem was almost insoluble. It was impossible to get in the rear of the city by landing to the north of it, for the approaches were there guarded by batteries on Haines Bluff which could shoot down any assailing column faster than it could advance. On the other hand, an army landing to the south of Vicksburg incurred the risk of starvation, since the guns of Vicksburg prevented supplies from passing down stream, while the guns of Port Hudson 200 miles below equally prevented them from passing up. Grant's first movement against Vicksburg was the correct one, along the Mississippi Central Railway; but because of his deficiency in cavalry, his line of communications was cut and he was obliged to retreat upon Corinth. Meanwhile a separate expedition under Sherman had been sent down the Mississippi river. It landed at Chickasaw Bayou, and attempted to storm the works at Haines Bluff in order to gain a foothold to the north of Vicksburg. This enterprise met with a bloody repulse. A period of intrigue succeeded, the result of which was that Grant felt obliged to abandon his first plan and take his whole army down the river to Vicksburg. After arriving on the west bank of the Mississippi opposite the mighty stronghold, the problem before him was to get his army into its rear. Two fruitless months were spent in attempts to navigate the intricate and tortuous system of bayous, in order either to land the army northwards without encountering the guns of Haines Bluff, or to carry supply-ships southwards by routes not commanded by the batteries of Vicksburg. Meanwhile Grant's popularity greatly declined, and President Lincoln was urged to remove him from command. But Lincoln's reply was, "I rather like the man; I guess we will try him a little longer." At this crisis Grant conceived a most daring scheme; and having heard it condemned by every one of his generals, he proceeded to try it on his own responsibility. On the 16th of April Porter's fleet was taken down the river below the city, sustaining slight damage from its batteries. Feints were made to the northward, while the body of the army was rapidly marched to Bruinsburg, about 25 miles below Vicksburg. A crossing was effected near that place, and the Confederates were defeated in an obstinate battle at Port Gibson. This obliged them to evacuate Grand Gulf, the strongest of the outposts to the southward. From Port Gibson Grant then proceeded to march north-easterly upon the city of Jackson, the capital of the state of Mississippi, intending to find and defeat Joseph Johnston, who was approaching to relieve Vicksburg. Grant's object was to throw himself between Johnston's army and that of Pemberton, the commander at Vicksburg, and to defeat them in detail. In order to do this, it was necessary for him to keep his army concentrated, and he could not spare troops to guard his line of communications with the Mississippi river. He therefore cut loose from his base altogether, and conducted this marvellous campaign upon such food as his men could carry in their knapsacks or seize in the course of their march. To avert certain ruin it was necessary that he should be victorious at every point; and he was. Having defeated Johnston in two battles, at Raymond and again at Jackson, he instantly faced about to the west and marched against Pemberton, who had come out to intercept his supposed line of communications. In a bloody battle at Champion Hill Pemberton was totally defeated, and his ruin was completed the next day at the Big Black river. Pemberton then retired into Vicksburg with the remnant of his force, while Sherman approached Haines Bluff in the rear and compelled the enemy to evacuate it. The supposed insoluble problem was now virtually at an end, for Grant's line of supplies from the northward was opened and made secure. Mindful of the possibility that Johnston might sufficiently recover strength to interrupt operations, Grant tried to carry Vicksburg by storm, and two assaults were made which were repulsed with great slaughter. He then resorted to siege operations, and by the third day of July the city was starved into submission. By this brilliant campaign Grant's reputation was at once raised to a very high pitch. He was made major-general in the regular army, and henceforth was allowed to have his own way in most things.

Operations at Vicksburg.

His next field of action was at Chattanooga. The Confederate commander, Braxton Bragg, had been driven out of that place by Rosecrans in a series of skilful manœuvres; but, in attempting to pursue Bragg through the difficult mountain country to the south, Rosecrans allowed the two wings and the centre of his army to become too widely separated, thus exposing himself to swift destruction. Bragg failed to seize the opportunity offered him, but nevertheless succeeded in bringing Rosecrans to battle in the valley of Chickamauga. There, in a murderous battle, in which nearly 40,000 men were killed or wounded, the Union right wing and centre were routed; but General Thomas, with almost incredible skill and bravery, not only saved the left wing, but very nearly retrieved the situation. Rosecrans retired his army into Chattanooga, but had not sufficient force to hold the crests of Lookout Mountain and Missionary Ridge, which were forthwith occupied by the Confederate army. This operation left the Union army without any good line of communications. The only route by which food could be brought was a long and difficult waggon road over a spur

of the Cumberland Mountains known as Waldron's Ridge. Drenching rains set in, the mules died on the route and blocked up the way, and presently the Union army suffered for want of food. Indeed, something like a famine set in, and nearly all the horses perished for want of forage. At this crisis Grant was appointed to command all the armies west of the Alleghanies, increased by the transfer of two corps from the army of the Potomac to that of the Cumberland. His first proceedings were to supersede Rosecrans by Thomas, and to order up Sherman from Vicksburg. By a beautiful series of operations an excellent line of communication was opened by General William Farrar Smith, and the sufferings at Chattanooga were relieved. On the arrival of Sherman's force it was moved by a circuitous and secret route to the north end of Missionary Ridge near Chickamauga station on the Dalton Railway, by which Bragg received his supplies. At this time Longstreet, who had been sent from Virginia to Bragg's assistance, and had taken part in the battle at Chickamauga, was engaged in a subsidiary operation. He had been imprudently sent away by Bragg to lay siege to Knoxville, and his line of communications was also the railway from Dalton. Bragg's left wing occupied the summit of Lookout Mountain, while his centre and right stretched along the crest of Missionary Ridge for a space of 5 or 6 miles. Under these conditions Grant's plan of battle was simple. His reinforcements from Virginia, commanded by Joseph Hooker, were in Lookout Valley. He proposed to make a demonstration with these troops which should engross Bragg's attention, while Sherman at the opposite extremity of the field should storm the northern end of Missionary Ridge, cut off Bragg from the Dalton Railway and crush his right wing, thus wrecking his army; but the battle, as fought, proceeded upon a very different plan. The accidental breaking of a pontoon bridge left in Lookout Valley one division of men which had been destined for Sherman's part of the field. This additional force so far strengthened Hooker that in the course of the fight which ensued upon Lookout Mountain he carried the whole position by storm, driving the Confederates down upon Missionary Ridge.

Battle of Missionary Ridge.

On the other hand, Sherman's enterprise was frustrated by an unforeseen obstacle. After he had surmounted the northern extremity of Missionary Ridge he was confronted by a yawning chasm which none of the Federal glasses had been able to detect, and as there were no good topographical maps, its existence was unknown. The crests beyond were crowned with Confederate artillery, and well manned. In these circumstances, the part that Sherman played, though a very useful one, was different from what had been intended. On the second day of the battle he attacked the heights before him; he was unable to carry them, but his pressure upon that vital point was so strong that it led Bragg to keep on reinforcing it at the expense of his centre, which was confronted by the army of General Thomas. Presently Grant, fearing for Sherman and wishing to stop this northward movement of Confederates, ordered four of Thomas's divisions to make a bayonet charge in front. They were to carry the Confederate works at the foot of Missionary Ridge and then halt and await orders. At that moment Grant was building better than he knew. The line of 20,000 men swept like an avalanche over the works at the foot of the ridge, and then in an uncontrollable spirit of victory kept on without orders, making their way up the perilous height. As they reached the top they broke through the Confederate centre in at least six different places, while at the same moment Hooker, who had come down from Lookout Mountain, overwhelmed Bragg's right and sent it tumbling in upon his routed centre. In a few moments the remnant of the Confederate army was a disorderly mob fleeing for life. This great victory secured for the northern army the line of the Alleghanies, as the capture of Vicksburg had secured the line of the Mississippi.

General-in-chief.

Grant's fame was now at its zenith. The rank of lieutenant-general was revived for him, and he was made general-in-chief of the armies of the United States. This appointment gave to the military operations of 1864 a greater coherence than that of former years. The theatre of war was now practically reduced to the seaboard states, Georgia, the two Carolinas, and Virginia. The Confederacy still possessed two formidable armies, one at Dalton in Georgia, commanded by Joseph Johnston, who had superseded Bragg, the other on the river Rapidan in Virginia, commanded by Lee, who seemed unconquerable. Grant's plan was to go directly by the overland route against Lee, while Sherman should advance from Chattanooga against Johnston. In Virginia, Grant took command in person. He now found himself opposed by a general of far greater calibre than any of those against whom he had contended in the west. The events of this last year added nothing to his military reputation. While they revealed in many ways Grant's fine soldierly qualities, it was nevertheless unquestionable that upon every occasion he was out-generalled by Lee. The first period of the summer's fighting began on 5th May 1864, and lasted until 3rd June. It was marked by the terrible battles of the Wilderness, Spottsylvania, and Cold Harbor, in the course of which Grant lost more than 60,000 men killed and wounded without making any perceptible advance towards the object of the campaign. In one of his despatches in May he had said, "I propose to fight it out on this line if it takes all summer," but after his bloody repulse at Cold Harbor, 3rd June, he abandoned that line and chose a different method of circumventing Lee and approaching Richmond. He did what M'Clellan was on the point of doing two years before when he was overruled by Halleck. He crossed the James river and moved upon Petersburg, a point from which he might hope to cut Lee's communications with points to the southward. But this movement was only partially successful; the Confederates succeeded in reaching Petersburg first, and the affair settled down into a siege which lasted both summer and winter. Meanwhile the ground was being cut from under Lee's feet. In a masterly campaign Sherman pushed Johnston back upon Atlanta. Jefferson Davis superseded Johnston by Hood, a general who believed in hard blows, and soon received some at Sherman's hands. The result was the fall of Atlanta. Hood then made a dash towards Tennessee, hoping to draw Sherman after him, but the force of the latter was sufficiently large to allow of his dividing it. He took 60,000 men with him on a march to the seaboard, there to obtain a new base from which to move to the assistance of Grant. The success of this sweeping movement was entirely dependent upon the crushing of Hood when the latter should invade Tennessee. This work was entrusted to General Thomas, who was left with about 20,000 men, while as many more were summoned from different quarters to reinforce him. On the 15th and 16th of December, in a masterly battle before Nashville, perhaps the most brilliant action of the war, Thomas completely annihilated the army of Hood. A few days later Sherman reached Savannah, and began from that point his northward march against Lee. The Confederates gathered a remnant of about 20,000 men to oppose him, the command being once more entrusted to the sagacious Johnston. In an exciting display of strategy Johnston was driven north-

wards before Sherman until the northern portion of North Carolina was reached. For a moment it seemed that the armies of Johnston and Lee would coalesce, only to be crushed between Grant and Sherman as the upper and the nether millstones, but this was prevented by Sheridan's brilliant victory at Five Forks, which turned Lee's right wing and cut off his southward retreat. Weight of numbers on the northern side at length became irresistible; Grant, with 100,000 men, broke through Lee's centre at Petersburg, the Confederate Government abandoned Richmond, and in a few days Lee surrendered the remnant of his army at Appomattox Courthouse. A few days later Johnston surrendered his army to Sherman, and the great Civil War was over.

After the assassination of President Lincoln a disposition was shown by his successor, Andrew Johnson, to deal severely with the Confederate leaders, and it was understood that indictments for treason were to be brought against General Lee and others. Grant nipped these proceedings in the bud by insisting that the United States Government was bound by the terms which he had accorded to Lee and his army at Appomattox. He went so far as to threaten to resign his commission if the President disregarded his protest. This energetic action on Grant's part saved the United States from a foul stain upon its escutcheon. In the summer of 1866 the grade of general was created, and Grant was promoted to that position. In the course of the following year he became involved in the deadly quarrel between President Johnson and Congress. In order to tie the President's hands Congress had passed the Tenure of Office Act, forbidding the President to remove any cabinet officer without the consent of the Senate; but in August 1867 President Johnson suspended Secretary Stanton and appointed Grant secretary of war *ad interim* until the pleasure of the Senate should be ascertained. Grant accepted the appointment under protest, and held it until the following January, when the Senate refused to confirm the President's action, and Secretary Stanton resumed his office. President Johnson was much disgusted at the readiness with which Grant turned over the office to Stanton, and a bitter controversy ensued between Johnson and Grant. Hitherto Grant had taken but little part in politics. The only vote which he had ever cast for President was in 1856 for James Buchanan; and sundry leading Democrats, so late as the beginning of 1868, hoped to make him their candidate in the election of 1868; but the effect of the controversy with President Johnson was to bring Grant forward most conspicuously as the candidate of the Republican party. At the convention in Chicago, 20th May 1868, he was unanimously nominated on the first ballot. The Democratic party soon afterwards did all in its power to help his election by nominating as his competitor the one Democrat in the United States who had the smallest chance of beating him—Horatio Seymour, lately governor of New York, an excellent statesman, but at that time quite hopeless as a candidate because of his attitude during the war. The result of the contest was at no time in doubt; Grant received 214 electoral votes, and Seymour 80.

Presidency, 1868.

The most important domestic event of Grant's first term as President was the adoption of the fifteenth amendment to the Constitution, 30th March 1870, guaranteeing the right of suffrage throughout the United States without regard to race, colour, or previous condition of servitude. The most important event in foreign policy was the treaty with Great Britain of 8th May 1871, commonly known as the Treaty of Washington, whereby several controversies between the United States and Great Britain, including the bitter questions as to damage inflicted upon the United States by the *Alabama* and other Confederate cruisers built and equipped in England, were amicably referred to arbitration. In 1869 the Government of San Domingo expressed a wish for the annexation of that island by the United States, and such a step was favoured by Grant, but it failed to obtain the requisite two-thirds vote in the Senate. In May 1872 something was done towards alleviating the odious Reconstruction laws for dragooning the South, which had been passed by Congress in spite of the vetos of President Johnson. The Amnesty Bill restored civil rights to all persons in the South, save some 350 who had held high positions under the Confederacy. As early as 1870 President Grant recommended measures of civil service reform, and succeeded in obtaining an Act authorizing him to appoint a Civil Service Commission, and to prescribe rules for its proceedings. A commission was accordingly created, but owing to the persistent hostility of the politicians in Congress it accomplished but little. The need for such civil service reform was beginning to be sorely felt by the country. During the fifty years since Crawford's Tenure of Office Act was passed in 1820, the country had been growing more and more familiar with the spectacle of corruption in high places. The evil rose to alarming proportions during Grant's Presidency, partly because of the immense extension of the civil service, partly because of the growing tendency to alliance between spoilsmen and the persons benefited by protective tariffs, and partly because the public attention was still so much absorbed in Southern affairs that little energy was left for curbing rascality in the North. The scandals, indeed, were rife in Washington, and affected persons who were in close relations with the President, so that evil-minded persons were inclined to suspect him of complicity with the rogues. President Grant was ill fitted for coping with the difficulties of such a situation. Along with high intellectual powers in certain directions, he had a simplicity of nature quite charming in itself, but often calculated to render him the easy prey of sharpers. He found it almost impossible to believe that anything could be wrong in persons to whom he had given his friendship, and on several occasions such friends proved themselves unworthy of him. The feeling was widely prevalent in the spring of 1872 that the interests of pure government in the United States demanded that President Grant should not be elected to a second term. This feeling led a number of high-minded gentlemen to form themselves into an organization under the name of Liberal Republicans. They held a convention at Cincinnati in May with the intention of nominating for the Presidency Charles Francis Adams, who had so ably represented the United States at the Court of St James's during the Civil War. The convention, was, however, captured by politicians who converted the whole affair into a farce by nominating Horace Greeley, editor of the *New York Tribune*, who represented almost anything rather than the object for which the convention had been called together. The Democrats had been awaiting the action of this convention; they despaired of electing a candidate of their own, and hoped to achieve success by adopting the Cincinnati nominee, should he prove to be an eligible person. The event showed that while their defeat in 1868 had taught them despondency, it had not taught them wisdom; it was still in their power to make a gallant fight by nominating a person for whom Republican reformers could vote. But with almost incredible fatuity, they held a convention and adopted Greeley as their candidate. As a natural result Grant was re-elected by an overwhelming majority.

Re-elected, 1872.

The most important event of his second term was his

veto of the Inflation Bill in 1874, followed by the passage of the Resumption Act in the following year. The country was still labouring under the curse of an inconvertible paper currency created by the Legal Tender Act of 1862. There was a considerable party in favour of debasing the currency indefinitely by inflation, and a Bill with that object in view was passed by Congress in April 1874. It was promptly vetoed by President Grant, and two months later he wrote a very sensible letter to Senator Jones of Nevada advocating a speedy return to specie payments. The passage of the Resumption Act in January 1875 was largely due to his consistent advocacy, and for these measures he surely deserves as high credit as for any of his victories in the field. In spite of these great services, popular dissatisfaction with the Republican party rapidly increased during the years 1874–76. The causes were twofold: firstly, there was great dissatisfaction with the troubles in the Southern states, owing to the harsh Reconstruction laws and the robberies committed by the carpet-bag governments which those laws kept in power; secondly, the scandals at Washington, comprising wholesale frauds upon the public revenue, awakened lively disgust. In some cases the culprits were so near to President Grant that many persons found it difficult to avoid the suspicion that he was himself implicated, and never perhaps was his hold upon popular favour so slight as in the summer and autumn of 1876.

Later life.

After the close of his Presidency in the spring of 1877 Grant started on a journey round the world, accompanied by his wife and one son. He was received with distinguished honours in England and on the continent of Europe, whence he made his way to India, China, and Japan. After his return to America he went back to his old home in Galena, Illinois. A faction among the managers of the Republican party attempted to secure his nomination for a third term as President, and in the convention at Chicago in June 1880 he received a vote exceeding 300 during 36 consecutive ballots. Nevertheless, his opponents made such effective use of the popular prejudice against third terms that the scheme was defeated, and Garfield was named in his stead. In August 1881 General Grant bought a house in the city of New York. His income was insufficient for the proper support of his family, and accordingly he had become partner in a banking house in which one of his sons was interested along with other persons. The name of the firm was Grant and Ward. The ex-President invested in it all his available property, but paid no attention to the management of the business. His facility in giving his confidence to unworthy people was now to be visited with dire calamity. In 1884 the firm became bankrupt, and it was discovered that two of the partners had been perpetrating systematic and gigantic frauds. This severe blow left General Grant quite penniless, just at the time when he was beginning to suffer acutely from the disease which finally carried him off. Down to this time he had never made any pretensions to literary skill or talent, and had never regarded himself in the light of an author; but on being approached by the *Century Magazine* with a request for some articles, he undertook the work in order to keep the wolf from the door. It proved a congenial task, and led to the writing of his *Personal Memoirs*, a frank, modest, and charming book, which ranks among the best standard military biographies. The sales earned for the general and his family something like half a million dollars. The circumstances in which it was written made it an act of heroism comparable with any that Grant ever showed as a soldier. During most of the time he was suffering tortures from cancer in the throat, and it was only four days before his death that he finished the manuscript. In the spring of 1885 Congress passed a Bill creating him a general on the retired list; and in the summer he was removed to a cottage at Mount M'Gregor, near Saratoga, where he passed the last five weeks of his life, and where he died on the 23rd of July 1885. His mortal remains were deposited in a tomb in Riverside Park, in New York City, overlooking the Hudson river.

Character.

As a soldier Grant possessed very high qualities; the combination of self-reliant courage, fertility of resource, and swiftness in action was perhaps never more perfectly realized than in his wonderful campaign in the rear of Vicksburg. He was invariably patient and equable in temper in the most trying circumstances, neither elated by success nor cast down by ill-fortune. For dogged persistency he has never been surpassed. He possessed, in a high degree, that quick and subtle appreciation of topography which is essential to success in great military operations. Though he was slow and deliberate in conversation and in the ordinary movements of his body, his thoughts moved nimbly and his military actions were marked by promptness. Yet, in spite of Vicksburg, one can hardly accord him a place in the first rank of military commanders. He never rose to the grade of Napoleon or Frederick, although in some of his movements we can see Napoleonic touches. When he was pitted against Lee, in the last year of his military life, there could be no doubt as to the superior genius of the Confederate general. In character Grant showed many admirable and lovable traits. There was a charming side to that trustful simplicity, which was at times almost like that of a sailor set ashore. He abounded in kindliness and generosity, and if there was anything especially difficult for him to endure, it was the sight of human suffering, as was shown on the night at Shiloh, where he lay out of doors in an icy rain rather than stay in a comfortable room where the surgeons were at work. His good sense was strong, as well as his sense of justice, and these qualities stood him in good service as President, especially in his triumphant fight against the greenback monster. Altogether, in spite of some shortcomings, Grant was a massive, noble, and lovable personality, well fit to be remembered as one of the heroes of a great nation.

Authorities.—Adam Badeau. *Military History of U. S. Grant.* N.Y., 1867-81. 3 vols. A book far too indiscriminate in praise.—James Grant Wilson. *Life and Public Services of U. S. Grant.* Revised edit. N.Y., 1886.—John Russell Young. *Around the World with General Grant.* N.Y., 1880.—U.S. Grant. *Personal Memoirs.* N.Y., 1885-86. 2 vols.—John Codman Ropes. *Story of the Civil War.* N.Y., 1892-98. 2 vols.—John Fiske. *The Mississippi Valley in the Civil War.* Boston, 1900.—James Ford Rhodes. *History of the United States*, vols. iii., iv. N.Y., 1896-99.
(J. Fi.)

Grantham, a municipal borough, incorporated in the 15th century (extended 1879), parliamentary borough (now returning only one member), and market-town of Lincolnshire, England, on the Witham, 105 miles north of London by rail. Area of municipal borough, 1677 acres. Population (1881), 16,886; (1901), 17,593.

Granville, a seaport and bathing resort in the arrondissement of Avranches, department of Manche, France, with terminal station on railway, 204 miles from Paris. Granville ranks next to Bordeaux as a market for cod-fish from Newfoundland. The total number of vessels (not including those engaged in coasting trade) entered and cleared in 1899 was, respectively, 252 of 43,416 tons, and 260 of 48,160 tons. Population (1881), 9693; (1891), 10,373; (1901), 11,667. In the commune are included the Chausey Islands, which lie 7 miles to the W.N.W. of Granville. They are a group of 52 islands, extending east and west for a length of 7 miles, and north and south for 5 miles,

but only Grande (100) is inhabited. It has a fort, lighthouse, and semaphore, and there are important granite quarries.

Granville, George Leveson-Gower, 2nd Earl (1815–1891), English statesman, eldest son of the 1st Earl (1773–1846), the friend of Canning and ambassador at Paris (1824–41), was born in London, 11th May 1815. After being at Eton and Christ Church, he was at Paris as attaché under his father, until, in 1836, he was returned to Parliament in the Whig interest for Morpeth. For a short time at the end of Melbourne's Ministry he was Under-Secretary for Foreign Affairs. From 1841 until his father's death in 1846 he sat for Lichfield. In the House of Lords he signalized himself as a Free Trader, but he was regarded as a courtly wit and a dandy rather than as a serious politician, and Lord John Russell made him Master of the Buckhounds (1846). He was made Vice-President of the Board of Trade in 1848, and in December 1851 succeeded Palmerston at the Foreign Office for a short time; in 1853 he became President of the Council. He took a prominent part in the promotion of the Exhibition of 1851 abroad, especially at Paris, and won golden opinions from the French. From 1855 Granville led the Liberals in the Upper House, and in June 1859 Queen Victoria, embarrassed by the rival ambitions of Palmerston and Russell, sent for him to form a Ministry, but Russell preferred to serve under Palmerston, and Granville was quite content to be President of the Council; in 1866 he retired with the Ministry, having meantime been appointed Lord Warden of the Cinque Ports. In December 1868 he became Colonial Secretary in Gladstone's first administration. His tact was invaluable to the Government in carrying the Irish Church and Land Bills through the House of Lords. On 27th June 1870, upon the death of Lord Clarendon, he was transferred to the Foreign Office. As Foreign Minister (1870–74 and 1880–85) Lord Granville was amiable but weak, and his periods of office were marked by a good deal of nerveless diplomacy, for which Great Britain both then and since had to pay dear. The Franco-German war of 1870 broke out within a few days of his pronouncement that not a cloud obscured the political horizon. Russia took advantage of the situation to denounce the Black Sea clauses of the Treaty of Paris (1856), Lord Granville's protest being entirely reasonable but quite ineffectual. In 1871 an intermediate zone was described by Granville and Gortchakoff between Russia and Afghanistan. When, however, in 1873, Russia took permanent possession of Khiva (within the neutral zone), Granville had to accept Schuvaloff's "assurances" that the advance was temporary. The Conservatives came back to power in 1874, and Granville's part for the next six years was to criticize Disraeli's "spirited" foreign policy, a task which he performed with much graceful irony, and to defend his own more pliant methods. He returned to the Foreign Office in 1880, but his policy remained an ineffectual one. In 1883–84 he was severely rebuffed by Bismarck over the Angra-Pequeña question. With a mind as open as Gladstone's to the reception, even in old age, of entirely new ideas, Granville adhered to his chief in the question of Home Rule (1886), and gave way with his accustomed grace to Lord Rosebery when the latter was preferred to the Foreign Office. He took charge of the Colonial Office (February–July 1886) for his remaining six months of office, though he was far from being *persona grata* in the colonies; and he retired from public life in the summer of 1886. He died in South Audley Street, London, on 31st March 1891. Lord Granville was an admirable after-dinner speaker and one of the most charming talkers. He spoke French like a Parisian, but with a slight Court accent recalling the *ancien régime*. He was a master of the art of diplomatic fencing and word-play, but he had no grasp of the really important problems which were gradually coming to the front in the British Empire.

Graslitz, a town in the north-west of Bohemia (Austria), near the Saxon frontier. It has a station on the Falkenau and Buschtiehrader railways. One of the most important industrial centres of Bohemia, its specialties are the manufacture of musical instruments, carried on both as a factory and domestic industry, and lace-making. Next in importance is cotton-spinning and weaving, machine embroidery, &c., and the mother-of-pearl industry. Graslitz, which is distinguished by its strong German-Nationalist sentiment, was the scene of some violent demonstrations in 1899, which were accompanied by loss of life. Population, all German (1900), 11,803.

Grasse, chief town of arrondissement, department of Alpes Maritimes, France, 30 miles W.S.W. of Nice by rail. About 2,000,000 ℔ of roses and 4,000,000 ℔ of orange flowers are annually produced for the distillation of essences. There are also important manufactures of olive and sweet almond oil. Population (1881), 7597; (1901), 15,429.

Gratz, or Graz, capital of the Austrian crownland of Styria. It possesses a number of interesting public monuments, two bridges, a new synagogue, a technical college, a new university building, a town hall (1892), a large new museum (1895), a court of justice, &c. The university is attended by about 1550 students, including Italians from the Küstenland and Dalmatia. The polytechnic is attended by nearly 400 students. There are four gymnasia, two realschule, and five other technical and special high schools. Not only trade, but also industry, has made great progress in consequence of increased railway facilities and the establishment in the town of the extensive workshops of the Southern Railway. Its manufactures now include rails, machinery, bicycles, &c., and all kinds of iron and steel goods; paper, perfumes, leather and leather goods; sugar, soap, chemicals, physical and optical instruments; and pottery, champagne, beer, flour, and artistic printing and lithography, &c. Gratz played a prominent part in the German national agitation under the Badeni and Thun ministries, and was the scene of violent demonstrations against the Government, which were repressed with loss of life. The progress of Socialism among the working classes has been as marked among the labourers as that of the Pan-Germanic sentiment among the other sections of the community. The "Emancipation from Rome" movement also aroused a strong echo in Gratz, particularly among the students. Population, almost wholly German and Roman Catholic (1890), 112,069; (1900), 138,270.

Graudenz, a town of Prussia, province of West Prussia, on the right bank of the Vistula, 37 miles by rail north by east from Thorn. It is a place of considerable manufacturing activity, especially in carriages and carpets, though there are also iron-foundries, flour-mills, breweries, and brick-works, a large trade in corn, cattle, horses, timber, and wool. The town possesses a museum, and a monument (1815) to Courbière, the defender of the town in 1807. Graudenz is an important place in the German system of fortifications, belonging to the cluster of forts on the eastern frontier. Population (1885), 17,336; (1900), 32,800.

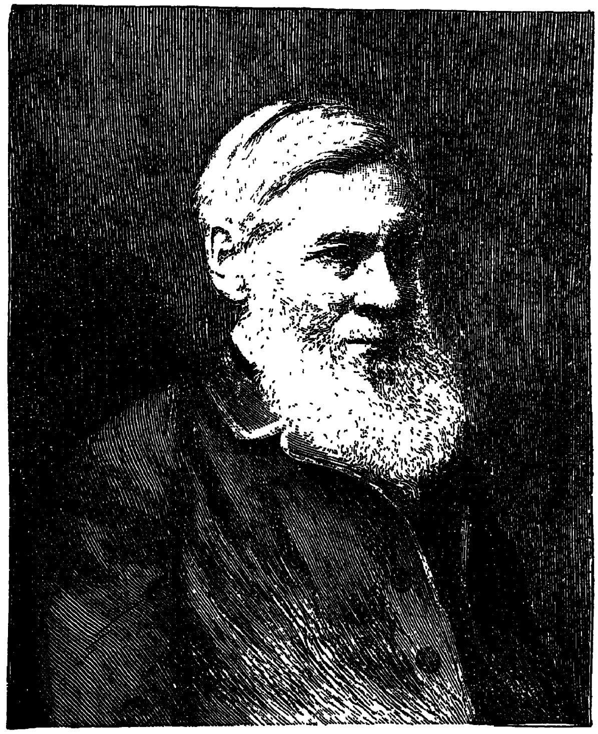
Gravelines, a town in the arrondissement of Dunkirk, department of Nord, France, 48 miles N.W. of Lille, with station on railway from Calais to Dunkirk. It is a centre for the cod and herring fisheries, and fish-salting and flax- and hemp-spinning are amongst its industries. The situation of the port is one of the best in

France on the North Sea. The harbour has an area of 75 acres; depth at entrance 18 and 16 feet, high spring and neap tides; the Government wet dock covers 6 acres, and has 1968 feet of quayage; a channel $1\frac{5}{8}$ mile long connects with the sea, and inland there is communication with the northern network of canals. In 1899, 162 vessels of 21,680 tons entered, and 164 of 21,846 tons cleared. The total tonnage of river traffic on the Aa amounted to 88,416 tons in 1900. The export trade is mainly with England. Population (1881), 3902; (1901), 6202.

Gravesend, a municipal and parliamentary borough of Kent, England, on the Thames, 22 miles east by south of London by rail. Gravesend belongs to the port of London. The hospital has been extended. There is a college for daughters of Congregational ministers, and an industrial school for boys. Recent erections are a technical school containing a public library, a public hall, and a sanatorium at Cobham. The town pier has been acquired by the Tilbury Railway Company. Area of municipal borough, 1256 acres. Population (1881), 23,302; (1901), 27,175.

Gray, Asa (1810–1888), American botanist, was born at Paris, Oneida county, N.Y., on 18th November 1810. He was the son of a farmer, and received no formal education except at a small rural academy and a provincial medical school. From the professor of chemistry and *materia medica* in the latter he obtained his first instruction in science (1825–26). In the spring of 1827 he first began to collect and identify plants. His formal education, such as it was, ended in February 1831, when he took the degree of Doctor of Medicine. His first contribution to descriptive botany appeared in 1835, and thereafter an uninterrupted series of contributions to systematic botany flowed from his pen for fifty-three years. In 1836 his first botanical text-book appeared under the title *Elements of Botany*, followed in 1839 by his *Botanical Text-Book for Colleges, Schools, and Private Students.* This text-book developed into his *Structural Botany*, written with a view to interest large numbers of readers. He published later the following smaller books: *First Lessons in Botany and Vegetable Physiology*, 1857; *How Plants Grow*, 1858; *Field, Forest, and Garden Botany*, 1869; *Botany for Young People, Part II., How Plants Behave*, 1872. These books served the purpose of developing popular interest in botanical studies. His most important contribution, however, was his *Manual of the Botany of the Northern United States*, the first edition of which appeared in 1847. This manual has passed through a large number of editions, is clear, accurate, and compact to an extraordinary degree, and within its geographical limits is an indispensable book for the student of American botany.

Throughout his life Dr Gray was a diligent writer of reviews of books on natural history subjects. Often these reviews were elaborate essays, for which the books served merely as texts; often they were clear and just summaries of extensive works; sometimes they were sharply critical, though never ill-natured or unfair; always they were interesting, lively, and of literary as well as scientific excellence. The greater part of Dr Gray's strictly scientific labour was devoted to a flora of North America, the plan of which originated with his early teacher and associate, Dr John Torrey of New York. The second volume of Torrey and Gray's *Flora* was completed in 1843; but for forty years thereafter Dr Gray gave up a large part of his time to the preparation of his *Synoptical Flora*, the first part of which did not appear till 1878. He lived at the precise period when the flora of North America was being discovered, described, and systematized; and his enthusiastic labours in this fresh field placed him at the head of American botanists and on a level with the most famous botanists of the world. In 1856 he published a paper on the distribution of plants under the title *Statistics of the Flora of the Northern United States;* and this paper was followed in 1859 by a memoir on the botany of Japan and its relations to that of North America, a paper of which Sir J. D. Hooker said that "in point of originality and far-reaching results [it] was its author's *opus magnum.*" It was Gray's study of plant



Asa Gray.

distribution which led to his intimate correspondence with Charles Darwin during the years in which Darwin was elaborating the doctrines that later became known as Darwinism. From 1855 to 1875 Dr Gray was both a keen critic and a sympathetic exponent of the Darwinian principles. His influence on this subject, both in the United States and in England, was due to the candour, clearness, and conservatism of his expositions. Dr Gray's religious views were those of the Evangelical bodies in the Protestant Church; so that, when Darwinism was attacked as equivalent to atheism, he was in position to answer effectively the unfounded allegation that it was fatal to the doctrine of Design. He taught that "the most puzzling things of all to the old-school teleologists are the *principia* of the Darwinian." He openly avowed his conviction that the present species are not special creations, but rather derived from previously existing species; and he made his avowal with frank courage, when this truth was scarcely recognized by any naturalists, and when to the clerical mind evolution meant atheism.

In 1842 Dr Gray accepted the Fisher professorship of natural history in Harvard University. On his accession to this chair the university had no herbarium, no botanical library, few plants of any value, and but a small garden, which for lack of money had never been well stocked or well arranged. Dr Gray soon brought together, chiefly by widespread exchanges, a valuable herbarium and library, and arranged the garden; and thereafter the development of these botanical resources was part of his regular labours. The herbarium soon became the largest

and most valuable in America, and on account of the numerous type specimens it contains it is likely to remain a collection of national importance. Nothing of what Dr Gray did for the botanical department of the university has been lost; on the contrary, his labours were so well directed that everything he originated and developed has been enlarged, improved, and placed on stable foundations. He himself made large contributions to the establishment by giving it all his own specimens, many books, and no little money, and by his will he gave it the royalties on his books. During his long connexion with the university he brought up two generations of botanists, who are now scattered all over the United States. The Gray Herbarium was for years the resort of nearly all the working botanists now in influential positions, and Dr Gray always took a strong personal interest in the researches and the personal prospects of the young men who studied under his eyes. His scientific life was mainly spent in the herbarium and garden in Cambridge; but his labours there were relieved by numerous journeys to different parts of the United States and to Europe, all of which contributed to his work on the Synoptical Flora. Every journey enlarged his experience, increased his resources, and added to his reputation. He lived to a good age—long enough, indeed, to receive from learned societies at home and abroad abundant evidence of their profound respect for his attainments and services. He died at Cambridge, Mass., 30th January 1888. (C. W. E.)

Grays Thurrock, a town and parish in the South-Eastern parliamentary division of Essex, England, on the Thames, 3 miles north-west of Tilbury Fort by rail. There are an endowed and two training-ship schools. Drainage works costing over £40,000 were completed in 1894. The buildings include a public hall and a free library (1894). The town does trade in bricks, lime, and cement. Area of urban district, 1382 acres. Population (1881), 5327; (1901), 13,831.

Great Barrington, a town of Berkshire county, Massachusetts, U.S.A., on the river Housatonic in the Berkshire Hills. It is traversed by a branch of the New York, New Haven, and Hartford Railway, and is well known as a summer resort. Population (1890), 4612; (1900), 5854, of whom 1187 were foreign-born and 138 negroes.

Great Britain. See BRITISH EMPIRE, ENGLAND AND WALES, ENGLISH HISTORY, SCOTLAND, UNITED KINGDOM.

Great Falls, capital of Cascade county, Montana, U.S.A., in 47° 30′ N. and 111° 17′ W., on the south bank of the Missouri river, opposite the mouth of Sun River, at an altitude of 3331 feet. It is near the great falls of the Missouri, from which it derives its name. It is on a branch line of the Great Northern Railway, and is the terminus of the Great Falls and Canada Railway, and of a branch line into the mountains to the south. It is a well-built city, founded in 1867. It has smelters for the treatment of silver, lead, and copper ores. Population (1890), 3979; (1900), 14,930, of whom 4692 were foreign-born and 128 negroes.

Great Salt Lake, a large body of water without outlet, in Utah, U.S.A. It lies at the western base of the Wasatch range, from which it receives numerous streams, the principal of which are the rivers Jordan, Weber, and Bear. The inflow to the lake is variable in amount, owing to irregularity in rainfall, and as the only means of discharge—evaporation—is quite uniform, the level of the lake has oscillated greatly in past times, while in recent years, owing to the fact that much of the water of its tributaries has been used for irrigation, the lake level has been considerably lowered. The lake being shallow and its shores quite level, especially on the west, a slight reduction in the water level causes a notable diminution in area. The lake is some 80 miles in length north and south, and on an average 40 miles in breadth. The water contains about 20 per cent. by weight of solid matter, mainly chloride of sodium. The country to the east and south of the lake is well settled by Mormons, and is highly cultivated, while that on the north and west, since it possesses no water for irrigation, is a desert.

Great Slave Lake (ATHAPUSCOW), a lake of Mackenzie district, Canada. It is situated between 60° 50′ and 62° 55′ N. lat. and 108° 40′ and 117° W. long., at an altitude of 520 feet above the sea. It is 325 miles long, from 15 to 65 miles wide, and includes an area of 9770 square miles. Its coast-line is very irregular and deeply indented by large bays, and its northern shores are rugged and mountainous. The Yellow-knife, Hoar-frost, Lockhart, discharging the waters of Clinton-Colden and Artillery lakes, the Tchzudezeth, Du Rocher, Hay, and Slave rivers—the last a continuation of the Mackenzie—empty into Great Slave Lake. It is navigable from about 1st July to the end of October. It was discovered in 1771 by Samuel Hearne.

Greathead, James Henry (1844–1896), British engineer, was born at Grahamstown, Cape Colony, on 6th August 1844. He migrated to England in 1859, and in 1864 was a pupil of P. W. Barlow, from whom he became acquainted with the shield system of tunnelling with which his name is especially associated. Barlow, indeed, had a strong belief in the shield, and was the author of a scheme for facilitating the traffic of London by the construction of underground railways running in cast-iron tubes constructed by its aid. To show what the method could do, it was resolved to make a subway under the Thames near the Tower, but the troubles encountered by Brunel in the Thames Tunnel, where also a shield was employed, made engineers hesitate to undertake the subway, even though it was of very much smaller dimensions (6 feet 7 inches internal diameter) than the tunnel. At this juncture Greathead came forward and offered to take up the contract; and he successfully carried it through in 1869 without finding any necessity to resort to the use of compressed air, which Barlow in 1867 had suggested might be employed in water-bearing strata. After this he began to practise on his own account, and mainly divided his time between railway construction and taking out patents for improvements in his shield, and for other inventions such as the "Ejector" hydrant (see POWER TRANSMISSION, HYDRAULIC). Early in the 'eighties he began to work in conjunction with a company whose aim was to introduce into London from America the Hallidie system of cable traction, and in 1884 an Act of Parliament was obtained authorizing what is now the City and South London Railway—a tube-railway to be worked by cables. This was begun in 1886, and the tunnels were driven by means of the Greathead shield, compressed air being used at those points where water-bearing gravel was encountered. During the progress of the works electrical traction became so far developed as to be superior to cables; the idea of using the latter was therefore abandoned, and when the railway was opened in 1889 it was as an electrical one. In 1888 Greathead became engineer, together with Sir Douglas Fox, to the Liverpool Overhead Electric Railway, and afterwards was engaged in two other important underground lines in London—the Waterloo and City, and the Central London. He lived to see the tunnels of the former completed under the river, but the latter was scarcely begun at the time of his death, which happened at Streatham, in the south of London, on 21st October 1896.

GREECE.

Geography and Statistics.

GREECE has undergone many vicissitudes in recent years. The natural and excusable desire of the Greeks to bring about the political union of their race has exposed the country to paroxysms of excitement at each successive crisis in the Eastern Question; a series of costly mobilizations has ruined the national finances, and repeated warlike movements have culminated in a disastrous conflict. Meanwhile the vital interests of the country have been neglected by reckless politicians, bent on acquiring popularity by flattering the national sentiment; urgent reforms have been postponed or abandoned, the administrative and judicial systems have been demoralized by party influences, and public order has not always been efficiently maintained. Notwithstanding these serious drawbacks, Greece has made sensible progress since 1870: commerce has advanced rapidly, agriculture and other industries by slow degrees, education is widely diffused, and though the State is bankrupt, the great mass of the people is well-to-do, if not rich. Owing to the tact and sagacity of King George, the country, amid all the vicissitudes of its recent history, has escaped revolution, and the dynasty may be regarded as firmly established. The acquisition of the fertile province of Thessaly will in course of time add greatly to the resources of the kingdom. The interest of Greece to the scholar, the antiquary, and the student of art has, if possible, been enhanced by recent discoveries, and the peculiar charm of its scenery has received wider appreciation. With improved communications and complete tranquillity in the interior, there will be a constant increase in the number of those who visit this beautiful and interesting country, which may derive no slight material profit from its historic and natural attractions.

No State survey of Greece has ever been undertaken. The area of the country, according to the official figures, was 47,516 square kilometres before the acquisition of the Ionian Islands in 1864, 50,211 square kil. prior to the annexation of Thessaly and part of Epirus in 1881, and 63,606 square kil. in 1896. If we deduct 395 square kil., the extent of territory ceded to Turkey after the war of 1897, the present area of Greece would be 63,211 square kil. Other authorities give 65,194 and 65,119 square kil. as the area prior to the rectification of the frontier in 1898. The population in 1889 was 2,187,208, or 34·38 to the square kil., the population of the territories annexed in 1881 being approximately 350,000; and in 1896, 2,433,806, or 38·26 to the square kil. (according to the official estimate of the area), showing an increase of 246,598, or 1·61 per cent. per annum. The population by sex in 1896 is given as 1,266,816 males and 1,166,990 females. This proportion (52 per cent. males to 48 females) corresponds to that found in Italy, Servia, and Bulgaria. The preponderance of males is most marked in the maritime districts, and in the departments of Larissa and Trikkala. Only in the department of Laconia, in the Cyclades, and in Cephalonia is the female population in excess of the male. Neither the census of 1896 nor that of 1889 gives any classification by professions, religion, or language, but the following figures are derived from unofficial sources:—agricultural and pastoral employments, 444,096; industries, 64,211; traders and their employees, 117,979; labourers and servants, 31,321; various professions, 15,735; officials, 12,109; clergy, 10,059; national defence, 34,624. In 1879, 1,635,698 of the population were returned as Orthodox Christians, 14,677 as Catholics, 2652 as Jews, and 740 as of other religions. The annexation of Thessaly and part of Epirus is stated to have added 24,165 Mahommedan subjects to the Hellenic kingdom. A considerable portion of these, however, emigrated immediately after the annexation, and although a certain number subsequently returned, the total Mahommedan population in Greece is estimated to be under 20,000. The Albanian population still probably exceeds 120,000. It is gradually being absorbed in the Hellenic population. The Vlach population was increased by the annexation of Thessaly; several thousands of these nomad shepherds are to be found in the Pindus range; the greater proportion speak Greek as well as a dialect of Rumanian. By a law of 27th November 1899 Greece, which had hitherto been divided into 16 departments (νομοί) was re-divided into 26 departments, as follows:—

Area and population.

Departments.	Population according to Census of 1896.	Departments.	Population according to Census of 1896.
1. Attica	255,978	15. Arcadia	167,092
2. Bœotia	57,091	16. Achaia	144,826
3. Phthiotis	98,764	17. Elis	91,425
4. Phocis	60,472	18. Triphylia	86,471
5. Acarnania	126,892	19. Messenia	119,327
6. Euritania	43,667	20. Laconia	62,839
7. Arta	39,144	21. Lacedæmon	84,929
8. Trikkala	96,007	22. Corfu	94,686
9. Karditsa	80,766	23. Cephalonia	70,077
10. Larissa	86,513	24. Leukas (with Ithaca)	43,173
11. Magnesia	91,828		
12. Eubœa	106,777	25. Zante	45,032
13. Argolis	80,695	26. Cyclades	134,747
14. Corinth	64,577		

The population is densest in the Ionian Islands, exceeding 286 per square mile. The departments of Acarnania, Phocis, and Eubœa are the most thinly inhabited (about 54, 57, and 62 per square mile respectively).

The movement of the population since 1881 was as follows:—

Year.	Births.	Deaths.	Marriages.	Excess of Births.
1882	43,157	32,194	11,186	10,963
1883	43,061	34,619	11,615	8,442
1884	57,995	35,899	13,657	22,096
1889	74,666	53,512	18,558	21,154
1890	78,226	55,813	19,899	22,443

Both the birth-rate and death-rate are low, being 27·6 and 20·7 per 1000 respectively. Infant mortality is slight, and in point of longevity Greece compares favourably with most other European countries. The number of illegitimate births is 12·25 per 1000. Of the total population 22·3 per cent. live in towns. The population of the principal towns is:—

	1889.	1896.		1889.	1896.
Athens	107,251	111,486	Volo	11,029	16,788
Piræus	34,327	43,848	Larissa	13,610	15,373
Patras	33,529	37,985	Zante	16,608	14,906
Trikkala	14,820	21,149	Kalamata	10,696	14,298
Hermopolis (Syra)	22,104	18,760	Pyrgos	12,647	12,708
Corfu	19,025	18,581	Tripolis	10,698	10,465

No trustworthy information is obtainable with regard to immigration and emigration. In 1889 it was computed that there were 135,466 native-born Greeks in foreign lands, but this figure is probably too low. Every year numbers of young men emigrate to the United States from Arcadia, Laconia, and Maina; there has been a considerable emigration to Egypt from the Cyclades. There is an increasing immigration into the towns from the mountainous districts.

In the higher departments of the administration no important changes have been effected in recent years. In 1898 the number of deputies in the Boulé was increased from 207 to 234. Some years previously, a law diminishing the national representation and enlarging the constituencies was passed by Trikoupis, with the object of checking the local influence of electors upon deputies, but the measure was subsequently repealed. The practice of bartering personal favours, known as συναλλαγή, still continues, to the great detriment of public morality. Local administration is in the hands of some 20,000 officials, most of them inadequately remunerated and liable to removal upon a change of Government. A proletariat of office-seekers has thus been created, and large numbers of well-educated persons spend many years in idleness or in political agitation. The administration of justice suffers under the existing system, more especially in the country districts, where the judges, most of whom are removable, must reckon with the influential politicians and their adherents. The pardon or release of a convicted criminal is not infrequently due to pressure on the part of some powerful patron. In the circumstances crime is less rife than might be expected. A serious feature is the great prevalence of homicide, due in part to the passionate character of the people, but still more to the almost universal practice of carrying weapons. The traditions of the vendetta are almost extinct in the Ionian Islands, but still linger in Maina, where family feuds are transmitted from generation to generation. The brigand of the old-fashioned type (λῃστής, κλεφτής) has almost disappeared, except in the remoter country districts, and piracy has been practically suppressed, but numbers of outlaws (φυγόδικοι) still haunt the mountains, and the efforts of the police to bring them to justice are far from successful. Their ranks were considerably increased after the war of 1897, when many deserters from the army and adventurers who came to Greece as volunteers betook themselves to a predatory life. On the other hand, there is no habitually criminal class in Greece, such as exists in the large centres of civilization. Professional mendicancy is still rare. The system of employing officers and soldiers of the regular army for police duties has proved unsatisfactory, and will soon be abolished. Prison discipline and sanitation are very deficient; conflicts among the prisoners are sometimes reported, in which knives and even revolvers are employed. A good prison has been built near Athens by Andreas Syngros, the national benefactor. The Greeks, like the other nations liberated from Turkish rule, are somewhat litigious, and numbers of lawyers find occupation even in the smaller country towns. A new civil code, based on Saxon and Italian law, has been drawn up by a commission of jurists. A court of appeal (at Larissa) has been added to the four already existing; there are now 22 courts of first instance and 237 justices of the peace.

Administration and justice.

A complete reorganization of the Greek army has been projected under the auspices of the Crown Prince. The experience of the war of 1897 proved the need of far-reaching administrative changes and disciplinary reforms. The existing organization is based on the laws of 1887 and 1896. Military service is obligatory, and liability to serve begins from the 21st year. The term of service comprises 2 years in the active army, 10 years in the active army reserve (for cavalry 8 years), 8 years in the territorial army (for cavalry 10 years), and 10 years for all branches in the territorial army reserve. As a rule, however, the period of service with the colours is considerably shortened. By a law passed in 1900 the army will consist of 3 divisions, each composed of 2 brigades, and other units to be fixed by royal decree. There are 10 regiments of infantry, each of 2 battalions, and 1 battalion-cadre, in addition to 8 battalions of Euzones or highlanders, and 3 regiments of cavalry, each of 4 squadrons. The infantry are armed with the single-loader Gras (·433″) rifle and a bayonet, the cavalry with a Gras carbine and a sword. The artillery consists of 3 regiments of field artillery of 20 batteries. Two field batteries are armed with 8·7-cm. Krupp guns, the remaining batteries with 7·5-cm. Krupp guns. There is 1 regiment of engineers composed of 2 battalions. The peace strength of the army in 1899 was as follows:—

Defence.

	Officers and Civilians.	Non-commissioned Officers and Men.	Horses and Mules.
War Office	62	...	20
Engineers	101	1,381	158
Artillery	217	2,583	1305
Cavalry	96	1,448	1269
Infantry	873	13,180	452
Ambulance	12	449	51
General services	390	8	86
Military instruction	123	10	180
Gendarmerie	139	4,108	395
Total	2013	23,167	3916

In time of war the total strength is 82,125 officers and men, 14,441 horses and mules, and 180 guns. The kingdom is divided into three military districts, Larissa, Missolonghi, and Athens.

The Greek fleet consists of 5 armour-clad vessels—3 battleships (built 1889–90) of 4885 tons each, and carrying 35 guns, 1 central battery ship (launched 1867), and 1 broadside ship (launched 1869); there are further 1 cruiser, 4 gunboats, 2 coast defence vessels, 29 torpedo boats of various types, 1 torpedo gunboat, 3 torpedo ships, 21 vessels used for various services, and 1 royal yacht. The personnel of the navy is composed of 369 officers and cadets, 917 petty officers, 2134 sailors and stokers, 45 boys, and 387 civilians. The navy is manned chiefly by conscription; the period of service is two years. The Greeks make better sailors than soldiers, and the navy, if reorganized by foreign officers, might be brought to a high state of efficiency.

The Greek branch of the Orthodox Eastern Church is practically autocephalous, like those of Servia, Montenegro, and Rumania, though nominally subject to the Patriarchate of Constantinople. The jurisdiction of the Patriarch was in fact repudiated in 1833, and the severance was completed in 1850. Ecclesiastical affairs are under the control of the Ministry of Education. Church government is vested in the Holy Synod, a council of five ecclesiastics under the presidency of the Metropolitan of Athens; its sittings are attended by a royal commissioner. There are nominally 18 archbishoprics and 22 bishoprics in Greece, but many of the sees are allowed to remain vacant. The number of priests is very large. They belong for the most part to the poorest classes, and, having no fixed stipends, often resort to agriculture or to small trading in order to supplement the scanty fees earned by their ministrations. There are 199 monasteries and 6 nunneries in Greece, with about 1650 monks and 250 nuns. The number of Roman Catholics is probably between 25,000 and 30,000; the majority are in the Cyclades. They have 3 archbishoprics (Athens, Naxos, and Corfu) and 5 bishoprics. There are about 60 Roman Catholic churches. The Greeks, an intelligent people, have always shown a remarkable zeal for learning, and popular education is making great strides. In 1898 there were 2914 "demotic" or primary schools, with 3465 teachers, attended by 129,210 boys (5·38 per cent. of the population) and 29,119 girls (1·19 per cent. of the population). The expenditure on primary schools, which in 1894 was 3,737,620 drachmæ, had risen

Religion and education.

in 1897 to 5,007,440 dr.; the attendance of pupils in the former year was 144,917, in the latter 158,349. In 1898 there were 243 "Hellenic" or secondary schools, with 647 teachers and 13,472 pupils (boys only), maintained by the State at a cost of 1,596,716 dr.; and 40 higher schools or gymnasia, with 291 masters and 3822 pupils, partly maintained by the State (expenditure, 842,640 dr.) and partly by benefactions. The Polytechnic Institute of Athens affords technical instruction in the departments of art and science to 359 students. There are 7 agricultural colleges, 5 theological seminaries, 5 nautical schools, the military college of the Euelpides at Athens, and many private schools. (For the native and foreign archæological institutions, see ATHENS.) The University of Athens in 1899 numbered 57 professors and 2802 students, of whom 815 were from abroad. Of the five faculties theology numbered 55 students, law 1147, medicine 864, arts 289, and pharmacy 121. The university receives a subvention from the State, which in 1899 amounted to 505,040 dr. Higher instruction is practically gratuitous in Greece, and there is a somewhat ominous increase in the number of educated persons who disdain agricultural pursuits and manual labour.

Commerce and industry.

Owing to the natural aptitude of the Greeks for commerce, and their predilection for a seafaring life, a great portion of the trade of the Levant has fallen into their hands. The Greek mercantile marine, which in 1888 consisted of 1352 vessels (70 steamers) with a total tonnage of 219,415 tons, numbered in 1898 1270 vessels (118 steamers) with a total tonnage of 326,041 tons. Almost the whole of the corn trade of Turkey is in Greek hands. A large number of the sailing ships, especially the smaller vessels occupied in the coasting trade, belong to the Heptanesian and Aegean islanders. A considerable portion of the shipping on the Danube and Pruth is owned by the inhabitants of Ithaca and Cephalonia. There are six principal Greek steamship companies, owning 44 steamers with a total tonnage of 27,251 tons. In 1847 there was but one lighthouse in Greek waters; in 1899 there were 110 lighthouses and port-lanterns. Hermopolis (Syra) is the chief seat of the carrying trade, but as a commercial port it yields to Piræus, which is the principal centre of distribution for imports. Other important ports are Patras, Volo, Corfu, Kalamata, and Laurion. The following table shows the total value of special Greek commerce for the given years:—

	1887.	1892.	1897.	1898.
Imports	131,849,325 fr.	119,306,007 fr.	116,363,348 fr.	152,083,634 fr.
Exports	102,652,487 ,,	82,261,464 ,,	81,708,626 ,,	89,488,100 ,,

Variations in the price and quantity of imported cereals and in the sale of currants account mainly for the marked fluctuations in the returns.

The imports and exports for 1897 were distributed as follows:—

	Imports from.	Exports to.
	Fr.	Fr.
Great Britain	29,486,910	26,763,302
Russia	29,256,722	2,434,927
Austria	11,583,956	8,085,969
Turkey	8,744,476	4,868,893
France	11,686,838	7,641,507
Italy	2,778,343	5,233,428
Germany	7,550,463	4,733,690
United States	3,890,662	3,644,286
Belgium	2,951,694	7,616,747
Rumania	568,817	841,716
Egypt	883,575	2,147,478
Holland	761,588	6,459,878
Other countries	6,219,304	1,236,805
	116,363,348	81,708,626

The principal articles of importation were:—

	1896.		1897.	
	Total Value in Francs.	Imports from the United Kingdom.	Total Value in Francs.	Imports from the United Kingdom.
Cereals	31,010,922	None.	33,118,185	None.
Textiles	22,769,703	14,259,858	21,149,714	13,236,880
Minerals, metals (raw)	13,158,009	9,123,887	12,536,251	9,404,953
Fish, caviar, &c.	3,654,307	1,677,436	4,047,410	1,528,554
Raw hides	3,333,108	369,614	3,565,454	250,311
Wood and timber	4,491,951	49,094	3,783,012	38,658
Minerals, metals (worked)	3,643,241	1,140,186	2,901,537	795,645

The chief articles of exportation were:—

	1896.		1897.	
	Total Value in Francs.	Exports to the United Kingdom.	Total Value in Francs.	Exports to the United Kingdom.
Currants	23,139,527	7,681,585	33,300,223	17,280,263
Ores	17,433,940	7,163,705	19,805,835	6,385,538
Wines	5,094.044	578,590	5,592,725	493,308
Cognac	962,157	1,179	1,081,439	43,389
Figs	3,598,068	24,862	2,553,108	16,860
Tobacco	2,582,708	117,733	1,899,407	66,861
Olive oil	3,041,161	13,848	4,645,785	549,715
Olives	1,138,462	42,527	684,374	19,223
Valonia	3,320,636	2,211,682	1,965,920	701,667
Sponges	1,240,400	173,200	1,040,260	84,820

Greece does not yet possess manufacturing industries on any large scale. In 1889 there were 145 establishments, employing steam of 5568 indicated horse-power. In 1892 the total horse-power employed in all factories was calculated to have increased to 10,000. Among the factories are flour mills, cloth and cotton mills, shipbuilding and engineering works, oil presses, tanneries, powder and dynamite mills. About 100 are established in the neighbourhood of Athens and Piræus.

Agriculture.

Greece is essentially an agricultural country; its prosperity depends on its agricultural products, and more than half the population is occupied in the cultivation of the soil. The land in the plains and valleys is exceedingly rich, and, wherever there is a sufficiency of water, produces magnificent crops. The country, especially since the acquisition of the fertile province of Thessaly, might under a well-developed agricultural system provide a food supply for all its inhabitants and an abundant surplus for exportation. Thessaly alone, indeed, could furnish cereals for the whole of Greece. Unfortunately, however, agriculture is still in a primitive state, and the condition of the rural population has received very inadequate attention from successive Governments. As a rule, countries dependent on agriculture are liable to sudden fluctuations in prosperity, but in Greece the diversity of products is so great that a failure in one class of crops is usually compensated by exceptional abundance in another. Among the causes which have hitherto retarded agricultural progress are the ignorance and conservatism of the peasantry, antiquated methods of cultivation, want of capital, absentee proprietorship, sparsity of population, bad roads, the prevalence of usury, the uncertainty of boundaries and the land tax, which, in the absence of a survey, is levied on ploughing oxen; to these may be added the growing distaste for rural life which has accompanied the spread of education. Large estates are managed under the métayer system; the landlords, who prefer to live in the larger towns, see little of their tenants, and rarely interest themselves in their welfare. A great proportion of the best arable land in Thessaly is owned by persons who reside permanently out of the country. In the Peloponnesos peasant proprietorship is almost universal; elsewhere it is gradually supplanting the métayer system; the small properties vary from 2 or 3 to 50 acres. The extensive State lands have been much encroached upon by neighbouring owners; a considerable portion has also been sold to the peasants. The rich plain of Thessaly suffers from alternate droughts and inundations, and from the ravages of field mice; with improved cultivation, drainage, and irrigation it might be rendered enormously productive. Usury is,

perhaps, a greater scourge to the rural population than any visitation of nature; the institution of agricultural banks, lending money at a fair rate of interest on the security of their land, would do much to rescue the peasants from the clutches of local Shylocks. The following table gives the approximate yield and acreage of agricultural products for 1893:—

Crop.	Acres.	Yield.
Cereals	1,111,500	20,250,000 bushels
Olives	432,000	15,000,000 ℔
Vineyards	336,000	66,000,000 gallons
Currants	168,000	350,000,000 ℔
Figs	52,000	60,000,000 ℔
Cotton	14,800	
Tobacco	12,000	16,000,000 ℔
Various	211,400	
Fallow	1,200,000	
Forest	2,025,400	
	Total, 5,563,100	

In addition to the above there are about 5,000,000 acres of pasture and 3,000,000 acres of waste land. The principal cereals are wheat, barley, maize, oats, sesame, and rye. Rice is grown in the marshy plains of Elis, Bœotia, Marathon, and Missolonghi. The cultivation of vegetables is increasing; beans, peas, and lentils are the most common. Of late years market-gardening has been taken up as a new industry in the neighbourhood of Athens. There is a great variety of fruits. Olive plantations are found everywhere; in 1860 they occupied about 90,000 acres, in 1887 433,701 acres. The annual yield of olive oil is estimated at 25,000,000 kilogrammes, and the value of the oil and fruit exported varies from five to ten million francs. Figs are also abundant, especially in Messenia and the Cyclades. Mulberry trees are planted for the purposes of sericulture. Other fruit trees are the orange, citron, lemon, pomegranate, and almond. Peaches, apricots, pears, cherries, &c. abound, but are seldom scientifically cultivated; the fruit is generally gathered while unripe. Cotton in 1887 occupied 14,984 acres, chiefly near Levadeia. Tobacco plantations in 1893 covered 16,320 acres, yielding 2,840,102 okes (1 oke=2¾ ℔); about half of the annual produce is exported, principally to Egypt, Holland, and Turkey. More important are the vineyards, which occupied in 1887 an area of 306,421 acres. The best wine is made at Patras, on the royal estate at Decelea, and on other estates in Attica; a peculiar flavour is imparted to the wine of the country by the addition of resin. The foreign demand for Greek wines is rapidly increasing; 3,770,257 gallons were exported in 1890, 4,974,196 gallons in 1894. There is also a growing demand for Greek cognac.

Currants.

The currant, by far the most important of Greek exports, is cultivated in a limited area extending along the southern shore of the Gulf of Corinth and the seaboard of the Western Peloponnesos, in Zante, Cephalonia, and Leukas, and in certain districts of Akarnania and Ætolia; attempts to cultivate it elsewhere have generally proved unsuccessful. The history of the currant industry has been a record of extraordinary vicissitudes. Prior to 1877 the currant was exported solely for eating purposes, the amounts for the years 1872 to 1877 being 70,766 tons, 71,222 tons, 76,210 tons, 72,916 tons, 86,947 tons, and 82,181 tons respectively. In 1877, however, the French vineyards began to suffer seriously from the phylloxera, and French wine producers were obliged to have recourse to dried currants, which make an excellent wine for blending purposes. The importation of currants into France at once rose from 881 tons in 1877 to 20,999 tons in 1880, and to 70,401 tons in 1889, or about 20,000 tons more than were imported into England in that year. Meanwhile the total amount of currants produced in Greece had nearly doubled in these thirteen years. The country was seized with a mania for currant planting; every other industry was neglected, and olive, orange, and lemon groves were cut down to make room for the more lucrative growth. The currant growers, in order to increase their production as rapidly as possible, had recourse to loans at a high rate of interest, and the great profits which they made were devoted to further planting, while the loans remained unpaid. A crisis followed rapidly. By 1891 the French vineyards had to a great extent recovered from the disease, and wine producers in France began to clamour against the competition of foreign wines and wine-producing raisins and currants. The import duty on these was thereupon raised from 6 francs to 15 francs per 100 kilos, and was further increased in 1894 to 25 francs. The currant trade with France was thus extinguished; of a crop averaging 160,000 tons, only some 110,000 now found a market. Although a fresh opening for exportation was found in Russia, the value of the fruit dropped from £15 to £5 per ton, a price scarcely covering the cost of cultivation. In July 1895 the Government introduced a measure, since known as the Retention (παρακράτησις) Law, by which it was enacted that every shipper should deliver into depots provided by the Government a weight of currants equivalent to 15 per cent. of the amount which he intended to export. A later law has fixed the quantity to be retained by the State at 10 per cent., which may be increased to 20 per cent., should a representative committee, meeting every summer at Athens, so advise the Government. The currants thus taken over by the Government cannot be exported unless they are reduced to pulp, syrup, or otherwise rendered unsuitable for eating purposes; they may be sold locally for wine-making or distilling, due precautions being taken that they are not used in any other way. The price of exported currants is thus maintained at an artificial figure. The Retention Law, which since 1895 has been voted annually, was passed for a period of ten years in 1899. This pernicious measure, which is in defiance of all economic laws, perpetuates a superfluous production, retards the development of other branches of agriculture, and burdens the Government with vast accumulations of an unmarketable commodity. It might excusably be adopted as a temporary expedient to meet a pressing crisis, but as a permanent system it can only prove detrimental to the country and the currant growers themselves. In 1889 an agricultural bank was established at Patras for the purpose of assisting currant growers. The following table gives the annual currant crop from 1877 to 1898, the figures for the last six years, however, being only approximate.

Year.	Total (Tons).	Exported to Great Britain.	Exported to France.	Year.	Total (Tons).	Exported to Great Britain.	Exported to France.
1877	82,181	...	881	1888	152,965	51,856	43,639
1878	100,004	...	9,086	1889	152,256	49,923	70,401
1879	92,311	...	19,087	1890	147,024	56,846	40,018
1880	92,337	...	20,999	1891	153,997	64,050	40,856
1881	121,994	...	30,315	1892	122,583	53,957	20,627
1882	109,403	51,933	26,282	1893	170,000	60,694	3,187
1883	114,980	52,099	24,815	1894	135,500	57,559	15,060
1884	129,268	59,629	39,198	1895	151,500	51,645	19,067
1885	113,287	55,765	37,730	1896	132,000	49,676	2,815
1886	127,570	48,892	45,000	1897	107,000	52,318	526
1887	127,160	55,549	37,438	1898	140,000	58,115	892

The "peronosporos," a species of white blight, first caused considerable damage in the Greek vineyards in 1892, recurring in 1897 and 1900.

Stock farming.

More than half the cultivable area of Greece is devoted to pasturage. Cattle-rearing, as a rule, is a distinct occupation from agricultural farming; the herds are sent to pasture on the mountains in the summer, and return to the plains at the beginning of winter. The larger cattle are comparatively rare, being kept almost exclusively for agricultural labour; the smaller are very abundant. The native breed of oxen is small; buffaloes are seldom seen except in north-western Thessaly; a few camels are used in the neighbourhood of Parnassos. The Thessalian breed of horses, small but sturdy and enduring, can hardly be taken to represent the celebrated chargers of antiquity. The flocks of long-horned sheep and goats add a picturesque feature to Greek rural scenery. The shepherds' dogs rival those of Bulgaria in ferocity. In 1892 the numbers of the various domestic animals were as follows:—sheep, 2,900,000; goats, 2,000,000; large cattle, 360,000; donkeys, 100,000; horses, 100,000; mules, 52,000; pigs, 25,000; and camels, 44.

Forests.

The forest area (about 2,025,400 acres) is for the most part State property. The principal trees are the oak and the various conifers. In Greece, as in other lands formerly subject to Turkish rule, the forests are not only neglected, but often deliberately destroyed; this great source of national wealth is thus continually diminishing. Every year immense forest fires may be seen raging in the mountains, and many of the most picturesque districts in the country are converted into desolate wildernesses. These conflagrations are mainly the work of shepherds eager to provide increased pasturage for their flocks; they are sometimes, however, due to the carelessness of smokers, and occasionally, it is said, to spontaneous ignition in hot weather. Great damage is also done by the goats, which browse on the young saplings; the pine trees are much injured by the practice of scoring their bark for resin. With the disappearance of the trees the soil of the mountain slopes, deprived of its natural protection, is soon washed away by the rain; the rapid descent of the water causes inundations in the plains, while the uplands become sterile and lose their vegetation. The climate has been affected by the change; rain falls less frequently but with greater violence, and the process of denudation is accelerated. The Government has from time to time made efforts for the protection of the forests, but with little success; a society for the re-afforesting of the country has been formed at Athens under royal patronage.

The chief minerals are silver, lead, zinc, copper manganese,

magnesia, iron, sulphur, and coal. Emery, salt, millstone and gypsum, which are found in considerable quantities, are worked by the Government. The important mines at Laurion, reopened in modern times by a Franco-Italian company, were declared to be State property in 1871; they are now worked by a Greek and a French company. The output of marketable ore in 1899 was as follows:—manganese iron ore, 306,625 tons; hæmatite iron ore, 134,381 tons; calamine or zinc ore, 23,710 tons; lead ore and galena, 15,749 tons; blende of zinc and lead ore, 1195 tons; arsenic lead smokes, 3000 tons, and speiss, 2100 tons: total 486,760 tons, besides 289,292 tons of dressed lead ore, producing 18,360 tons of silver pig lead with about 2000 grams of silver per ton of lead. The total value of the exports from the Laurion mines, which in 1875 amounted to only £150,513, had in 1899 increased to £827,209. The revenue accruing to the Government from all mines and quarries, including those worked by the State, was estimated in the budget for 1900 at 1,115,000 drachmæ. The great abundance of marble in Greece has latterly attracted the attention of foreign capitalists. New quarries have been opened by an English company on the north slope of Mount Pentelikon, and are now connected by rail with Athens and Piræus. The marble on this side of the mountain is harder than that on the south, which alone was worked by the ancients. The estimated output in 1900 was 10,800 tons. White marble is also found at Skyros, Tenos, and Naxos; gray at Stoura and Karystos; variegated at Valaxa and Karystos; green on Taygetos; black at Tenos, and red in Maina.

Mines.

The important drainage works at Lake Copais were taken over by an English company in 1890. The lake covered an area of 58,080 acres, the greater part of which is now rendered fit for cultivation. In 1899, 2,400,000 okes of wheat, 900,000 okes of barley, 680,000 okes of hay, and 590,000 okes of maize, besides other produce, were raised off the reclaimed lands. The drainage works consist of a canal 28 kilometres in length, and a tunnel of 600 metres descending through the mountain to a lower lake, which is connected by a second tunnel with the sea. The canal through the isthmus of Corinth was opened to navigation in November 1893. The total cost of the works, which were begun in 1882, was 70,000,000 francs. The narrowness of the canal, which is only 24 metres broad at the surface, and the strength of the current which passes through it, seriously detract from its utility. The high charges imposed on foreign vessels have proved almost prohibitive. There are reduced rates for ships flying the Greek flag. Up to February 1899, 15,272 vessels had passed through the canal. In 1898 the receipts from Greek ships were 241,921 drachmæ, from foreign ships 19,382 francs gold. The widening of the Euripus Channel at Chalcis to the extent of 21·56 metres was accomplished in 1894. The operations involved the destruction of the Venetian tower which guarded the strait.

Public works.

Internal communication by roads is improving, though much remains to be done, especially as regards the quality of the roads. A considerable impetus was given to road-making under the Trikoupis administration. In 1878 there were only 555 miles of roads; in 1898 there were 2398 miles. Railways were open to traffic in 1900 for a length of 598 miles, an increase of 29 miles since 1892; some 62 miles, which will complete the circle of the Morea railways, are in course of construction. A very important undertaking is the completion of a line from Piræus to the frontier, the contract for which was signed in 1900 between the Greek Government and the Eastern Railways Extension Syndicate. A line connecting Piræus with Larissa was begun in 1890, but in 1894 the English company which had undertaken the contract went into liquidation. The line will now be carried as far as Demerli, in the south of Thessaly, a distance of 218 miles; it will subsequently be continued to some point, not yet determined, on the Turkish frontier. There will be branch lines to Lamia and Chalcis. The establishment of a connexion with the continental railway system, by a junction with the line from Belgrade to Salonika, would be of immense advantage to Greece, and Piræus would become an important place of embarkation for Egypt, India, and the Far East. In 1898 the number of post offices was 372, with 550 employés. The receipts amounted to 1,789,236 francs, the expenditure to 1,870.963 francs. During the year there passed through the post 3,104,050 ordinary letters for the interior, 4,984,902 for foreign destinations; 225,180 registered letters; 139,450 post-cards; 75,712 samples; 5,620,730 printed papers for the interior, 2,519,067 for foreign destinations. In the same year there were 221 telegraph offices with 394 instruments and 9 telephones, employing 974 clerks, whose duties, however, were in most cases divided between the postal and telegraph services. Telegraph lines extended over 5235 miles, with 6240 miles of wires. There were despatched during the year 902,872 inland telegrams, 319,048 foreign, and 19,002 service telegrams. Receipts amounted to 1,211,669 francs, expenditure to 779,925 francs.

Communications.

The financial history of Greece has been unsatisfactory from the outset. Excessive military and naval expenditure (mainly due to repeated and hasty mobilizations), a lax and improvident system of administration, the corruption of political parties, and the instability of the Government, which has rendered impossible the continuous application of any scheme of fiscal reform —all alike have contributed to the economic ruin of the country. For a long series of years preceding the declaration of national insolvency in 1893 successive budgets presented a deficit, which in years of political excitement and military activity assumed enormous proportions: the shortcomings of the budget were supplied by the proceeds of foreign loans, or by means of advances obtained in the country at a high rate of interest. The two loans which had been contracted during the war of independence were extinguished by means of a conversion in 1889. Of the existing foreign loans the earliest is that of 60,000,000 frs., guaranteed by the three protecting Powers in 1832: owing to the payment of interest and amortization by the Powers, the capital amounted in 1871 to 100,392,833 fr.; on this Greece pays an annual sum of 900,000 fr., of which 300,000 have been granted by the Powers as a yearly subvention to King George. The only other existing foreign obligation of early date is the debt to the heirs of King Otho (4,500,000 dr.) contracted in 1868. A large amount of internal debt was incurred between 1848 and 1880, but a considerable proportion of this was redeemed with the proceeds of the foreign loans negotiated after this period. At the end of 1880 the entire national debt, external and internal, stood at 252,652,481 dr. In 1881 the era of great foreign loans began. In that year a 5 per cent. loan of 120,000,000 fr. was raised to defray the expenses of the mobilization of 1880. This was followed in 1884 by a 5 per cent. loan of 170,000,000 fr., of which 100,000,000 was actually issued. The service of these loans was guaranteed by various State revenues. A "patriotic loan" of 30,000,000 dr. without interest, issued during the war excitement of 1885, proved a failure, only 2,723,860 dr. being subscribed. In 1888 a 4 per cent. loan of 135,000,000 fr. was contracted, secured on the receipts of the five State monopolies, the management of which was entrusted to a privileged company. In the following year (1889) two 4 per cent. loans of 30,000,000 fr. and 125,000,000 fr. respectively were issued without guarantee or sinking fund: Greek credit had now apparently attained an established position in the foreign money market, but a decline of public confidence soon became evident. In 1890, of a 5 per cent. loan of 80,000,000 fr. effective, authorized for the construction of the Piræus-Larissa Railway, only 40,050,000 fr. was taken up abroad and 12,900,000 fr. at home; large portions of the proceeds were devoted to other purposes. In 1892 the Government was compelled to make large additions to the internal floating debt, and to borrow 16,500,000 fr. from the National Bank on onerous terms. In 1893 an effort to obtain a foreign loan for the reduction of the forced currency proved unsuccessful. (For the events leading up to the declaration of national bankruptcy in that year see below under *Recent History*.) A funding convention was concluded in the summer, under which the creditors accepted scrip instead of cash payments of interest. A few months later this arrangement was reversed by the Chamber, and on the 13th December a law was passed assigning provisionally to all the foreign loans alike 30 per cent. of the stipulated interest: the reduced coupons were made payable in paper instead of gold, the sinking funds were suspended, and the sums encashed by the monopoly company were confiscated. The causes of the financial catastrophe may be briefly summarized as follows:—(1) The military preparations of 1885–86, with the attendant disorganization of the country; the extraordinary expenditure of these years amounted to 130,987,772 dr. (2) Excessive borrowing abroad, involving a charge for the service of foreign loans altogether disproportionate to the revenue. (3) Remissness in the collection of taxation: the total loss through arrears in a period of ten years (1882–91) was 36,549,202 dr., being in the main attributable to non-payment of direct taxes. (4) The adverse balance of trade, largely due to the neglected condition of agriculture; in the five years preceding the crisis (1888–92) the exports were stated to amount to £19,578,973, while the imports reached £24,890,146; foreign live stock and cereals being imported to the amount of £6,193,579. The proximate cause of the crisis was the rise in the exchange owing to the excessive amount of paper money in circulation. Forced currency was first introduced in 1868, when 15,000,000 dr. in paper money was issued; it was abolished in the following year, but reintroduced in 1877 with a paper issue of 44,000,000 dr. It was abolished a second time in 1884, but again put into circulation in 1885, when paper loans to the amount of 45,000,000 dr. were authorized. In 1893 the total authorized forced currency was 146,000,000 dr., of which 88,000,000 (including 14,000,000 dr. in small notes) was on account of the Government. The rate of exchange, as a rule, varies directly with the amount of paper money in circulation, but, owing to speculation, it is liable to violent fluctuations whenever there is an exceptional demand for gold in the market. In 1893 the gold franc stood at the ratio of 1·60 to the paper drachma: the service of the foreign

Finance.

loans required upwards of 31,000,000 dr. in gold, and any attempt to realize this sum in the market would have involved an outlay equivalent to at least half the budget. With the failure of the projected loan for the withdrawal of the forced currency repudiation became inevitable. The law of the 13th December was not recognized by the national creditors: prolonged negotiations followed, but no arrangement was arrived at till 1897, when the intervention of the Powers after the war with Turkey furnished the opportunity for a definite settlement. It was stipulated that Turkey should receive an indemnity of £T4,000,000 contingent on the evacuation of Thessaly; in order to secure the payment of this sum by Greece without prejudice to the interests of her creditors, and to enable the country to recover from the economic consequences of the war, Great Britain, France, and Russia undertook to guarantee a $2\frac{1}{2}$ per cent. loan of 170,000,000 fr., of which 150,000,000 fr. has been issued. By the preliminary treaty of peace (18th September 1897) an International Financial Commission, composed of six representatives of the Powers, was charged with the payment of the indemnity to Turkey (£T4,000,000), and with "absolute control" over the collection and employment of revenues sufficient for the service of the foreign debt. A law defining the powers of the Commission was passed by the Chamber, 26th February 1898 (o.s.). The revenues assigned to its supervision were the five Government monopolies, the tobacco and stamp duties, and the import duties of Piræus (total annual value estimated at 39,600,000 dr.): the collection was entrusted to a Greek society, which is under the absolute control of the Commission. The returns of Piræus customs (estimated at 10,700,000 dr.) are regarded as an extra guarantee, and are handed over to the Greek Government; when the produce of the other revenues exceeds 28,900,000 dr. the "plus value" or surplus is divided in the proportion of 50·8 per cent. to the Greek Government and 49·2 per cent. to the creditors. The plus values amounted to 3,301,481 dr. in 1898, 3,533,755 dr. in 1899, and 3,442,713 dr. in 1900. Simultaneously with the establishment of the control the interest for the Monopoly Loan was fixed at 43 per cent., for the Funding Loan at 40 per cent., and for the other loans at 32 per cent. of the original interest. With the revenues at its disposal the International Commission has already been enabled to make certain augmentations in the service of the foreign debt; since 1900 it has begun to take measures for the reduction of the forced currency, of which 2,000,000 dr. will be annually bought up and destroyed till the amount in circulation is reduced to 40,000,000 dr. On the 1st January 1901 the authorized paper issue was 164,000,000 dr., of which 92,000,000 (including 18,000,000 in fractional currency) was on account of the Government; the amount in actual circulation was 148,619,618 dr. The financial commission retains its powers until the extinction of all the foreign loans contracted since 1881. Though its activity is mainly limited to the administration of the assigned revenues, it has exercised a beneficial influence over the whole domain of Greek finance. No change can be made in its composition or working without the consent of the six Powers, and none of the officials employed in the collection of the revenues subject to its control can be dismissed or transferred without its consent. It thus constitutes an element of stability and order which cannot fail to react on the general administration. It is unable, however, to control the expenditure or to assert any direct influence over the Government, with which the responsibility still rests for an improved system of collection, a more efficient staff of functionaries, and the repression of smuggling. The country has shown a remarkable vitality in recovering from the disasters of 1897, and should it in future obtain a respite from paroxysms of military and political excitement, its financial regeneration will be assured.

The following table gives the actual expenditure and receipts for the period 1889–99 inclusive:—

Year.	Actual Receipts.	Actual Expenditure.	Surplus or Deficit.
	Drachmæ.	Drachmæ.	Drachmæ.
1889	83,731,591	110,772,327	− 27,040,736
1890	79,931,795	125,932,579	− 46,000,784
1891	90,321,872	122,836,385	− 32,514,513
1892	95,465,569	107,283,498	− 11,817,929
1893	96,723,418	92,133,565	+ 4,589,853
1894	102,885,643	85,135,752	+ 17,749,891
1895	94,657,065	91,641,967	+ 3,015,098
1896	96,931,726	90,890,607	+ 6,041,119
1897	92,485,825	137,043,929	− 44,558,104
1898	104,949,718	110,341,431	− 5,391,713
1899	111,318,273	104,586,504	+ 6,731,769

The budget estimates for 1901 were as follows:—Civil list, 1,325,000 dr.; pensions, payment of deputies, &c., 7,433,763 dr.; public debt, 32,344,624 dr.; foreign affairs, 2,846,018 dr.; justice, 6,243,573 dr.; interior, 15,140,566 dr.; religion, 5,392,457 dr.; army, 17,393,014 dr.; navy, 7,123,947 dr.; finance, 7,129,947 dr.; collection of revenue, 9,438,235 dr.; various expenditure, 6,910,628 dr.—total, 118,721,772 dr.

Banking, &c.

The two privileged banks in Greece are the National Bank, founded in 1841; capital, 20,000,000 francs, in 20,000 shares of 1000 francs each, fully paid up; reserve fund, 13,500,000 francs; notes in circulation, 126,900,000 francs; and the Ionian Bank, incorporated in 1839; capital paid up, £315,500, in 12,620 shares of £25 each; notes in circulation, about 13,000,000 francs. The National Bank has its central establishment at Athens, with 33 branches throughout the country. The headquarters of the Ionian Bank are in London; it has 5 branches in Greece. The privileged Epiro-Thessalian Bank ceased to exist from 12th January 1900, when it was amalgamated with the National Bank. There are three other banking companies in Athens, and several private banks. Greece entered the Latin Monetary Union in 1868. The monetary unit is the new drachma, equivalent to the franc, and divided into 100 lepta or centimes. There are nickel coins of 20, 10, and 5 lepta, copper coins of 10 and 5 lepta. Gold and silver coins were minted in Paris between 1868 and 1884, but have since practically disappeared from the country. The paper currency consists of 500-dr., 100-dr., 25-dr., 10-dr., and 5-dr. notes; there are also fractional notes for 2 dr. and 1 dr. The decimal system of weights and measures was adopted in 1876, but some of the old Turkish standards are still in general use.

Ionian Islands.—Since their annexation to Greece in 1864, the history of the "Ionian Islands" (Corfu, Paxos, Cephalonia, Santa Maura, Ithaca, Zante, and Cerigo) has been uneventful. Corfu (Kerkyra) with Paxos; Cephalonia; Santa Maura (Leukas) with Ithaca (Thiaki); and Zante (Zakynthos) each form separate nomarchies or departments, the population of which in 1896 has been given above. Cerigo (Kýthera) now forms part of the nomarchy of Laconia. The beautiful island of *Corfu* has latterly suffered a decline of prosperity. Centralization at Athens has affected some of the local industries and institutions; the university, founded by Lord Guildford, has been abolished; commerce has considerably diminished, partly owing to the fact that the neighbouring coasts of Albania and Epirus now trade directly with Trieste, Fiume, and Marseilles, and the number of winter visitors has decreased owing to the growing popularity of Cairo, Algiers, and other health resorts. In recent years the stagnation of trade has been more marked owing to successive failures in the olive and wine crops, the staple products of the island. The total exports, which in 1895 were valued at £147,200 (£20,579 to the United Kingdom), were estimated in 1898 at only £87,809 (£3754 to the United Kingdom), and in 1899 at £60,815 (£6937 to the United Kingdom). The imports, which in 1896 reached £238,346 (£63,012 from the United Kingdom), were valued in 1898 at £158,426 (£21,326 from the United Kingdom), and in 1899 at £126,471 (£16,833 from the United Kingdom). Corfu and the other Ionian Islands have retained the exemption from direct taxation which they enjoyed under the British protectorate; in lieu of this there is an *ad valorem* tax of $20\frac{1}{2}$ per cent. on exported oil and a tax of 6 per cent. on wine exported to Greek ports; these commodities are further liable to an export duty of $1\frac{1}{2}$ per cent., which is levied on all agricultural produce and articles of local manufacture for the maintenance and construction of roads. The excellent roads, which date from the British administration, are kept in fair repair. Agriculture has made little progress in Corfu; many of the landed proprietors live in the town, and pay little attention to their estates, which are let out to the peasants on the *métayer* system. The unproductiveness of the olive trees in recent years is stated to be largely due to neglect. Among the principal industrial establishments of Corfu are steam oil-presses and flour mills, soap and candle factories, tanneries, and a playing-cards factory. The substantial residence of the British High Commissioners, built in the time of Sir Thomas Maitland, is now a royal palace. In the

neighbourhood of the town is the Villa Monrepos, built by Sir Frederick Adam, and now occasionally occupied by the Greek royal family. The Ionian Academy, founded by Lord Guildford, contains a library and a museum. Near the village of Gastouri is the remarkable Achilleion, once the residence of the Empress Elizabeth of Austria. The house, which is decorated in the Pompeian style, is said to have cost upwards of 5,000,000 francs; it commands a magnificent view, and is surrounded by beautiful gardens. The small rocky island of *Paxos* numbers about 5000 inhabitants. *Cephalonia*, the largest of the Ionian Islands, contains the highest mountain in the group, Mount Ænos or Monte Nero (5300 feet), the slopes of which are still partly covered with beautiful forests of pine (*abies Cephalonica*). Argostoli (population 9172) and Lixouri (population 5414), the principal towns, stand respectively on the east and west shores of the gulf of Livadi, a long inlet on the western side of the island. Currants, which are not grown in Corfu, form one of the principal products of Cephalonia, Santa Maura, and Ithaca. The total exports from these islands in 1898 were estimated at £161,008 (currants £118,958), in 1899 at £135,935 (currants £94,610). The currants are mainly exported to Holland. The total imports in 1898 were £228,705 (£35,450 from the United Kingdom); in 1899, £222,315 (£33,850 from the United Kingdom). The excess of imports over exports is covered by remittances from natives trading abroad. The island of *Ithaca* is inhabited by an industrious agricultural and seafaring population (11,409 in 1896). The ships of the enterprising islanders appear in every port of the Mediterranean, and carry on a busy traffic on the rivers Danube and Pruth. The wine of Ithaca enjoys a high reputation. In latter years the prosperity of the islands has declined, and there has been a considerable emigration to Australia. The remarkable Cyclopean fortress on Mount Ætos, commonly called the Castle of Ulysses, was excavated by Schliemann in 1878. In view of the theory latterly supported by Professor Dörpfeld, that Leukas is the Ithaca of Homer, excavations on the island were carried out by that scholar and Herr Goekup in 1900 and 1901, but without important results. *Leukas*, which owes its name to its white limestone cliffs, was formerly connected with the mainland. The intervening lagoon is shallow, but a passage is being opened which will be navigable to ships of considerable tonnage. The population of Leukas, with that of the small adjacent islands, in 1896 was 31,769. The fertile and beautiful *Zante* has not recovered its prosperity since the earthquakes of 1893, and many of the public and private buildings remain in a dilapidated condition. The island has also suffered severely from the crisis in the currant trade, hitherto its principal source of wealth. *Cerigo*, which has no geographical connexion with the other islands, is rocky, and comparatively unproductive. A large proportion of the male population goes abroad for harvest work during the summer. Quails are captured in great numbers in the spring and autumn, and are exported alive. The population in 1896 was 12,306. The small neighbouring island of *Cerigotto* or Antikýthera has latterly been brought into notice, owing to the remarkable discovery of ancient statues at the bottom of the sea near its coast (January 1901). A signal station was established here during the Cretan insurrection of 1897, by which messages were transmitted from Crete to Athens. The total population of the Ionian Islands was 265,279 in 1896.

Cyclades and Sporades.—The Cyclades, a compact group of islands in the Greek Archipelago, form a cluster around the island of *Syros*, the principal town of which, Syra, officially known as Hermopolis, is the capital of a department. Population, 134,747. The islands, though seldom visited by foreigners, are for the most part highly interesting and picturesque, notwithstanding their somewhat barren appearance when viewed from the sea; many of them bear traces of the feudal rule of Venetian families in the Middle Ages, and their inhabitants in general may be regarded as presenting the best type of the Greek race. To the student of antiquity the most interesting islands of the group are: *Delos* (*q.v.*), one of the greatest centres of ancient religious, political, and commercial life, where an important series of researches has been latterly carried out by French archæologists; *Melos*, where, in addition to various buildings of the Hellenic and Roman periods, the large prehistoric stronghold of Phylakopi has been excavated by members of the British school at Athens; and *Thera* (Santorin), the ancient capital of which has been explored by Baron Hiller von Gaertringen. Thera is also of special interest to geologists owing to its remarkable volcanic phenomena. *Naxos*, the largest and most fertile island of the group, contains the highest mountain in the Cyclades (Zia, 3290 feet); the island annually exports upwards of 2000 tons of emery, a State monopoly, the proceeds of which are now hypothecated to the foreign debt. The oak woods of *Keos* (Zeá) and *Ios* furnish considerable supplies of valonia. *Kimolos*, which is absolutely treeless, produces fuller's-earth. The famous marble quarries of *Paros* have been practically abandoned in modern times; the marble of *Tenos* is now worked by a British syndicate. The mineral wealth of the Cyclades has hitherto been much neglected; iron ore is exported from *Seriphos*, manganese and sulphur from Melos, and volcanic cement (pozzolana) from Santorin. Other articles of export are wine, brandy, hides, and tobacco. *Kythnos*, Melos, and other islands possess hot springs with therapeutic qualities. The prosperity of Syra, formerly an important distributing centre for the whole Levant, has been declining for several years.

Of the Sporades, or "scattered islands," of the Ægean, only the group known as the North Sporades belongs to Greece, Skiathos, Skopelos, and Ikos being included in the department of Magnesia, and Skyros in that of Eubœa. *Skiathos* is a beautifully wooded and picturesque island; the town stands on a declivity surrounding an excellent harbour. The larger island of *Skopelos* is also well wooded. Almost every householder in both these islands is the owner, joint owner, or skipper of a sailing ship. *Skyros* is fertile, and celebrated for its wheat. The population of the Cyclades and Greek Sporades in 1896 was as follows (the population of small adjacent islands is included in some of the figures):—

Cyclades.

Syros	27,774	Santorin	14,472
Mykonos	4,403	Anaphe	643
Zeá	5,019	Amorgos	4,286
Kythnos	4,353	Melos	5,310
Seriphos	3,851	Siphnos	4,060
Andros	18,809	Kimolos	1,655
Tenos	12,300	Pholegandros	1,000
Naxos	15,608	Sikinos	697
Paros	8,336	Ios	2,171

Sporades.

Skopelos	5,295	Skyros	3,512
Ikos	653	Skiathos	2,790

(J. D. B.)

Recent History (1862–1899).

Recent Greek history is little more than a record of successive episodes in the prolonged struggle of the race to attain national unity. The Greeks never acquiesced in the narrow limits assigned to the kingdom in 1832; the exclusion of Crete was regarded as

a special injustice, and Prince Leopold of Saxe-Coburg-Gotha, to whom the throne was then offered, declined to accept it so long as the island was not included in the new realm. At the outbreak of the Russo-Turkish war in 1854, the Greek army was mobilized, and an insurrection was fomented in Epirus, but the occupation of Piræus by French troops put an end to the dream of national aggrandizement. It was not till 1864 that an accession of territory was obtained by the acquisition of the seven Ionian Islands, which since 1815 had formed a separate commonwealth under British protection. In 1862 King Otho, the first sovereign of modern Greece, was deposed by a revolution, and next year Prince William George of Schleswig-Holstein-Sonderburg-Glucksburg, whom Great Britain had designated as a suitable candidate for the vacant throne, was elected by the National Assembly with the title of "George I., King of the Hellenes." On 29th October 1863 the new sovereign arrived in Athens, and in the following June the British authorities handed over the Ionian Islands to a Greek commissioner. King George thus began his reign under the most favourable auspices, the patriotic sentiments of the Greeks being flattered by the acquisition of new territory. He was, however, soon confronted with constitutional difficulties; party spirit ran riot at Athens, the ministries which he appointed proved short-lived, his counsellor Count Sponneck became the object of violent attacks, and at the end of 1864 he was compelled to accept an ultra-democratic constitution, drawn up by the National Assembly. This, the sixth constitution voted since the establishment of the kingdom, is that which is still in force. In the following year Count Sponneck left Greece, and the attention of the nation was concentrated on the affairs of Crete. The revolution which broke out in that island received moral and material support from the Greek Government, with the tacit approval of Russia; military preparations were pressed forward at Athens, and cruisers were purchased, but the king, aware of the inability of Greece to attain her ends by warlike means, discouraged a provocative attitude towards Turkey, and eventually dismissed the bellicose Cabinet of Koumoundouros. The removal of a powerful minister commanding a large parliamentary majority constituted an important precedent in the exercise of the royal prerogative; the king adopted a similar course with regard to Delyannis in 1892 and 1897. The relations with the Porte, however, continued to grow worse, and Hobart Pasha, with a Turkish fleet, made a demonstration off Syra. The Cretan insurrection was finally crushed in the spring of 1869, and a conference of the Powers, which assembled that year at Paris, imposed a settlement of the Turkish dispute on Greece, but took no steps on behalf of the Cretans. In 1870 the murder of several Englishmen by brigands in the neighbourhood of Athens produced an unfavourable impression in Europe; in the following year the confiscation of the Laurion mines, which had been ceded to a Franco-Italian company, provoked energetic action on the part of France and Italy. In 1875, after an acute constitutional crisis, Charilaos Trikoupis, who but ten months previously had been imprisoned for denouncing the Crown in a newspaper article, was summoned to form a Cabinet. This remarkable man, the only great statesman whom modern Greece has produced, exercised an extraordinary influence over his countrymen for the next twenty years; had he been able to maintain himself uninterruptedly in power during that period, Greece might have escaped a long succession of misfortunes. His principal opponent, Theodore Delyannis, succeeded in rallying a strong body of adherents, and political parties, hitherto divided into numerous factions, centred around these two prominent figures.

Accession of George I.

In 1877 the outbreak of the Russo-Turkish war produced a fever of excitement in Greece; it was felt that the quarrels of the party leaders compromised the interests of the country, and the populace of Athens insisted on the formation of a coalition Cabinet. The "great" or "œcumenical" ministry, as it was called, now came into existence under the presidency of the veteran Kanaris; in reality, however, it was controlled by Trikoupis, who, recognizing the unpreparedness of the country, resolved on a pacific policy. The capture of Plevna by the Russians brought about the fall of the "œcumenical" ministry, and Koumoundouros and Delyannis, who succeeded to power, ordered the invasion of Thessaly. Their warlike energies, however, were soon checked by the signing of the San Stefano Treaty, in which the claims of Greece to an extension of frontier were altogether ignored. At the Berlin Congress two Greek delegates obtained a hearing on the proposal of Lord Salisbury. The Congress decided that the rectification of the frontier should be left to Turkey and Greece, the mediation of the Powers being proposed in case of non-agreement; it was suggested, however, that the rectified frontier should extend from the valley of the Peneus on the east to the mouth of the Kalamas, opposite the southern extremity of Corfu, on the west. In 1879 a Greco-Turkish commission for the delimitation met first at Prevesa, and subsequently at Constantinople, but its conferences were without result, the Turkish commissioners declining the boundary suggested at Berlin. Greece then invoked the arbitration of the Powers, and the settlement of the question was undertaken by a conference of ambassadors at Berlin (1880). The line approved by the conference was practically that suggested by the Congress; Turkey, however, refused to accept it, and the Greek army was once more mobilized. It was evident, however, that nothing could be gained by an appeal to arms, the Powers not being prepared to apply coercion to Turkey. By a convention signed at Constantinople in July 1881, the demarcation was entrusted to a commission representing the six Powers and the two interested parties. The line drawn ran westwards from a point between the mouth of the Peneus and Platamona to the summits of Mounts Kritiri and Zygos, thence following the course of the river Arta to its mouth. An area of 13,395 square kilometres, with a population of 300,000 souls, was thus added to the kingdom, while Turkey was left in possession of Iannina, Metzovo, and most of Epirus. The ceded territory was occupied by Greek troops before the close of the year.

New frontier, 1881.

In 1882 Trikoupis came into power at the head of a strong party, over which he exercised an influence and authority hitherto unknown in Greek political life. With the exception of three brief intervals (May 1885 to May 1886, October 1890 to February 1892, and a few months in 1893), he continued in office for the next twelve years. The reforms which he introduced during this period were generally of an unpopular character, and were loudly denounced by his democratic rivals; most of them were cancelled during the intervals when his opponent Delyannis occupied the premiership. The same want of continuity proved fatal to the somewhat ambitious financial programme which he now inaugurated. While pursuing a cautious foreign policy, and keeping in control the rash impetuosity of his fellow-countrymen, he shared to the full the national desire for expansion, but he looked to the development of the material resources of the country as a necessary preliminary to the realization of the dreams of Hellenism.

Trikoupis and Delyannis.

With this view he endeavoured to attract foreign capital to the country, and the confidence which he inspired in financial circles abroad enabled him to contract a number of loans and to better the financial situation by a series of conversions. Under a stable, wise, and economical administration this far-reaching programme might perhaps have been carried out with success, but the vicissitudes of party politics and the periodical outbursts of national sentiment rendered its realization impossible. In April 1885 Trikoupis fell from power, and a few months later the indignation excited in Greece by the revolution of Philippopolis placed Delyannis once more at the head of a warlike movement. The army and fleet were again mobilized with a view to exacting territorial compensation for the aggrandizement of Bulgaria, and several conflicts with the Turkish troops took place on the frontier. The Powers, after repeatedly inviting the Delyannis Cabinet to disarm, established a blockade of Piræus and other Greek ports (8th May 1886), France alone declining to co-operate in this measure. Delyannis resigned (11th May) and Trikoupis, who succeeded to power, issued a decree of disarmament (25th May). Hostilities, however, continued on the frontier, and the blockade was not raised till 7th June. Trikoupis had now to face the serious financial situation brought about by the military activity of his predecessor. He imposed heavy taxation, which the people, for the time at least, bore without murmuring, and he continued to inspire such confidence abroad that Greek securities maintained their price in the foreign market. It was ominous, however, that a loan which he issued in 1890 was only partially covered. Meanwhile the Cretan difficulty had become once more a source of trouble to Greece. In 1889 Trikoupis was grossly deceived by the Turkish Government, which, after inducing him to dissuade the Cretans from opposing the occupation of certain fortified posts, issued a firman annulling many important provisions in the constitution of the island. The indignation in Greece was intense, and popular discontent was increased by the success of the Bulgarians in obtaining the *exequatur* of the Sultan for a number of bishops in Macedonia. In the autumn of 1890 Trikoupis was beaten at the elections, and Delyannis, who had promised the people a radical reform of the taxation, succeeded to power. He proved unequal, however, to cope with the financial difficulty, which now became urgent; and the king, perceiving that a crisis was imminent, dismissed him and recalled Trikoupis. The hope of averting national bankruptcy depended on the possibility of raising a loan by which the rapid depreciation of the paper currency might be arrested, but foreign financiers demanded guarantees which seemed likely to prove hurtful to Greek susceptibilities; an agitation was raised at Athens, and Trikoupis suddenly resigned (May 1893). His conduct at this juncture appears to have been due to some misunderstandings which had arisen between him and the king. The Sotiropoulos-Rhalles ministry which followed effected a temporary settlement with the national creditors, but Trikoupis, returning to power in the autumn, at once annulled the arrangement. He now proceeded to a series of arbitrary measures which provoked the severest criticism throughout Europe and exposed Greece to the determined hostility of Germany. A law was hastily passed which deprived the creditors of 70 per cent. of their interest, and the proceeds of the revenues conceded to the monopoly bondholders were seized (December 1893). Long negotiations followed, resulting in an arrangement which was subsequently reversed by the German bondholders. In January 1895 Trikoupis resigned office, in consequence of a disagreement with the Crown Prince on a question of military discipline. His popularity had vanished, his health was shattered, and he determined to abandon his political career. His death at Cannes (11th April 1896), on the eve of a great national convulsion, deprived Greece of his masterly guidance and sober judgment at a critical moment in her history.

Nationalist agitation, 1896.

His funeral took place at Athens on 23rd April, while the city was still decorated with flags and garlands after the celebration of the Olympic games. The revival of the ancient festival, which drew together multitudes of Greeks from abroad, led to a lively awakening of the national sentiment, hitherto depressed by the economic misfortunes of the kingdom, and a secret patriotic society, known as the *Ethniké Hetæria*, began to develop prodigious activity, enrolling members from every rank of life and establishing branches in all parts of the Hellenic world. The society had been founded in 1894, by a handful of young officers who considered that the military organization of the country was neglected by the Government; its principal aim was the preparation of an insurrectionary movement in Macedonia, which, owing to the activity of the Bulgarians and the reconciliation of Prince Ferdinand with Russia, seemed likely to be withdrawn for ever from the domain of Greek irredentism. The outbreak of another insurrection in Crete supplied the means of creating a diversion for Turkey while the movement in Macedonia was being matured; arms and volunteers were shipped to the island, but the society was as yet unable to force the hand of the Government, and Delyannis, who had succeeded Trikoupis in 1895, loyally aided the Powers in the restoration of order by advising the Cretans to accept the constitution of 1896. The appearance of strong insurgent bands in Macedonia in the summer of that year testified to the activity of the society and provoked the remonstrances of the Powers, while the spread of its propaganda in the army led to the issue of a royal rescript announcing grand military manœuvres, the formation of a standing camp, and the rearmament of the troops with a new weapon (6th December). The objects of the society were effectually furthered by the evident determination of the Porte to evade the application of the stipulated reforms in Crete; the Cretan Christians lost patience, and indignation was widespread in Greece. Emissaries of the society were despatched to the island, and affairs were brought to a climax by an outbreak at Canea on 4th February 1897. The Turkish troops fired on the Christians, thousands of whom took refuge on the warships of the Powers, and a portion of the town was consumed by fire.

Cretan crisis, 1897.

Delyannis now announced that the Government had abandoned the policy of abstention. On the 6th two warships were despatched to Canea, and on the 10th a torpedo flotilla, commanded by Prince George, left Piræus amid tumultuous demonstrations. The ostensible object of these measures was the protection of Greek subjects in Crete, and Delyannis was still anxious to avoid a definite rupture with Turkey, but the Ethniké Hetæria had found means to influence several members of the ministry and to alarm the king. Prince George, who had received orders to prevent the landing of Turkish reinforcements on the island, soon withdrew from Cretan waters owing to the decisive attitude adopted by the commanders of the international squadron. A note was now addressed by the Government to the Powers, declaring that Greece could no longer remain a passive spectator of events in Crete, and on 13th February a force of 1500 men, under Colonel Vassos, embarked at Piræus. On the same day a Greek warship fired on a Turkish steam yacht which was conveying troops from Candia to Sitia. Landing

near Canea on the night of the 14th, Colonel Vassos issued a proclamation announcing the occupation of Crete in the name of King George. He had received orders to expel the Turkish garrisons from the fortresses, but his advance on Canea was arrested by the international occupation of that town, and after a few engagements with the Turkish troops and irregulars he withdrew into the interior of the island. Proposals for the coercion of Greece were now put forward by Germany, but Great Britain declined to take action until an understanding had been arrived at with regard to the future government of Crete. Eventually (2nd March) collective notes were addressed to the Greek and Turkish Governments announcing the decision of the Powers that (1) Crete could in no case in present circumstances be annexed to Greece; (2) in view of the delays caused by Turkey in the application of the reforms, Crete should be endowed with an effective autonomous administration, calculated to ensure it a separate government, under the suzerainty of the Sultan. Greece was at the same time summoned to remove its army and fleet within the space of six days, and Turkey was warned that its troops must for the present be concentrated in the fortified towns and ultimately withdrawn from the island. The action of the Powers produced the utmost exasperation at Athens; the populace demanded war with Turkey and the annexation of Crete, and the Government drew up a reply to the Powers in which, while expressing the conviction that autonomy would prove a failure, it indicated its readiness to withdraw some of the ships, but declined to recall the army. A suggestion that the troops might receive a European mandate for the preservation of order in the island proved unacceptable to the Powers, owing to the aggressive action of Colonel Vassos after his arrival. Meanwhile troops, volunteers, and munitions of war were hurriedly despatched to the Turkish frontier in anticipation of an international blockade of the Greek ports, but the Powers contented themselves with a pacific blockade of Crete, and military preparations went on unimpeded.

War with Turkey.

While the Powers dallied, the danger of war increased; on 29th March the Crown Prince assumed command of the Greek troops in Thessaly, and a few days later hostilities were precipitated by the irregular forces of the Ethniké Hetæria, which attacked several Turkish outposts near Grevena. According to a report of its proceedings, subsequently published by the society, this invasion received the previous sanction of the prime minister. On 17th April Turkey declared war. The disastrous campaign which followed was of short duration, and it was evident from the outset that the Greeks had greatly underrated the military strength of their opponents (see below, *Greco-Turkish War*). Delyannis was invited by the king to resign, but refusing to do so was dismissed (29th April). His successor, Rhalles, after recalling the army from Crete (9th May) invoked the mediation of the Powers, and an armistice was concluded on the 19th of that month. Thus ended an unfortunate enterprise, which was undertaken in the hope that discord among the Powers would lead to a European war and the dismemberment of Turkey. Greek interference in Crete had at least the result of compelling Europe to withdraw the island for ever from Turkish rule. The conditions of peace put forward by Turkey included a war indemnity of £10,000,000 and the retention of Thessaly; the latter demand, however, was resolutely opposed by Great Britain, and the indemnity was subsequently reduced to £4,000,000. The definitive treaty of peace, which was signed at Constantinople on 6th December, contained a provision for a slight modification of the frontier, designed to afford Turkey certain strategical advantages; the delimitation was carried out by a commission composed of military delegates of the Powers and representatives of the interested parties. The evacuation of Thessaly by the Turkish troops was completed in June 1898. An immediate result of the war was the institution of an international financial commission at Athens, charged with the control of certain revenues assigned to the service of the national debt. The state of the country after the conclusion of hostilities was deplorable; the towns of Northern Greece and the islands were crowded with destitute refugees from Thessaly; violent recriminations prevailed at Athens, and the position of the dynasty seemed endangered. A reaction, however, set in, in consequence of an attempt to assassinate King George (28th February 1898), whose great services to the nation in obtaining favourable terms from the Powers began to receive general recognition. In the following summer the king made a tour through the country, and was everywhere received with enthusiasm. In the autumn the Powers, on the initiative of Russia, decided to entrust Prince George of Greece with the government of Crete; on 26th November an intimation that the prince had been appointed High Commissioner in the island was formally conveyed to the court of Athens, and on 21st December he landed in Crete amid enthusiastic demonstrations (see CRETE).

AUTHORITIES.—C. WORDSWORTH. *Greece: Pictorial, Descriptive, and Historical.* New ed., revised by H. F. Tozer. London, 1882.—K. STEPHANOS. *La Grèce.* Paris, 1884.—C. NEUMANN and J. PARTSCH. *Physikalische Geographie von Griechenland.* Breslau, 1885.—K. KRUMBACHER. *Griechische Reise.* Berlin, 1886.—J. P. MAHAFFY. *Rambles and Studies in Greece.* London, 1887 — J. RENNELL RODD. *The Customs and Lore of Modern Greece.* London, 1892.—R. A. H. BICKFORD-SMITH. *Greece under King George.* London, 1893.—CH. DIEHL. *Excursions archéologiques en Grèce.* Paris, 1893.—PERROT and CHIPIEZ. *Histoire de l'Art.* Tome vi., "La Grèce primitive," Paris, 1894; tome vii., "La Grèce archaïque." Paris, 1898.—A. PHILIPPSON. *Griechenland und seine Stellung im Orient.* Leipzig, 1897.—L. SERGEANT. *Greece in the Nineteenth Century.* London, 1897.—J. G. FRAZER. *Pausanias's Description of Greece,* 6 vols. London, 1898.—*Pausanias and other Greek Sketches.* London, 1900.—*Greco-Turkish War of 1897.* From Official Sources. By a German Staff Officer. English translation. London, 1898.—J. A. SYMONDS. *Studies, and Sketches in Italy and Greece,* 3 vols., 2nd ed. London, 1898.—V. BÉRARD. *La Turquie et l'Hellénisme contemporaine.* Paris 1900. For Mediæval and Modern History see: K. N. SATHAS. Μεσαιωνικὴ Βιβλιοθήκη, 7 vols., Venice, 1872–94; and *Μνημεῖα Ἑλληνικῆς ἱστορίας. Documents inédits relatifs à l'histoire du moyen âge,* 9 vols. Paris, 1880–90.—D. G. KAMPOUROGLOS. *Ἱστορία τῶν Ἀθηναίων.* Τουρκοκρατία, 1458–1687, 2 vols., Athens, 1889–90; and *Μνημεῖα τῆς ἱστορίας τῶν Ἀθηναίων,* 3 vols. Athens, 1889–92.—G. E. MAVROGIANNES. *Ἱστορία τῶν Ἰονίων νήσων,* 1797–1815, 2 vols. Athens, 1889.—P. KAROLIDES. *Ἱστορία τοῦ ΙΘ' αἰῶνος,* 1814–92. Athens, 1891–93.—E. KYRIAKIDES. *Ἱστορία τοῦ συγχρόνου Ἑλληνισμοῦ,* 1832–92, 2 vols. Athens, 1892.—G. KONSTANTINIDES. *Ἱστορία τῶν Ἀθηνῶν ἀπὸ Χριστοῦ γεννήσεως μεχρὶ τοῦ 1821,* 2nd ed. Athens, 1894.—D. BIKELAS. *La Grèce Byzantine et Moderne.* Paris, 1893. For special Topography: A. MELIARAKES. *Κυκλαδικὰ ἤτοι γεωγραφία καὶ ἱστορία τῶν κυκλαδικῶν νήσων.* Athens, 1874. *Ὑπομνήματα περιγραφικὴ τῶν κυκλάδων νήσων Ἄνδρου καὶ Κέω.* Athens, 1880. *Γεωγραφία πολιτικὴ νέα καὶ ἀρχαία τοῦ νομοῦ Ἀργολίδος καὶ Κορινθίας.* Athens, 1886. *Γεωγραφία πολιτικὴ νέα καὶ ἀρχαία τοῦ νομοῦ Κεφαλληνίας.* Athens, 1890.—TH. BENT. *The Cyclades.* London, 1885.—A. BÖTTICHER. *Olympia,* 2nd ed. Berlin, 1886.—J. PARTSCH. *Die Insel Corfu: eine geographische Monographie;* Gotha, 1887. *Die Insel Leukas;* Gotha, 1889. *Kephallenia und Ithaka;* Gotha, 1890. *Die Insel Zante;* Gotha, 1891.—A. PHILIPPSON. *Der Peloponnes.* (*Versuch einer Landeskunde auf geologischer Grundlage.*) Berlin, 1892.—"Thessalien und Epirus" (*Reisen und Forschungen im nördlichen Griechenland*). Berlin, 1897. *Die griechischen Inseln des ägäischen Meeres.* Berlin, 1897.—W. J. WOODHOUSE. *Aetolia.* Oxford, 1897.—SCHULTZ and BARNSLEY. *The Monastery of St Luke of Stiris.* London, 1901.—M. LAMPRINIDES. Ἡ Ναυπλία. Athens, 1898.—*Monuments de l'art Byzantine,* publiés par le Ministère de l'Instruction, tome i. G. MILLET. "Le Monastère de Daphni." Paris, 1900.

(J. D. B.)

GRECO-TURKISH WAR, 1897.

This war involved two practically distinct campaigns, in Thessaly and in Epirus. Upon the Thessalian frontier the

Turks, early in March, had concentrated six divisions (about 58,000 men), 1500 sabres, and 156 guns, under Edhem Pasha. A seventh division was rendered available a little later. The Greeks numbered about 45,000 infantry, 800 cavalry, and 96 guns, under the Crown Prince. On both sides there was a considerable dispersion of forces along the frontier. The Turkish navy, an important factor in the war of 1877–78, had become paralytic ten years later, and the Greek squadron held complete command of the sea. Expeditionary forces directed against the Turkish line of communications might have influenced the course of the campaign; but for such work the Greeks were quite unprepared, and beyond bombarding one or two insignificant ports on the coast-line, and aiding the transport of troops from Athens to Volo, the navy practically accomplished nothing. On the 9th and 10th April Greek irregulars crossed the frontier, either with a view to provoke hostilities or in the hope of fomenting a rising in Macedonia. On the 16th and 17th some fighting occurred, in which Greek regulars took part; and on the 18th Edhem Pasha, whose headquarters had for some time been established at Elassona, ordered a general advance. The Turkish plan was to turn the Greek left and to bring on a decisive action, but this was not carried out. In the centre the Turks occupied the Meluna Pass on the 19th, and the way was practically open to Larissa. The Turkish right wing, however, moving on Damani and the Reveni Pass, encountered resistance, and the left wing was temporarily checked by the Greeks among the mountains near Nezeros. At Mati, covering the road to Tyrnavo, the Greeks entrenched themselves. Here sharp fighting occurred on the 21st and 22nd, during which the Greeks sought to turn the right flank of the superior Turkish central column. On the 23rd fighting was renewed, and the advance guard of the Turkish left column, which had been reinforced, and had pressed back the Greeks, reached Deliler. The Turkish forces had now drawn together, and the Greeks were threatened on both flanks. In the evening a general retreat was ordered, and the loose discipline of the Greek army was at once manifested. Rumours of disaster spread among the ranks, and wild panic supervened. There was nothing to prevent an orderly retirement upon Larissa, which had been fortified and provisioned, and which offered a good defensive position. The general *débâcle* could not, however, be arrested, and in great disorder the mass of the Greek army fled southwards to Pharsala. There was no pursuit, and the Turkish commander-in-chief did not reach Larissa till the 27th. Thus ended the first phase of the war, in which the Greeks showed tenacity in defence, which proved fruitless by reason of initially bad strategic dispositions entailing far too great dispersion, and also because there was no plan of action beyond a general desire to avoid risking a defeat which might prevent the expected risings in Macedonia and elsewhere. The handling of the Turkish army showed little skill or enterprise; but on both sides political considerations tended to prevent the application of sound military principles.

Larissa being abandoned by the Greeks, Velestino, the junction of the Thessalian railways, where there was a strong position covering Volo, seemed to be the natural rallying point for the Greek army. Here the support of the fleet would have been secured, and a Turkish advance across the Othrys range upon Athens could not have taken place until the flanking position had been captured. Whether by direction or by natural impulse, however, the mass of the Greek troops made for Pharsala, where some order was re-established, and preparations were made to resist attack. The importance of Velestino was recognized by sending a brigade thither by railway from Pharsala, and the inferior Greek army was thus split into two portions, separated by nearly 40 miles. On 27th April a Turkish reconnaissance on Velestino was repulsed, and further fighting occurred on the 29th and 30th, in which the Greeks under Colonel Smolenski held their own. Meanwhile the Turks made preparations to attack Pharsala, and on 5th May the Greeks were driven from their positions in front of the town by three divisions. Further fighting followed on the 6th, and in the evening the Greek army retired in fair order upon Domokos. It was intended to turn the Greek left with the first division under Hairi Pasha, but the flanking force did not arrive in time to bring about a decisive result. The abandonment of Pharsala involved that of Velestino, where the Turks had obtained no advantage, and on the evening of the 5th Colonel Smolenski began a retirement upon Halmyros. Again delaying, Edhem Pasha did not attack Domokos till the 17th, giving the Greeks time to entrench their positions. The attack was delivered in three columns, of which the right was checked and the centre failed to take the Greek trenches and suffered much loss. The left column, however, menaced the line of retreat, and the Greek army abandoned the whole position during the night. No effective stand was made at the Furka Pass, which was evacuated on the following night. Colonel Smolenski, who arrived on the 18th from Halmyros, was directed to hold the pass of Thermopylæ. The Greek forces being much demoralized, the intervention of the Tsar was invoked by telegraph; and the latter sent a personal appeal to the Sultan, who directed a suspension of hostilities. On the 20th an armistice was arranged.

In Epirus at the outbreak of war about 15,000 Greeks, including a cavalry regiment and five batteries, the whole under Colonel Manos, occupied a line of defence from Arta to Peta. The Turks, about 28,000 strong, with forty-eight guns, under Achmet Hifsi Pasha, were distributed mainly at Iannina, Pentepagadia, and in front of Arta. On 18th April the Turks commenced a three days' bombardment of Arta; but successive attempts to take the bridge were repulsed, and during the night of the 21st they retired on Philippiada, 26 miles distant, which was attacked and occupied by Colonel Manos on the 23rd. The Greeks then advanced to Pentepagadia, meeting with little resistance. Their difficulties now began. After some skirmishing on the 27th, the position held by their advanced force near Homopulos was attacked on the 28th. The attack was renewed on the 29th, and no Greek reinforcements were forthcoming when needed. The Euzones made a good defence, but were driven back by superior force, and a retreat was ordered, which quickly degenerated into panic-stricken flight to and across the Arta. Reinforcements, including 2500 Epirote volunteers, were sent to Arta from Athens, and on 12th May another incursion into Turkish territory began, the apparent object being to occupy a portion of the country in view of the breakdown in Thessaly and the probability that hostilities would shortly end. The advance was made in three columns, while the Epirote volunteers were landed near the mouth of the Luro river with the idea of cutting off the Turkish garrison of Prevesa. The centre column, consisting of a brigade, three squadrons, and two batteries, which were intended to take up and hold a defensive position, attacked the Turks near Strevina on the 13th. The Greeks fought well, and being reinforced by a battalion from the left column, resumed the offensive on the following day, and fairly held their own. On the night of the 15th a retreat was ordered and well carried out. The volunteers landed at the mouth of the Luro were attacked and routed with heavy loss.

The campaign in Epirus thus failed as completely as that in Thessaly. Under the terms of the treaty of peace, signed on 20th September, and arranged by the European Powers, Turkey obtained an indemnity of £T4,000,000, and a rectification of the Thessalian frontier, carrying with it some strategic advantage. History records few more unjustifiable wars than that which Greece gratuitously provoked. The Greek troops on several occasions showed tenacity and endurance, but discipline and cohesion were manifestly wanting. Many of the officers were incapable; the campaign was gravely mismanaged; and politics, which led to the war, impeded its operations. On the other hand, the fruits of the German tuition, which began in 1880, and received a powerful stimulus by the appointment of General von der Goltz in 1883, were shown in the Turkish army. The mobilization was on the whole smoothly carried out, and the newly completed railways greatly facilitated the concentration on the frontier. The young school of officers trained by General von der Goltz displayed ability, and the artillery at Pharsala and Domokos was well handled. The superior leading was, however, not conspicuously successful; and while the rank and file again showed excellent military qualities, political conditions and the Oriental predilection for half-measures and for denying full responsibility and full powers to commanders in the field enfeebled the conduct of the campaign. On account of the total want of careful and systematic peace training on both sides, a war which presented several interesting strategic problems provided warnings in place of military lessons. (G. S. C.)

Modern Greek Literature.

The works of modern Greek poets and prose writers are usually classified according to the form of the language in which they are written. In contemporary literature two distinct forms of the modern language present themselves—the vernacular (ἡ καθομιλουμένη) and the purified (ἡ καθαρεύουσα). The former is the oral language, spoken by the whole Greek world, with local dialectic variations; the latter is based on the Greek of the Hellenistic writers, modified, but not essentially altered, in successive ages by the popular speech. At the time of the War of Independence the enthusiasm of the Greeks and the Philhellenes was fired by the memory of an illustrious past, and at its close a classical reaction followed: the ancient nomenclature was introduced in every department of the new state, towns and districts received their former names, and children were christened after Greek heroes and philosophers instead of the Christian saints. In the literary revival which attended the national movement, two schools of writers made their appearance—the purists, who, rejecting the spoken idiom as degenerate and corrupt, aimed at the restoration of the classical language, and the vulgarists, who regarded the vernacular or "Romaic" as the genuine and legitimate representative of the ancient tongue. A controversy which had existed in former times was thus revived, with the result that a state of confusion still prevails in the national literature. The classical scholar who is as yet unacquainted with modern Greek will find in the pages of an ordinary periodical or newspaper specimens of the conventional literary language which he can read with ease side by side with poems or even prose in the vernacular which he will be altogether unable to interpret.

The vernacular or oral language is never taught, but is universally spoken. It has been evolved from the ancient language by a natural and regular process, similar to that which has produced the Romance languages from the Latin, or the Russian, Bulgarian, and Servian from the old Slavonic. In the case of Greek the process has been less complete; the speech of illiterate peasants in Epirus and Asia Minor approximates more nearly to the classical tongue than Italian to Latin. If we except certain peculiar dialects, such as the Tzakonian in the south-eastern Morea, the differences of idiom prevailing among the members of a widely scattered race are surprisingly slight. This comparative uniformity may be attributed to the maritime character of the Greeks, to the intercourse between the great centres of population, such as Constantinople, Smyrna, Salonika, and Alexandria, to the influence of the Church, and still more to that of the schools, which even in the darkest period of the national history were maintained throughout the Greek world. The phonetic modifications which occur in the different dialects are also relatively insignificant. A comparative study of these can hardly fail to suggest the conclusion that the ancient pronunciation is to a large extent represented by the modern. There are, apparently, some important deviations, *e.g.*, the prevailing itacism, or use of the "i" sound for η, υ, ει, οι, υι, the converse use of the "u" sound for "i," and the pronunciation of the diphthongs αυ and ευ as "af" and "ef," are undoubted corruptions; but in these and other instances the original pronunciation has been retained in various dialects. The arbitrary systems of pronunciation adopted in England, France, and Germany differ from each other in essential particulars. Notwithstanding certain variations in the dialects, the general uniformity in the use of the accents, which rarely deviates from that denoted by the Alexandrine grammarians, shows the system of accentuation according to metrical quantity to be erroneous. The spoken Greek, like the other languages of modern Europe, has received an analytic development. The case endings show a tendency to disappear or to assimilate; the dative is totally lost, the genitive is often replaced by a preposition with the accusative. In the conjugations the perfect and future tenses are formed by the auxiliaries ἔχω and θέλω; the infinitive has ceased to exist except in a shortened form with the auxiliary. As in the Romance languages, a new nominative is often formed from the accusative: thus ὁ ἀνήρ, ἡ γυνή, ἡ νύξ become ὁ ἄνδρας, ἡ γυναῖκα, ἡ νύχτα; the nominative plural of all feminine nouns ends in -ς; the final nasal in noun and verb forms usually disappears; the final syllable, as well as the first syllable, is sometimes lost, as in φεῖδι, ξεῖδι, λᾶδι, for ὀφείδιον, ὀξείδιον, ἐλαΐδιον. The retention of the passive, which has disappeared in most languages of the Indo-European family, is a peculiar feature. The spoken language contains a large number of foreign words.

The Greek vernacular has developed on parallel lines with the modern European languages, and in obedience to the same laws; like them, it might have grown into a literary language had any great writers arisen in the Middle Ages to do for it what Dante and his successors of the *trecento* did for Italian. But the effort to adapt it to the requirements of modern literature will hardly prove successful. In the first place, the national sentiment of the Greeks will always prompt them to imitate the classical writers, and so far as possible to appropriate their diction. The beauty and dignity of the ancient tongue will always possess such an attraction for cultivated writers that they will be led insensibly to adopt its forms and borrow from its wealth of phrase and idiom. In the next place, a certain literary tradition and usage has already been formed which cannot easily be broken down. For more than half a century the generally accepted written language, half modern half ancient, has been in use in the schools, the university, the parliament, the state departments, and the pulpit, and its influence upon the speech of the more educated classes is already noticeable. It largely

owes its present form—though a fixed standard is still lacking—to the influence and teaching of Koraës (1748–1833), whose literary activity was contemporary with the national renascence. As in the time of the decadence a κοινὴ διάλεκτος stood midway between the classical language and the popular speech, so at the beginning of the 19th century there existed a common literary dialect, largely influenced by the vernacular, but retaining the characteristics of the old Hellenistic, from which it was derived by an unbroken literary tradition. This written language Koraës took as the basis of his reforms, purging it of foreign elements, preserving its classical remnants and enlarging its vocabulary with words borrowed from the ancient lexicon or, in case of need, invented in accordance with a fixed principle. He thus adopted a middle course, discountenancing alike the pedantry of the purists and the over-confident optimism of the vulgarists, who found in the uncouth popular speech all the material for a *langue savante*. The language which he thus endeavoured to shape and reconstruct is, of course, conventional and artificial. In course of time it will probably tend to approach the vernacular, while the latter will gradually be modified by the spread of education. The spoken and written languages, however, will always be separated by a wide interval.

Many of the best poets of modern Greece have written in the vernacular, which is best adapted for the natural and spontaneous expression of the feelings. Dionysios Solomos (1798–1857), the greatest of them all, employed the dialect of the Ionian Islands. Of his lyrics, which are full of poetic fire and inspiration, the most celebrated is his "Ode to Liberty." Other poets, of what may be described as the Ionic school, such as Andreas Kalvos (1796–1869), Julius Typaldos (1814–83), John Zampelios (1787–1856), and Gerasimos Markoras (born 1826), followed his example in using the Heptanesian dialect. On the other hand, Georgios Terzetes (1806–74), Aristotle Valaorites (1824–79) and Gerasimos Mavrogiannes, though natives of the Ionian Islands, adopted in their lyrics the language of the Klephtic ballads—in other words, the vernacular of the Pindus range and the mountainous district of Epirus. This dialect had at least the advantage of being generally current throughout the mainland, while it derived distinction from the heroic exploits of the champions of Greek liberty. The poems of Valaorites, which are characterized by vivid imagination and grace of style, have made a deep impression on the nation. Other poets who largely employed the Epirotic dialect and drew their inspiration from the Klephtic songs were John Vilaras (1771–1823), George Zalokostas (1805–1857) in his lyric pieces, and Theodore Aphentoules, a Cretan (died 1893). With the poems of this group may be classed those of Demetrius Bikelas (born 1835). The popular language has been generally adopted by the younger generation of poets, among whom may be mentioned Aristomenes Probelegios (born 1850), George Bizyenos (1853–96), George Drosines, Kostes Palamas (born 1859), John Polémes, Argyres Ephthaliotes, and Jacob Polylas (died 1896).

Contemporary with the first-mentioned or Ionic group, there existed at Constantinople a school of poets who wrote in the accepted literary language, and whose writings served as models for the later group which gathered at Athens after the emancipation of Greece. The literary traditions founded by Alexander Rizos Rhangabés (1810–1892) and the brothers Alexander and Panagiotis Soutzos (1803–63 and 1800–68), who belonged to Phanariot families, were maintained in Athens by Spiridion Basiliades (1843–74), Angelos Vlachos (born 1838), John Karasoutzas (1824–73), Demetrios Paparrhegopoulos (1843–1873), and Achilles Paraschos (born 1838). The last, a poet of fine feeling, has also employed the popular language. In general the practice of versification in the literary language has declined, though sedulously encouraged by the university of Athens, and fostered by annual poetic competitions with prizes provided by patriotic citizens. Greek lyric poetry during the first half of the century was mainly inspired by the patriotic sentiment aroused by the struggle for independence, but in the present generation it often shows a tendency towards the philosophic and contemplative mood under the influence of Western models. Among recent satirists, George Soures (born 1853) occupies a unique position. He reviews social and political events in the Ῥωμῃός, a witty little newspaper written entirely in verse, which is read with delight by all classes of the population.

There has been an abundant production of dramatic literature in recent years. In addition to Alexander Rhangabés, John Zampelios, and the two Soutzos, who belong to the past generation, Kleon Rhangabes, Angelos Vlachos, Demetrios Koromelas, Basiliades and Bernadakes are the most prominent among modern dramatic writers. Numerous translations of foreign masterpieces have appeared, among which the metrical versions of *Romeo and Juliet*, *Othello*, *King Lear*, *Hamlet*, *Macbeth*, and *The Merchant of Venice*, by Demetrios Bikelas, deserve mention as examples of artistic excellence. Goethe's *Faust* has been rendered into verse by Probelegios, and *Hamlet*, *Antony and Cleopatra*, *Coriolanus* and *Julius Cæsar*, into prose by Damiralis.

Almost all the prose writers have employed the literary language. In historical research the Greeks continue to display much activity and erudition, but no great work comparable to Spiridion Trikoupis's *History of the Revolution* has appeared in the present generation. A history of the Greek nation from the earliest times to the present day, by Spiridion Lampros, and a general history of the 19th century by Karolides, have recently been published. The valuable Μνημεῖα of Sathas, the μελέται Βυζαντινῆς ἱστορίας of Spiridion Zampelios, and Mavrogiannes's *History of the Ionian Islands* deserve special mention, as well as the essays of Bikelas, which treat of the Byzantine and modern epochs of Greek history. Some of the last-named were translated into English by the late marquis of Bute. Among the writers on jurisprudence are Peter Paparrhegopoulos, Kalligas, Basileios Œkonomedes, and Nikolaos Saripolos. Brailas-Armenes and John Skaltzounes, the latter an opponent of Darwin, have written philosophical works. The *Ecclesiastical History* of Diomedes Kyriakos and the *Theological Treatises* of Archbishop Latas should be noted. The best-known writers of philological works are Constantine Kontos, a strong advocate of literary purism, George Hatzidakes, Theodore Papademetrakopoulos, and John Psichari; in archæology, Stephen Koumanoudes, Panagiotes Kavvadias, and Christos Tsountas have won a recognized position among scholars. John Svoronos is a high authority on numismatics. The works of John Hatzidakis on mathematics, Anast. Christomanos on chemistry, and Demetrios Aeginetes on astronomy are well known.

The earlier works of fiction, written in the period succeeding the emancipation of Greece, were much affected by foreign influence. Modern Greece has not produced any great novelist. The Κρητικοὶ γάμοι of Spiridion Zampelios, the scene of which is laid in Crete, and the *Thanos Blechas* of Kalligas are interesting, the former for accuracy of historical detail, the latter as a picture of peasant life in the mountains of Greece. Original novel writing has not been much cultivated, but translations of foreign romances abound. In later times the short story

has come into vogue through the example of D. Bikelas, whose tales have acquired great popularity; one of them, *Loukis Laras*, has been translated into many languages. The example of Bikelas has been followed by Drosinis Karkavitzas, Ephthaliotis, Xenopoulos, and many others. The most distinguished of the writers who adhere to the vernacular in prose is John Psichari, professor of the École des Hautes Études in Paris. He is the recognized leader of the vulgarists. Among the best-known of his works are Τὸ *ταξεῖδί μου*, a narrative of a journey in Greek lands, Τὄνειρο *τοῦ Γιαννίρη*, Ἡ *Ζούλεα*, and ὁ Μάγος. The tales of Karkavitzas and Ephthaliotis are also in the vernacular. Among the younger of M. Psichari's followers is M. Pallis, who has recently published a translation of the *Iliad*. Owing to the limited resources of the popular language, the writers of this school are sometimes compelled to employ strange and little-known words borrowed from the various dialects. The vernacular has never been adopted by writers on scientific subjects, owing to its inherent unsuitability and the incongruity arising from the introduction of technical terms derived from the ancient language. Notwithstanding the zeal of its adherents, it seems unlikely to maintain its place in literature outside the domain of poetry; nor can any other result be expected, unless its advocates succeed in reforming the system of public instruction in Greece.

Many periodicals are published at Athens, among which may be mentioned the *Athena*, edited by Constantine Kontos, the *Ethniké Agogí*, a continuation of the old *Hestia*, the *Harmonia*, and the *Διάπλασις τῶν παίδων*, an educational review. The Parnassos, the Archæological Society, and other learned bodies issue annual or quarterly reports. The Greek journals are both numerous and widely read. They contain much clever writing, which is often marred by inaccuracy and a deficient sense of responsibility. For many years the *Nea Heméra* of Trieste exerted a considerable influence over the Greek world, owing to the able political reviews of its editor, Anastasios Byzantios (died 1898), a publicist of remarkable insight and judgment.

AUTHORITIES. — D. BIKELAS. *Περὶ νεοελληνικῆς φιλολογίας, δοκίμιον.* London, 1871. Reprinted in *Διαλέξεις καὶ Ἀναμνήσεις.* Athens, 1893.—J. S. BLACKIE. *Horæ Hellenicæ.* London, 1874.—NICOLAI. *Geschichte der neugriechischen Litteratur.* Leipzig, 1876.—C. GIDEL. *Études sur la littérature grecque moderne.* Paris, 1878. — E. LEGRAND. *Bibliothèque grecque vulgaire*, vol. i. Paris, 1880. — J. LAMBER. *Poètes grecs contemporains.* Paris, 1881. — KONTOS. *Γλωσσικαὶ παρατηρήσεις.* Athens, 1882.—RHANGABÉ und SANDERS. *Geschichte der neugriechischen Litteratur von ihren Anfängen bis auf die neueste Zeit.* Leipzig, 1885.—J. PSICHARI. *Essais de grammaire historique néo-grecque*, 2 vols., Paris, 1886 and 1889; *Études de philologie néo-grecque.* Paris, 1892.—F. BLASS. *Die Aussprache des Griechischen*, 3rd ed. Berlin, 1888.—PAPADEMETRAKOPOULOS. Βάσανος ἑλληνικῆς προφορᾶς. Athens, 1889.—M. KONSTANTINIDES. *Neo-hellenica (Dialogues in Modern Greek, with Appendix on the Cypriot Dialect).* London, 1892.—RHOÏDES. Τὰ Εἴδωλα. Γλωσσικὴ *μελέτη.* Athens, 1893.—POLITES. *Μελεταὶ περὶ τοῦ Βίου καὶ τῆς γλώσσης* Ἑλληνικοῦ *λάου*, 2 vols. Athens, 1899.—For Mediæval and Byzantine Literature see: E. LEGRAND. *Bibliographie hellénique ou description raisonnée des ouvrages publiés en Grec par des Grecs au XV^e et au XVI^e siècles*, 5 vols. Paris, 1886–88.—S. PORTIUS. *Grammatica linguae graecae vulgaris.* Réproduction de l'édition de 1638, suivie d'un commentaire par W. Meyer. Paris, 1889.—K. DIETRICH. *Geschichte der griechischen Sprache von der hellenistischen Zeit bis zum 10. Jahrh. nach Christ.* (Byzantinisches Archiv, Heft I.) Leipzig, 1898. — *Byzantinische Zeitschrift* from 1892. **Lexicons**: A. N. JANNARIS. *A Concise Dictionary of the English and Modern Greek Languages* (English-Greek). London, 1895.—BYZANTIOS (Skarlatos D.). *Λεξικὸν τῆς* Ἑλληνικῆς *γλώσσης.* Athens, 1895. — A. SAKELLARIOS. *Λεξικὸν τῆς* Ἑλληνικῆς *γλώσσης*, 5th ed. Athens, 1898.—S. KOUMANOUDES. *Συναγωγὴ νέων λέξεων.* Athens, 1900. **Grammars**: MITSOTAKES. *Praktische Grammatik des neugriechischen Schrift und Umgangssprache.* Stuttgart, 1891. — M. GARDNER. *A Practical Modern Greek Grammar.* London, 1892.—G. N. HATZIDAKES. *Einleitung in die neugriechische Grammatik.* Leipzig, 1892.—E. VINCENT and T. G. DICKSON. *Handbook to Modern Greek.* London, 1893.—A. THUMB. *Handbuch der neugriechischen Volkssprache.* Strassburg, 1895.—C. WIED. *Die Kunst der neugriechischen Volkssprache durch Selbstunterricht schnell und leicht zu lernen*, 2nd ed. (undated). Vienna.—A. N. JANNARIS. *Historical Greek Grammar.* London, 1897. (J. D. B.)

Greek Church. See ORTHODOX EASTERN CHURCH.

Green, John Richard (1837–1883), English historian, was born at Oxford on 12th December 1837, and educated at Magdalen College School and at Jesus College, where he obtained an open scholarship. On leaving Oxford he took orders and became the incumbent of St Philip's, Stepney. His preaching was eloquent and able; he worked diligently among his poor parishioners, and won their affection by his ready sympathy. Meanwhile he studied history in a scholarly fashion, and wrote much for the *Saturday Review*. Partly because his health was weak and partly because he ceased to agree with the teaching of the Church of England, he abandoned clerical life and devoted himself to history; in 1868 he took the post of librarian at Lambeth, but his health was already breaking down, and he was attacked by consumption. His *Short History of the English People* (1874) at once attained extraordinary popularity, and was afterwards expanded in a work of four volumes (1877–80). Green is pre-eminently a picturesque historian; he had a vivid imagination and a keen eye for colour. His chief aim was to depict the progressive life of the English people rather than to write a political history of the English state. In accomplishing this aim he worked up the results of wide reading into a series of brilliant pictures. While generally accurate in his statement of facts, and showing a firm grasp of the main tendency of a period, he often builds more on his authorities than is warranted by their words, and is apt to overlook points which would have forced him to modify his representations and lower the tone of his colours. From his animated pages thousands have learnt to take pleasure in the history of their own people, but could scarcely learn to appreciate the complexity inherent in all historical movement. His style is extremely bright, but it lacks sobriety and presents some affectations. His later histories, *The Making of England* (1882) and *The Conquest of England* (1883), are more soberly written than his earlier books, and are valuable contributions to historical knowledge. Green died at Mentone on 7th March 1883. He was a singularly attractive man, of wide intellectual sympathies and an enthusiastic temperament; his good-humour was unfailing and he was a brilliant talker; and his work was done with admirable courage in spite of ill-health. It is an open secret that Mrs Humphry Ward's *Robert Elsmere* was largely a portrait of him. In 1877 J. R. Green married Miss Alice Stopford; and Mrs Green, besides writing a memoir of her husband, prefixed to the 1888 edition of his *Short History*, has herself done valuable work as a historian, particularly in her *Henry II.* in the "English Statesmen" series (1888) and her *Town Life in the 15th Century* (1894). (W. HU.)

See also the *Letters of J. R. Green* (1901), edited by Leslie Stephen.

Green, Thomas Hill (1836–1882), English philosopher, the most typical English representative of the school of thought called *Neo-Kantian*, or *Neo-Hegelian*, was born on 7th April 1836 at Birkin, a village in the West Riding of Yorkshire, of which his father was rector. On the paternal side he was descended from Oliver Cromwell, whose honest, sturdy independence of character he seemed to have inherited. His education was conducted entirely at home until, at the age of four-

teen, he entered Rugby, where he remained five years. In 1855 he became an undergraduate member of Balliol College, Oxford, of which society he was, in 1860, elected Fellow. His life, henceforth, was devoted to teaching (mainly philosophical) in the university—first as college tutor, afterwards, from 1878 until his death (at Oxford on the 26th of March 1882), as Whyte's Professor of Moral Philosophy. The lectures he delivered as professor form the substance of his two most important works, viz., the *Prolegomena to Ethics*, and the *Lectures on the Principles of Political Obligation*, which contain the whole of his positive constructive teaching. These works were not published until after his death, but Green's views were previously known to the outside world indirectly through the *Introduction* to the standard edition of Hume's works (by Green and Grose), in which the doctrine of the "English" or "Empirical" Philosophy was exhaustively examined.

Hume's Empiricism, combined with a belief in biological evolution (derived from Herbert Spencer), was the chief feature in English thought during the third quarter of the 19th century. Green represents primarily the reaction against doctrines which, when carried out to their logical conclusion, not only "rendered all philosophy futile," but were fatal to practical life. By reducing the human mind to a series of unrelated atomic sensations, this teaching destroyed the possibility of knowledge, and, further, by representing man as a "being who is simply the result of natural forces," it made conduct, or any theory of conduct, unmeaning; for life in any human, intelligible sense implies a personal self which (1) *knows* what to do, (2) has *power* to do it. Green was thus driven, not theoretically, but as a practical necessity, to raise again the whole question of Man in relation to Nature. When (he held) we have discovered what Man in himself is, and what his relation to his environment, we shall then know his function—what he is fitted to do. In the light of this knowledge we shall be able to formulate the Moral Code, which, in turn, will serve as a criterion of actual civic and social institutions. These form, naturally and necessarily, the objective expression of moral ideas, and it is in some civic or social whole that the Moral Ideal must finally take concrete shape.

To ask "What is Man?" is to ask "What is Experience?" for Experience means that of which I am conscious. The facts of consciousness are the only facts which, to begin with, we are justified in asserting to exist. On the other hand, they are valid evidence for whatever is necessary to their own explanation, *i.e.*, for whatever is logically involved in them. Now the most striking characteristic of man, that in fact which marks him specially, as contrasted with other animals, is *self*-consciousness. The simplest mental act into which we can analyse the operations of the human mind—the act of sense-perception—is never merely a *change*, physical or psychical, but is the *consciousness* of a change. Human experience consists, not of processes in an animal organism, but of these processes recognized as such. That which we perceive is from the outset an apprehended fact—that is to say, it cannot be analysed into isolated elements (so-called sensations) which, as such, are not constituents of consciousness at all, but exists from the first as a synthesis of relations in a consciousness which keeps distinct the "self" and the various elements of the "object," though holding all together in the unity of the act of perception. In other words, the whole mental structure we call knowledge consists, in its simplest equally with its most complex constituents, of the "work of the mind." Locke and Hume held that the work of the mind was *eo ipso* unreal because it was "made by" man and not "given to" man. It thus represented a subjective creation, not an objective fact. But this consequence follows only upon the assumption that the work of the mind is arbitrary, an assumption shown to be unjustified by the results of exact science, with the distinction, universally recognized, which such science draws between truth and falsehood, between the real and "mere ideas." This (obviously valid) distinction logically involves the consequence that the object, or content, of knowledge, viz., reality, is an intelligible ideal reality, a system of thought relations, a spiritual cosmos. How is the existence of this ideal whole to be accounted for? Only by the existence of some "principle which renders all relations possible and is itself determined by none of them"; an eternal self-consciousness which knows in whole what we know in part. To God the world *is*, to man the world *becomes*. Human experience is God gradually made manifest.

Carrying on the same analytical method into the special department of Moral Philosophy, Green held that Ethics applies to the peculiar conditions of Social life that investigation into man's nature which Metaphysics began. The Faculty employed in this further investigation is no "separate moral Faculty," but that same Reason which is the source of all our knowledge—Ethical and other. Self-reflexion gradually reveals to us human capacity, human function, with, consequently, human responsibility. It brings out into clear consciousness certain potentialities in the realization of which man's true good must consist. As the result of this analysis, combined with an investigation into the surroundings man lives in, a "content"—a Moral Code—becomes gradually evolved. Personal good is perceived to be realizable only by making actual the conceptions thus arrived at. So long as these remain potential, or ideal, they form the motive of action; motive consisting always in the idea of some "end" or "good" which man presents to himself as an end in the attainment of which he would be satisfied, that is, in the realization of which he would find his true self. The determination to realize the self in some definite way constitutes an "act of Will," which, as thus constituted, is neither arbitrary nor externally determined. For the motive which may be said to be its cause lies *in* the man himself, and the identification of the Self with such a motive is a *Self*-determination, which is at once both rational and free. The "Freedom of Man" is constituted, not by a supposed ability to do anything he may choose, but in the power to identify himself with that true good which reason reveals to him as *his* true good. This good consists in the realization of personal character; hence the final good, *i.e.*, the Moral Ideal, as a whole, can be realized only in some Society of persons who, while remaining ends to themselves in the sense that their individuality is not lost but rendered more perfect, find this perfection attainable only when the separate individualities are integrated as parts of a social whole. Society is as necessary to form persons as persons are to constitute Society. Social union is the indispensable condition of the development of the special capacities of the individual members. Human self-perfection cannot be gained in isolation; it is attainable only in interrelation with fellow-citizens in the Social Community.

The law of our being, so revealed, involves in its turn civic or political duties. Moral goodness cannot be limited to, still less constituted by, the cultivation of self-regarding virtues, but consists in the attempt to realize in practice that moral ideal which self-analysis has revealed to us as *our* ideal. From this fact arises the ground of political obligation, for the institutions of political or civic life are the concrete embodiment of moral ideas in terms of our day and generation. But, as Society exists only for the proper development of persons, we have a criterion by which to test these institutions, viz., do they, or do they not, contribute to the development of moral character in the individual citizens? It is obvious that the final Moral

Ideal is not realized in any body of civic institutions actually existing, but the same analysis which demonstrates this deficiency points out the direction which a true development will take. Hence arises the conception of rights and duties which *should be* maintained by Law, as opposed to those actually maintained; with the further consequence that it may become occasionally a moral duty to rebel against the State in the interest of the State itself, that is, in order better to subserve that end or function which constitutes the *raison d'être* of the State. The State does not consist in any definite concrete organization formed once for all. It represents a "general will" which is a desire for a common good. Its basis is not a coercive authority imposed upon the citizens from without, but consists in the spiritual recognition, on the part of the citizens, of that which constitutes their true nature. "Will, not force, is the basis of the State."

Green's teaching was, directly and indirectly, the most potent philosophical influence in England during the last quarter of the 19th century, while his enthusiasm for a common citizenship, and his personal example in practical municipal life, inspired much of the effort made, in the years succeeding his death, to bring the universities more into touch with the people and to break down the rigour of class distinctions.

Of his philosophical doctrine proper, the most striking characteristic is Integration, as opposed to Disintegration, both in Thought and in Reality. "That which is" is a *whole*, not an *aggregate*; an organic complex of parts, not a mechanical mass; a "whole" too not material but spiritual, a "world of Thought-relations." On the critical side this teaching is now admittedly valid against the older Empiricism, and the cogency of the reasoning by which his constructive theory is supported is generally recognized. Nevertheless, Green's statement of his conclusions presents important difficulties. Even apart from the impossibility of conceiving a whole of relations which are relations and nothing else (this objection is perhaps largely verbal), no explanation is given of the fact (obvious in experience) that the spiritual entities of which the Universe is composed *appear* material. Certain elements present themselves in Feeling which seem stubbornly to resist any attempt to explain them in terms of Thought. While, again, legitimately insisting upon Personality as a fundamental constituent in any true theory of Reality, the relation between human individualities and the divine Person is left vague and obscure; nor is it easy to see how the existence of several individualities—human or divine—in *one* cosmos is theoretically possible. It is at the solution of these two questions that Philosophy in the immediate future may be expected to work.

Green's most important treatise—the *Prolegomena to Ethics*—practically complete in manuscript at his death—was published in the year following. Shortly afterwards Nettleship's standard edition of his *Works* (exclusive of the *Prolegomena*) appeared in three volumes: vol. i. containing reprints of Green's criticism of Hume, Spencer, Lewes; vol. ii. Lectures on Kant, on Logic, on the Principles of Political Obligation; vol. iii. Miscellanies, preceded by a full *Memoir* by the Editor. The *Principles of Political Obligation* was afterwards published in separate form. A criticism of *Neo-Hegelianism* will be found in Professor Seth's *Hegelianism and Personality*, to which may be added articles in *Mind* (January and April 1884) by Mr A. J. Balfour and Professor Henry Sidgwick. (W. H. F*.)

Greenaway, Kate (1846–1901), English artist and book illustrator, was the daughter of John Greenaway, a well-known draughtsman and engraver on wood, and was born in London on the 17th of March 1846. After a course of study at South Kensington, at "Heatherley's" life classes, and at the Slade School, Kate Greenaway began, in 1868, to exhibit water-colour drawings at the Dudley Gallery, London. Her more remarkable early work, however, consisted of Christmas cards, which, by reason of their quaint beauty of design and charm of draughtsmanship, enjoyed an extraordinary vogue. Her subjects were, in the main, young girls, children, flowers, and landscape; and the air of artless simplicity, freshness, humour, and purity of these little works so appealed to public and artists alike, that the enthusiastic welcome habitually accorded to them is to be attributed to something more than love of novelty. In the line she had struck out Kate Greenaway was encouraged by H. Stacy Marks, R.A., and she refused to listen to those friends who urged her to return to a more conventional manner. Thenceforward her illustrations for children (such as for *Little Folks*, 1873, *et seq.*) attracted much attention. In 1877 her drawings at the Dudley Gallery were sold for £54, and her Royal Academy picture for eighteen guineas; and in the same year she began to draw for the *Illustrated London News*. In the year 1879 she produced *Under the Window*, of which 150,000 copies are said to have been sold, and of which French and German editions were also issued. Then followed *The Birthday Book*, *Mother Goose*, *Little Ann*, and other books for children, which were appreciated not less by adults, and were to be found on sale in the bookshops of every capital in Europe and in the cities of America. The extraordinary success achieved by the young girl may be estimated by the amounts paid to her as her share of the profits: for *Under the Window* she received £1130; for *The Birthday Book*, £1250; for *Mother Goose*, £905; and for *Little Ann*, £567. These four books alone produced a clear return of £8000. "Toy-books" though they were, these little works created a revolution in illustration, and so were of real importance; they were loudly applauded by John Ruskin (*Art of England* and *Fors Clavigera*), by Ernest Chesneau and Arsène Alexandre in France, by Dr Muther in Germany, and by leading art-critics throughout the world. In 1890 Kate Greenaway was elected a member of the Royal Institute of Painters in Water Colours, and in 1891, 1894, and 1898 she exhibited water-colour drawings (including illustrations for her books) at the gallery of the Fine Art Society (by which a representative selection was exhibited in 1902), where they surprised the world by the infinite delicacy, tenderness, and grace which they displayed. A leading feature in Miss Greenaway's work was her revival of the delightfully quaint costume of the beginning of the 19th century; this lent humour to her fancy, and so captivated the public taste that it has been said, with poetic exaggeration, that "Kate Greenaway dressed the children of two continents." Her drawings of children have been compared with Stothard's for grace and with Reynolds's for naturalness, and those of flowers with the work of even Van Huysum and Botticelli. From 1883 to 1897, with a break only in 1896, she issued a series of *Kate Greenaway's Almanacs*. Although she illustrated *The Pied Piper of Hamelin* and other works, the artist preferred to provide her own text; the numerous verses which were found among her papers after her death prove that she might have added to her reputation with her pen. She was possessed of great charm of character. Extremely shy of public notice, she was not less modest in private life; her friendships, though few, were very cordial. She died at Hampstead on 6th November 1901. (M. H. S.)

Greenbacks, a form of paper currency in the United States, so named from the green colour used on the backs of the notes. They are Treasury notes, and were first issued by the Government in 1862, "as a question of hard necessity," to provide for the expenses of the Civil War. The Government, following the example of the banks, had suspended specie payment. The new notes were therefore for the time being an inconvertible paper currency, and, since they were made legal tender, were really a form of fiat money. The first Act, providing for the issue of notes to the amount of $150,000,000, was passed on the 25th February 1862; the Acts of 11th July 1862 and 3rd March 1863 each authorized further issues of $150,000,000. The notes soon depreciated in value, and at the lowest were worth only 35 cents on the dollar. The Act of 12th April 1866 authorized the retirement of $4,000,000 of notes per month, but was repealed two years later. On 1st

January 1879 specie payment was resumed, and the amount of notes then nominally remaining ($346,681,016) was still outstanding on 1st January 1902.

The so-called *Greenback party*, which first came into definite political existence in 1874, was in favour of further increasing the volume of greenbacks. Their candidate for the presidency in 1876 was Peter Cooper, who received 81,740 votes. In 1880 the party, enlarged by fusion with labour reformers, nominated James B. Weaver, and not only polled 307,306 votes, but elected eight representatives to Congress. In 1884 their candidate was General Benjamin F. Butler (also the candidate of the Anti-Monopoly party), who received 133,825 votes. Since then the party has been merged in the Populists.

Green Bay, capital town of Brown county, Wisconsin, U.S.A., in 44° 31′ N. and 88° 00′ W., at the head of Green Bay, at an altitude of 591 feet. It has four railways, the Chicago and North-Western, the Chicago, Milwaukee, and St Paul, the Green Bay and Western, and the Kewaunee, Green Bay, and Western. Its excellent harbour and ample railway facilities give it a large commerce. Its manufactures are chiefly of lumber; the city contains many saw and shingle mills. Population (1880), 7464; (1890), 9069; (1900), 18,684.

Greenbush. See RENSSELAER, N.Y.

Greencastle, capital of Putnam county, Indiana, U.S.A., at an altitude of 762 feet. It is on the Vandalia, the Chicago, Indianapolis, and Louisville, and the Cleveland, Cincinnati, Chicago, and St Louis railways. It is the seat of De Pauw University, a co-educational Methodist-Episcopal institution, founded in 1832. In 1899 this had 22 professors and instructors and 475 students, about one-third of whom were women. Its property exceeded $500,000, and its income for the year was $31,848. Population (1880), 3644; (1890), 4390 (1900), 3661, of whom 143 were foreign-born and 155 negroes.

Greenfield, capital of Franklin county, Massachusetts, U.S.A., including an area of 20 square miles of hill country. The principal village, of the same name as the town, is situated on the northern bank of the Deerfield river, and on the Fitchburg and the Boston and Maine railways, at an altitude of 200 feet. Population of the town (1880), 3903; (1890), 5252; (1900), 7927, of whom 1431 were foreign-born.

GREENLAND.

SINCE 1880 the unknown parts of the coasts of Greenland have been explored by several expeditions. In 1882 Lieutenant Lockwood and Sergeant (afterwards Captain) Brainard, of the United States expedition to Lady Franklin Bay,[1] explored the north-west coast beyond Cape Britannia to a promontory in 83° 24′ N. lat. and 40° 46′ E. long., and they saw to the north-east Cape Washington, in about 83° 38′ N. lat. and 39° 30′ E. long., the most northerly point of land hitherto observed. In July 1892 Lieutenant R. E. Peary and E. Astrup discovered Independence Bay, on the north-east coast, in 81° 37′ N. lat. and 34° 5′ W. long.[2] In May 1895 it was revisited by Peary, who supposed this bay to be a sound communicating with Victoria Inlet on the north-west coast. To the north Heilprin Land and Melville Land were seen stretching northwards, but the probability seemed to be that the coast soon trended north-west. In 1901 Lieutenant Peary rounded the north point, and penetrated as far north as 83° 50′ N. The previously little-known east coast has to a great extent been well explored since 1880. The Danes G. Holm and V. Garde have carefully explored and mapped the coast from Cape Farewell to Angmagssalik, in 66° N. lat.[3] Nansen and his companions also travelled along a part of this coast in 1888.[4] Nordenskiöld visited in the *Sophia* Angmagssalik, in 65° 36′ N. lat., in 1883.[5] Captain C. Ryder, in 1891–92, explored and mapped the large Scoresby Sound, or, more correctly, Scoresby Fjord.[6] Lieutenant G. Amdrup, in 1899, explored the coast from Angmagssalik north to 67° 22′ N. lat.[7] A part of this coast, about 67° N. lat., had also been seen by Nansen in 1882.[8] In 1899 Professor Nathorst explored the land between Franz Josef Fjord and Scoresby Fjord, where the large King Oscar Fjord, connecting Davy's Sound with Franz Joseph Fjord, was discovered.[9] In 1900 Lieutenant Amdrup explored the still unknown east coast from 69° 10′ N. south to 67° N. Only the following portions of the coasts of Greenland still remain unexplored: the east coast between Cape Bismarck in 77° N. lat. and Independence Bay, and the north-east and north coast between this and Cape Washington.

Character of the East Coast.—Our ideas of the east coast of Greenland have been somewhat changed by recent explorations. It is an unusually glaciated coast, evidently owing to the north polar current carrying the ice masses from the north polar basin south-westwards along the land, and giving it an entirely Arctic climate down to Cape Farewell. In some parts the interior ice-covering extends down to the outer coast, while in other parts its margin is situated more inland, and the ice-bare coast-land is deeply intersected by fjords extending far into the interior, where they are blocked by enormous glaciers or "ice-currents" from the interior ice-covering, which discharge masses of icebergs into them. The east coast of Greenland is in this respect highly interesting. All coasts in the world which are much intersected by deep fjords have with very few exceptions a western exposure, *e.g.*, Norway, Scotland, British Columbia and Alaska, Patagonia and Chile, and even Spitsbergen and Novaya Zemlya, whose west coasts are far more intersected than their east ones. Greenland forms the most prominent exception, its eastern coast being quite as much intersected as its western. The reason is to be found in its geographical position, a cold ice-covered polar current running south along the land, while not far outside there is an open warmer sea, a circumstance which, while producing a cold climate, must also give rise to much precipitation, the land being thus exposed to the alternate erosion of a rough atmosphere and large glaciers. On the east coast of Baffin Land and Labrador there are similar conditions. The fact is, that

1 A. W. GREELY. *Report on the Proceedings of the United States Expedition to Lady Franklin Bay, Grinnell Land*, vols. i. and ii. Washington, 1885. *Three Years of Arctic Service*, 2 vols. London, 1886.

2 R. E. PEARY. *Northward over the "Great Ice,"* 2 vols. New York, 1898.—E. ASTRUP. *Blandt Nordpolen's Naboer.* Kristiania, 1895.

3 *Meddelelser om Grönland*, Parts ix. and x. Copenhagen, 1888.

4 F. NANSEN. *The First Crossing of Greenland*, vol. i. London, 1890.—H. MOHN and F. NANSEN. "Wissenschaftliche Ergebnisse von Dr F. Nansen Durchquerung von Grönland, 1888." *Ergänzungsheft*, No. 105 zu *Petermann's Mitteilungen.* Gotha, 1892.

5 A. E. NORDENSKIÖLD. *Den andra Dicksonska Expeditionen til Grönland.* Stockholm, 1885.

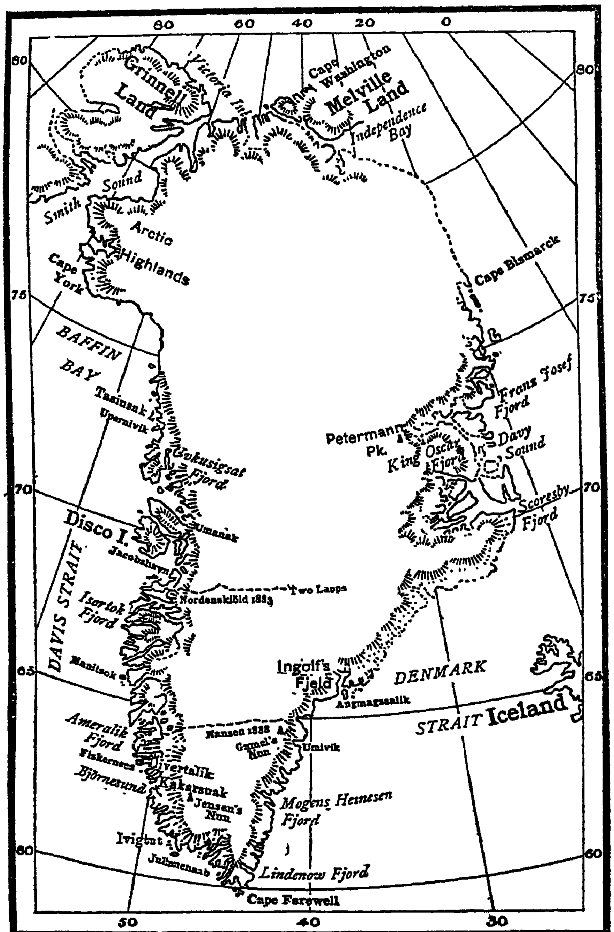
6 *Meddelelser om Grönland*, Parts xvii.–xix. Copenhagen, 1895–96.

7 *Geografisk Tidskrift*, vol. xv. pp. 53–71. Copenhagen, 1899.

8 *Geografisk Tidskrift*, vol. vii. pp. 76–79. Copenhagen, 1884.

9 A. G. NATHORST. *The Geographical Journal*, vol. xiv. 1899, p. 534; vol. xvii. 1901, p. 48. *Två Somrar i Norra Ishafvet.* Stockholm, 1901.

the east coast of Greenland has the largest system of fjords known on the Earth's surface. The Scoresby Fjord has a length of about 180 miles from the outer coast to the point where it is blocked by the glaciers, and with its numerous branches covers an enormous area. Franz Josef Fjord, with its branch King Oscar Fjord, communicating with Davy Sound, seems to form a system of fjords on a similar scale. These fjords are very deep; the greatest depth found by Ryder in Scoresby Sound was 300 fathoms, but there are certainly still greater depths. Assuming that the fjords are submerged or drowned valleys, which is most likely, this indicates that the land was once at



B. V. Darbishire & O. J. R. Howarth, Engl Miles 100 50 0 100 200 300 Oxford, 1901.

SKETCH MAP OF GREENLAND.

least 2000 feet higher, or the sea-level was 2000 feet lower, and probably more. A few soundings made outside this coast seem to indicate that the fjords continue as deep submarine valleys far out into the sea. Along the east coast there are also many high mountains, exceeding 6000 and 7000 feet in height. One of the highest peaks hitherto measured is at Tiningnertok, on the Lindenow Fjord, in 60° 35′ N. lat., which is 7340 feet high. At the bottom of Mogens Heinesen Fjord, 62° 30′ N. lat., the peaks are 6300 feet, and in the region of Umanak, 63° N. lat., they even exceed 6600 feet. At Umivik, where Nansen began his journey across the "inland ice," the highest peak projecting through the ice-covering was Gamél's Nunatak, 6440 feet, in 64° 34′ N. lat. In the region of Angmagssalik, which is very mountainous, the mountains rise to 6500 feet, the most prominent peak being Ingolf's Fjeld, in 66° 20′ N. lat., about 6000 feet, which is seen far off in the sea, and forms an excellent landmark. This is evidently the Blaaserk (*i.e.*, Blue Sark or blue coat) of the old Norsemen, their first landmark on their way from Iceland to the Öster Bygel, the present Julianehaab district, on the south-west coast of Greenland.[1] A little farther north the coast is much lower, rising only to heights of 2000 feet, and just north of 67° 10′ N. lat. only to 500 feet or less.[2] The highest mountains near the inner branches of Scoresby Fjord are about 7000 feet. The Petermann Spitze, near the shore of Franz Josef Fjord, measured by Payer and found to be 11,000 feet, has hitherto been considered to be the highest mountain in Greenland, but according to Nathorst it "is probably only two-thirds as high as Payer supposed," perhaps between 8000 or 9000 feet.

Along the west coast of Greenland the mountains are generally not quite so high, but even there peaks of 5000 and 6000 feet are not uncommon. As a whole the coasts are unusually mountainous, and Greenland forms in this respect an interesting exception, as there is no other known land of such a size so filled along its coasts on all sides with high mountains and deep fjords and valleys.

The "Inland Ice."—The whole interior of Greenland is completely covered by the so-called "inland ice," an enormous glacier forming a regular shield-shaped expanse of snow and glacier ice, and burying all valleys and mountains far below its surface. It rises in the interior to a level of 9000 feet, and in places perhaps 10,000 feet or more, and descends gradually by extremely gentle slopes towards the coasts or the bottom of the fjords on all sides, discharging a great part of its yearly drainage or surplus of precipitation in the form of icebergs in the fjords, the so-called ice-fjords, which are numerous both on the west and the east coast. These icebergs float away, and are gradually melted in the sea, the temperature of which is thus lowered by cold stored up in the interior of Greenland. The last remains of these icebergs are met with in the Atlantic south of Newfoundland. The interior of the inland ice has been explored by several expeditions since 1875. Captain J. A. D. Jensen reached, in 1878, the Jensen Nunataks (5400 feet above the sea), about 45 miles from the western margin, in 62° 50′ N. lat.[3] Nordenskiöld penetrated, in 1883, about 70 miles inland from its western margin in 68° 20′ N. lat., and two Lapps of his expedition went still farther on skis. Peary and Maigaard reached, in 1886, about 100 miles inland from the western margin a height of 7500 feet, in 69° 30′ N. lat. Nansen with five companions crossed, in 1888, the inland ice from the east coast to the west, in about 64° 25′ N. lat., and reached a height of 8922 feet. Peary and Astrup crossed, in 1892, the northern part of the inland ice between 78° and 82° N. lat., reaching a height of about 8000 feet, and determined the northern termination of the ice-covering. Peary made very nearly the same journey again in 1895. Captain V. Garde explored, in 1893, the interior of the inland ice between 61° and 62° N. lat., near its southern termination, and he reached a height of 7080 feet about 60 miles from the margin.[4]

The surface of the inland ice forms in a transverse section from the west to the east coast an extremely

[1] Their second or third landmark was Hvidserk (*i.e.*, white sark or coat), near Hvarf, in the region of Cape Farewell. Hvidserk is one of the most prominent snow-covered mountains on the east or south coast near Cape Farewell. It is difficult, however, for one who has not seen this part of the coast to decide which mountain it may be.

[2] See C. KRUUSE in *Geografisk Tidskrift*, vol. xv. p. 64. Copenhagen, 1899. See also F. NANSEN, "Die Ostküste Grönlands," *Ergänzungsheft*, No. 105 zu *Petermann's Mitteilungen* (Gotha, 1892), p. 55 and pl. iv. sketch No. 11.

[3] J. A. D. JENSEN. "Expedition til Syd-Grönland," i. 1878. *Meddelelser om Grönland*, Part i. Copenhagen, 1879.

[4] T. V. GARDE. "Beskrivelse af Expeditionen til Sydvestgrönland 1893." *Meddelelser om Grönland*, Part xvi. Copenhagen, 1896.

regular curve, almost approaching an arc of a wide circle, which along Nansen's route has its highest ridge somewhat nearer the east than the west coast. The same also seems to be the case farther south. The curve shows, however, slight irregularities in the shape of undulations. The angle of the slope decreases gradually from the margin of the inland ice, where it may be 1° or more, towards the interior, where it is 0°. In the interior the surface of the inland ice is composed of dry snow which never melts, and which is constantly packed and worked smooth by the winds. It extends as a completely even plain of snow, with long, almost imperceptible, undulations or waves, at a height of 8000 to 10,000 feet, obliterating the features of the underlying land, the mountains and valleys of which are completely interred. Over the deepest valleys of the land in the interior this ice-cap must be at least 6000 or 7000 feet thick or more. Approaching the coasts from the interior, the snow of the surface gradually changes its structure. At first it becomes more coarse-grained, like the *Firn Schnee* of the Alps, and is moist by melting during the summer. Nearer the coast, where the melting on the surface is more considerable, the wet snow freezes hard during the winter and is more or less transformed into ice, on the surface of which rivers and lakes are formed, the water of which, however, soon finds its way through crevasses and holes in the ice down to its under surface, and reaches the sea as a sub-glacial river. Near its margin the surface of the inland ice is broken up by numerous large crevasses, formed by the outward motion of the glacier covering the underlying land. The steep ice-walls at the margin of the inland ice show, especially where the motion of the ice is slow, a distinct striation, which indicates the strata of annual precipitation with the intervening thin seams of dust (Nordenskiöld's kryokonite). This is partly dust blown on to the surface of the ice from the ice-bare coast-land and partly the dust of the atmosphere brought down by the falling snow and accumulated on the surface of the glacier's covering by the melting during the summer. In the rapidly moving glaciers of the ice-fjords this striation is not distinctly visible, being evidently obliterated by the strong motion of the ice masses.

The ice-cap of Greenland must to some extent be considered as a viscous mass, which, by the vertical pressure in its interior, is pressed outwards and slowly flows towards the coasts, just as a mass of pitch placed on a table and left to itself will in the course of time flow outwards towards all sides. The motion of the outwards-creeping inland ice will naturally be more independent of the configurations of the underlying land in the interior, where its thickness is so enormous, than near the margin where it is thinner. Here the ice converges into the valleys and moves with increasing velocity in the form of glaciers into the fjords, where they break off as icebergs. The drainage of the interior of Greenland is thus partly given off in the solid form of icebergs, partly by the melting of the snow and ice on the surface of the ice-cap, especially near its western margin, and to some slight extent also by the melting produced on its under side by the interior heat of the Earth.

Glaciers.—After Professor Amund Helland had, in July 1875, discovered the amazingly great velocity, up to 64¾ feet (19·77 m.) in twenty-four hours, with which the glaciers of Greenland move into the sea, the margin of the inland ice and its glaciers was studied by several expeditions. K. J. V. Steenstrup during several years, Captain Hammer in 1879–80, Captain Ryder in 1886–87, Dr Drygalski in 1891–93,[1] and several American expeditions in later years, all examined the question closely. The highest known velocities of glaciers was measured by Ryder in the Upernivik glacier (in 73° N. lat.), where, between the 13th and 14th August of 1886, he found a velocity of 121 feet in twenty-four hours, and an average velocity during several days of 99 feet (Danish).[2] It was, however, ascertained that there is a great difference between the velocities of the glaciers in winter and in summer. For instance, Ryder found that the Upernivik glacier had an average velocity of only 33 feet in April 1887. There seem to be periodical oscillations in the extension of the glaciers and the inland ice similar to those that have been observed on the glaciers of the Alps and elsewhere. But these interesting phenomena have not hitherto been subject to systematic observation, and our knowledge of them is therefore uncertain. Numerous glacial marks, however, such as polished striated rocks, moraines, erratic blocks, &c., prove that the whole of Greenland, even the small islands and skerries outside the coast, has once been covered by the inland ice.

Geology.—It is unnecessary to discuss in detail all the researches into the geology of Greenland during the last quarter of the 19th century: the reader is referred to the excellent series of publications, *Meddelelser om Grönland*, published in Copenhagen, where much valuable information in this respect may be found. The highly interesting Cretaceous and Tertiary strata with plant fossils at Atanikerdluk and other places on the west coast between 69° 25′ and 72° N. lat. have been carefully investigated by K. J. V. Steenstrup, Nordenskiold, and Nathorst, and valuable memoirs on them have been published by Oswald Heer, Nathorst, and Steenstrup. In the southern part of the explored east coast, south of Angmagssalik, no sedimentary rocks with fossils have been found; they are all crystalline schists. In Scoresby Fjord the Ryder expedition found Jurassic deposits, besides basalts and crystalline schists. In the Franz Josef Fjord region Nathorst discovered also deposits of the Silurian and Devonian systems. Numerous raised beaches and terraces, containing shells of marine Mollusca, &c., occur along the whole coast of Greenland, and indicate that the whole of this large island has been raised, or the sea has sunk, in post-Tertiary times, after the inland ice covered its now ice-bare outskirts. In the north along the shores of Smith Sound these traces of the gradual upheaval of the land, or sinking of the sea, are very marked; but they are also very distinct in the south, although not found so high above sea-level, which seems to show that the upheaval has been greater in the north. In Uvkusigsat Fjord (72° 20′ N. lat.) the highest terrace is 480 feet (150 m.) above the sea.[3] On Manitsok (67° 50′ N. lat.) the highest raised beach was 360 feet (108 m.) above the sea.[4] In the Isortok Fjord (67° 11′ N. lat.) the highest raised beach is 380 feet (119·2 m.) above sea-level.[5] In the Ameralik Fjord (64° 14′ N. lat.) the highest marine terrace is about 340 feet (106 m.) above sea-level, and at Ilivertalik (63° 14′ N. lat.), north of Fiskernees, the highest terrace is about 325 feet (101 m.) above the sea. At Kakarsuak, near the Björnesund (62° 50′ N. lat.), a terrace is found at 615 feet (192 m.) above the sea, but it is doubtful whether this is of marine origin.[6] In the Julianehaab district, between 60° and 61° N. lat., the highest marine terraces are found at about 160 feet (50 m.) above the sea.[7] The highest marine terrace

[1] E. v. DRYGALSKI. *Grönland-Expedition der Ge ellschaft für Erdkunde zu Berlin, 1891–1893*, 2 vols. Berlin, 1897.

[2] C. H. RYDER. "Undersögelse af Grönlands Vestkyst fra 72° til 74° 35′ N. Br." *Meddelelser om Grönland*, Part viii. (Copenhagen, 1889), pp. 203–70.

[3] *Meddelelser om Grönland*, Part iv. (Copenhagen, 1883), p. 230; see also Part xiv. p. 317 *et seq.*, p. 323.

[4] *Ibid.*, Part xiv. (Copenhagen, 1898), p. 323.

[5] *Ibid.*, Part ii. (Copenhagen, 1881), pp. 181–88.

[6] *Ibid.*, Part i. (Copenhagen, 1879), pp 99–101.

[7] *Ibid.*, Part ii. (Copenhagen, 1881), p. 39; Part xvi. (1896), pp. 150–54.

observed in Scoresby Fjord, on the east coast, was 240 feet above sea-level.[1] There is a common belief that during quite recent time the west and south-west coast, within the Danish possessions, has been sinking. Although there are many indications which may make this probable, none of them can be said to be quite decisive.[2]

Native iron has been found by K. J. V. Steenstrup in several places on the west coast enclosed as smaller or larger nodules in the basalt. This iron has very often beautiful Widmannstätten figures like those of iron meteorites.[3] In 1895 Peary found native iron at Cape York; since John Ross's voyage in 1818 it had been known to exist there, and from it the Eskimo got iron for their weapons. In 1897 Peary brought the largest nodule to New York; it was estimated to weigh nearly 100 tons. This iron is considered by several of the first authorities on the subject to be of meteoric origin,[4] but no evidence hitherto given seems to prove decisively that it cannot be telluric. That the nodules found were lying on gneissic rock, with no basaltic rocks in the neighbourhood, does not prove that the iron may not originate from basalt, for the nodules may have been transported by the glaciers, like other erratic blocks, and will stand erosion much longer than the basalt, which may long ago have disappeared. This iron seems, however, in several respects to be unlike the celebrated large nodules of iron found by Nordenskiöld at Uifak on Disco Island, but appears to resemble much more closely the softer kind of iron nodules found by Steenstrup in the basalt;[5] it stands exposure to the air equally well, and has similar Widmannstätten figures very sharp, as is to be expected in such a large mass. It contains, however, more nickel and also phosphorus.

Climate.—The climate of the interior has been found to be of a continental character, with large ranges of temperature, and with an almost permanent anti-cyclonic region over the interior of the inland ice, from which the prevailing winds radiate towards the coasts. On the 64th parallel the mean annual temperature at an elevation of 6560 feet is supposed to be −13° F., or reduced to sea-level 5° F. The mean annual temperature in the interior farther north is supposed to be −10° F. reduced to sea-level. The mean temperature of the warmest month, July, in the interior should be, reduced to sea-level, on the 64th parallel 32° F., and that of the coldest month, January, about −22° F., while in North Greenland it is probably −40° reduced to sea-level. Here we may probably find the lowest temperatures of the northern hemisphere. The interior of Greenland contains both summer and winter a pole of cold, situated in the opposite longitude to that of Siberia, with which it is well able to compete in extreme severity. On Nansen's expedition temperatures of about −49° F. were experienced during the nights in the beginning of September, and the minimum during the winter may probably sink to −90° F. in the interior of the inland ice. These low temperatures are evidently caused by the radiation of heat from the snow-surface in the rarefied air in the interior. The daily range of temperature is therefore very considerable, sometimes amounting to 40°. Such a range is elsewhere found only in deserts, but the surface of the inland ice may be considered to be an elevated desert of snow.[6] The climate of the east coast is on the whole considerably more Arctic than that of the west coast on corresponding latitudes; the land is much more snow-covered, and the snow-line goes considerably lower. The probability also is that there is more precipitation, and that the mean temperatures are lower.[7] The well-known strangely warm and dry *föhn*-winds of Greenland occur both on the west and the east coast; they are more local phenomena than was previously believed, and are formed by cyclonic winds passing over local mountains or also passing down the outer slope of the inland ice.[8]

Fauna and Flora.—It has been a common belief that the fauna and flora of Greenland are essentially European, a circumstance which would make it probable that Greenland has been separated by sea from America during a longer period of time than from Europe. The correctness of this hypothesis may, however, be doubted. The land mammals of Greenland are decidedly more American than European: the musk-ox, the banded lemming (*Cuniculus torquatus*), the white polar wolf, of which there seems to have been an invasion recently round the northern part of the country to the east coast, the Eskimo and the dog,—probably also the reindeer,—have all of them come from America, while the other land mammals, the polar bear, the polar fox, the Arctic hare, the stoat (*Mustela erminea*), are perfectly circumpolar forms. The species of seals and whales are, if anything, more American than European, and so to some extent are the fishes. The bladder-nose seal (*Cystophora cristata*), for instance, may be said to be a Greenland-American species, while a Scandinavian species, such as the grey seal (*Halichœrus grypus*), appears to be very rare both in Greenland and America. Of the sixty-one species of birds breeding in Greenland, eight are European-Asiatic, four are American, and the rest circumpolar or North Atlantic and North Pacific in their distribution.[9] About 310 species of vascular plants are found, of which about forty species are American, forty-four European-Asiatic, fifteen endemic, and the rest common both to America and Europe or Asia. We thus see that the American and the European-Asiatic elements of the flora are nearly equivalent; and if the flora of Arctic North America were better known, the number of plants common to America might be still more enlarged.[10]

At Tasiusak (73° 22′ N. lat.), the most northern civilized settlement in the world, gardening has been attempted without success, but several plants do well in forcing frames. At Umanak (70° 40′ N. lat.) is the most northern garden in the world. Broccoli and radishes grow well, turnips (but not every year), lettuce, and chervil succeed sometimes, but parsley cannot be reared. At Jacobshavn (69° 12′ N. lat.), only some 15 miles from the inland ice, gardening succeeds very well; broccoli and lettuce grow willingly; the spinach produces large leaves; chervil, pepper-grass, leeks, parsley, and turnips grow very well; the radishes are sown and gathered twice during

[1] *Meddelelser om Grönland*, Part xix. (1896), p. 175.

[2] *Ibid.*, Part i. p. 34; Part ii. p. 40; Part xiv. pp. 343–47; Part iv. p. 237; Part viii. p. 26.

[3] *Ibid.*, Part iv. (Copenhagen, 1883), pp. 115–31.

[4] See Peary. *Northward over the "Great Ice,"* vol. 2. p. 604 *et seq.* New York, 1898.

[5] See *loc. cit.*, pp. 127–8.

[6] H. Mohn. "The Climate of the Interior of Greenland," *The Scott. Geogr. Magazine*, vol. ix. (Edinburgh, 1893), pp. 142–45, 199. —H. Mohn and F. Nansen. "Wissenschaftliche Ergebnisse," &c., *Ergänzungsheft*, No. 105 zu *Petermann's Mitteilungen* (1892), p. 51.

[7] On the climate of the east coast of Greenland see V. Willaume-Jantzen. *Meddelelser om Grönland*, Part ix. (1889), pp. 285–310; Part xvii. (1895), pp. 171–80.

[8] See A. Paulsen. *Meteorolog. Zeitschrift* (1889), p. 241.—F. Nansen. *The First Crossing of Greenland* (London, 1890), vol. ii. pp. 496–97.—H. Mohn and F. Nansen. "Wissenschaftliche Ergebnisse," &c., *Ergänzungsheft*, No. 105 zu *Petermann's Mitteilungen* (1892), p. 51.

[9] H. Winge. "Grönlands Fugle," *Meddelelser om Grönland*, Part xxi. pp. 62–63. Copenhagen, 1899.

[10] See J. Lange. "Conspectus Florae Groenlandicae," *Meddelelser om Grönland*, Part iii. Copenhagen, 1880 and 1887.—E. Warming. "Om Grönlands Vegetation," *Meddelelser om Grönland*, Part xii. (Copenhagen, 1888); and in *Botanische Jahrbücher*, vol. x. (1888–89). —See also A. Blytt. *Englers Jahrbücher*, ii. (1882) pp. 1–50.— A. G. Nathorst. *Öfversigt af K. Vetenskap. Akad. Forhandl.* Stockholm, 1884. "Kritische Bemerkungen über die Geschichte der Vegetation Grönlands," *Botanische Jahrbücher*, vol. xiv. (1891).

the summer (June to August). In the south, in the Julianehaab district, even flowering plants, such as aster, nemophilia, and mignonette, are cultivated, and broccoli, spinach, sorrel, chervil, parsley, rhubarb, turnips, lettuce, radishes grow very well. Potatoes give fair results when they are taken good care of, carrots grow to a thickness of one inch and a half, while cabbage does poorly. Strawberries and cucumbers have been ripened in a forcing frame. In the "Kongespeil" (King's mirror) from the 13th century it is stated that the old Norsemen tried in vain to raise barley.

Population.—The Eskimo population of Danish Greenland (west coast) seems to have decreased since the Norwegians came to the country a century and a half ago. Hans Egede estimated the population then at 30,000, but this is probably a large over-estimate. The decrease may chiefly have been due to infectious diseases, especially a very severe epidemic of smallpox. During the last half of the 19th century there was on the whole a slight increase of the native population: in 1855 it was 9648; in 1870, 9615; in 1881, 9701; in 1883, 9844; in 1885, 9914; in 1888, 10,221; in 1890, 10,254; in 1895, 10,639; and in 1899, 10,974. The population fluctuates a good deal owing, to some extent, to an emigration of natives from the east to the west coast.[1] The population of the east coast seems on the whole to be decreasing. In the north part of the east coast, in the region of Scoresby Fjord and Franz Josef Fjord, numerous ruins of Eskimo settlements are found, and in 1823 Sabine met Eskimo there, but now they have either completely died out or have wandered south. In the district of Angmagssalik the population in 1884 was 413 natives, and on the east coast between Angmagssalik and Cape Farewell there were 135, the population of the east coast being altogether 548 in 1884.[2] In 1892 the population of the Angmagssalik district was only 293, a decrease of 120 since 1884, which is chiefly owing to the fact that a great number of natives (118) had travelled farther south. In 1894[3] the number had decreased to 247, this decrease being chiefly due to an epidemic of influenza. In 1895 also the population numbered 247, while in 1896 it increased to 372, chiefly owing to 118 individuals having come from the south.[4] On 31st December 1899 the population numbered 403. The little tribe of Eskimo living in the region of Cape York near Smith Sound—the so-called "Arctic Highlanders" or Smith Sound Eskimo—numbered in 1895, 253. In 1896 this number was reduced to 229 by an epidemic of influenza. In 1897 the number was 234.[5]

Trade.—The chief addition to trading districts since 1880 was made in 1894, when a new trading and missionary station or "coloni" was established in Angmagssalik on the east coast, where a missionary and a "colonibestyrer," or superintendent of the district, with their families reside. The trade of Greenland has on the whole much decreased during late years, and trading and missions now cost the Danish State a comparatively large sum (about £11,000 every year), although this is partly covered by the income from the cryolite royalty of the mines at Ivigtut. The Danish Mission[6] in Greenland has a yearly grant from the Greenland trade of 36,000 kroner (£2000), besides a contribution of 16,000 kroner (£880) from the Danish State. If these sums be considered, the results of the Greenland trade and missions of late years are the following, according to Mr C. Ryberg, of the Greenland directorate: 1895–96, *deficiency* 183,699 kroner; 1896–97, *deficiency* 284,024 kroner; 1897–98, *deficiency* 92,420 kroner; 1898–99, *deficiency* 40,430 kroner; 1899–1900, *profit* 20,839 kroner; 1900–1, *deficiency* 106,091 kroner. The mean result of this term of six years is consequently a yearly deficiency of 114,304 kroner (£6350). The decline in the value of the trade, which some years ago was very profitable, has to a great extent been brought about by the fall in the price of seal-oil. The exceptional profit in the year 1899–1900 was chiefly due to the extraordinarily high prices of the skins of the blue fox and polar bear, on account of the Paris Exhibition. It might be expected that there should be a decrease in the Greenland seal fisheries, caused by the European and American sealers catching larger quantities every year, especially along the coasts of Newfoundland and Labrador, and so actually diminishing the number of the animals in the Greenland seas. The statistics of South Greenland, however, do not seem to demonstrate any such decrease. For North Greenland there is no information at hand for the later years. According to Mr C. Ryberg, there were, in the seventeen years from 1874 to 1890, 32,826 seals caught yearly in South Greenland. In the following years there were caught in the same district: 1891–92, 24,583 seals; 1892–93, 33,338 seals; 1893–94, 29,726 seals; 1894–95, 38,075 seals; 1895–96, 29,964 seals; and in 1896–97, 41,912. The mean number of seals caught yearly during this period was consequently 32,933 seals, or very nearly the same as during the previous seventeen years.

For further information about Greenland see especially *Meddelelser om Grönland*, Parts i.–xxiii. (Copenhagen, 1879–99); it is chiefly written in Danish, but each part has a summary in French. In Part xiii. there is a complete list of literature about Greenland up to 1880. The more important literature of later years has already been cited in the footnotes. As to the discovery of Greenland by the Norsemen and its early history see KONRAD MAURER'S excellent paper in the report of *Die zweite Deutsche Nordpol Expedition*, 1869–70, vol. ii.—G. STORM. *Studies on the "Vineland" Voyages.* Christiania and Copenhagen, 1889 (see also *Aarbog for Nordisk Oldkyndighed og Historie.* Copenhagen, 1888).—K. J. V. STEENSTRUP. "Om Österbgyden," *Meddelelser om Grönland*, Part ix. (1882), pp. 1–51.—FINNUR JÓNSSON. "Grönlands gamle Topografi efter Kilderne," *Meddelelser om Grönland*, Part xx. (1899), pp. 265–329. (F. N.)

Greenock, a seaport town and parliamentary burgh of Renfrewshire, Scotland, on the south bank of the river Clyde, 21½ miles west-north-west of Glasgow by water, 23 miles by rail. Public erections since 1880 are the municipal chambers, in the Renaissance style, completed in 1886 at a cost of £225,000; Established, Roman Catholic (1900), Reformed Presbyterian, and two United Free churches, a technical college (1900), an eye infirmary, a new post office (1899), a masonic temple, and electric lighting works. Smithston poorhouse and lunatic asylum, which cost £100,000, was erected in 1879. Street tramways connect the town with both Gourock and Port Glasgow. Shipbuilding alone now stands out prominently above other industries; 43,358 tons were launched in 1889, and 41,654 in 1899. Sugar-refining has declined, and in 1900 there were only four refineries at work. Among other industries are boiler and engine making, and an aluminium factory was established in 1898. The dock and quay accommodation now covers 100 acres, and £1,500,000 has been spent on the harbour from first to last. The James Watt dock cost £650,000 in 1886; it is 2000 by 400 feet, and has a depth of 32 feet at low water. Two large tidal harbours cost £500,000. Indeed, the harbour had been improved more

[1] F. NANSEN. *Eskimo Life* (London, 1893), p. 331.
[2] G. HOLM. *Meddelelser om Grönland*, Part x. (1888), p. 200.
[3] C. RYDER. *Ibid.*, Part xvii. (1895), p. 143.
[4] C. RYBERG. "Fra Missions og Handelsstationen ved Angmagssalik," *Geografisk Tidskrift*, vol. xiv. (Copenhagen, 1898), p. 117.
[5] R. E. PEARY. *Northward over the "Great Ice"* (New York, 1898), vol. i. p. 480.
[6] The Moravian Mission, which had worked in Greenland a century and a half, finally retired from the country in 1900.

rapidly and more expensively than the trade of the port warranted, and in 1887 the trustees found themselves unable to pay the interest on the mortgage bonds. At the end of 1898 there were 267 vessels of 273,954 tons on the register of the port. In 1888, 6630 vessels of 1,379,616 tons entered, and 6903 vessels of 1,528,164 tons cleared. In 1898, 9533 vessels of 1,685,235 tons entered, and 9627 vessels of 1,887,565 tons cleared. The value of the foreign and colonial imports was £3,170,328 in 1888, and £1,341,908 in 1898; of the exports, £225,747 in 1888, and £191,261 in 1898. Fort Matilda, with submarine mines, protects the river at Greenock. The School Board manages an academy. Other educational institutions are a school of art and a school of navigation and engineering. Population (1881), 66,704; (1901), 67,645.

Greensboro, capital of Guilford county, North Carolina, U.S.A., at an altitude of 837 feet. It is on the Southern and the Cape Fear and Yadkin Valley railways. It has cotton and flour mills and blast furnaces. Several minor educational institutions are situated here. The name comes from General Greene, who in 1781 defeated the British under Cornwallis at Guilford Court House, near this place. Population (1880), 2105; (1890), 3317; (1900), 10,035, of whom 90 were foreign-born and 4086 negroes.

Greensburg, capital of Westmoreland county, Pennsylvania, U.S.A., at an altitude of 1091 feet, on the Pennsylvania Railway. It has manufactures of iron and glass. Population (1890), 4202; (1900), 6508, of whom 484 were foreign-born and 128 negroes.

Greenville, capital of Washington county, Mississippi, U.S.A., on the eastern bank of the Mississippi river, in the Yazoo Bottom, at an altitude of 125 feet, on the Southern and Yazoo and Mississippi Valley railways. It is in one of the richest cotton regions of the South, and has a large cotton trade. Population (1880), 2191; (1890), 6658; (1900), 7642, of whom 249 were foreign-born and 4987 negroes.

Greenville, capital of Greenville county, South Carolina, U.S.A., at an altitude of 976 feet, on the Southern and the Charleston and Western Carolina railways. It is in the cotton belt, and handles the crop of an extensive surrounding country. It has some manufactures, especially of cotton goods. It is the seat of Furman University and two colleges for women. Population (1880), 6160; (1890), 8607; (1900), 11,860, of whom 119 were foreign-born and 5414 negroes.

Greenville, capital of Hunt county, Texas, U.S.A., at an altitude of 552 feet. It is at the intersection of the Missouri, Kansas, and Texas, the Houston and South-Western, the Sherman, Shreveport, and Southern, and the Texas Midland railways. It is an important shipping point for cotton, and the seat of Burleson College, a Baptist institution, opened in 1893. Population (1890), 4330; (1900), 6860, of whom 114 were foreign-born and 1751 negroes.

Greenwich, a municipal and parliamentary borough of England, on the south bank of the Thames, 4 miles E.S.E. of St Paul's, London, on the South-Eastern and Chatham Railway. A new building for the Royal Observatory was completed in 1899. About a quarter of a mile to the east is the magnetic pavilion, placed thus far away to avoid the disturbance which would be occasioned by the iron used in the principal building. The Government whitebait dinner was resumed in 1895, after an interval of fifteen years. A stained glass window to the memory of General Wolfe was placed in the parish church in 1896. By the London Government Act of 1899 the borough of Greenwich was taken out of the county of Kent and made one of the twenty-eight metropolitan boroughs of the county of London. Population of the metropolitan borough (1891), 78,514; (1901), 95,770.

Greenwich, a town of Fairfield county, Connecticut, U.S.A., with an area of 49 square miles of hill country, and containing a borough of the same name. Greenwich borough is on Long Island Sound, and on the New York, New Haven, and Hartford Railway. It is a popular summer resort, especially for New York business men. Population of the town (1880), 7892; (1890), 10,131; (1900), 12,172, of whom 3271 were foreign-born and 356 negroes.

Greg, William Rathbone (1809–1881), English essayist, the son of a merchant, was born at Manchester in 1809. He became a manufacturer, and entering with ardour into the struggle for free trade, obtained in 1842 the Anti-Corn Law League's prize for the best essay on "Agriculture and the Corn Laws." He was too much occupied with political, economical, and theological speculations to give undivided attention to his business, which became unprosperous, and was relinquished in 1850. Greg turned vigorously to authorship; his *Creed of Christendom* was published in 1851, and in 1852 he contributed no fewer than twelve articles to four leading quarterlies. Disraeli spoke of him eulogistically; Sir George Cornewall Lewis bestowed a Commissionership of Customs upon him in 1856; and in 1864 he was made Comptroller of the Stationery Office. He continued to write, and besides contributions to periodicals produced several volumes of essays on political and social philosophy. The general spirit of these is indicated by the titles of two of the most celebrated, *The Enigmas of Life* (1872) and *Rocks Ahead* (1874). They represent a reaction from the high hopes of the author's youth, when wise legislation was assumed to be a remedy for every public ill. Greg in old age went into the opposite extreme; but his accuracy of thought and deep moral earnestness were always valuable. He died at Wimbledon on the 15th of November 1881.

Gregorovius, Ferdinand (1821 - 1891), German historian and miscellaneous writer, was born at Neidenburg, East Prussia, on the 19th of January 1821. He studied theology and philosophy at Königsberg University, being intended for the priesthood, but relinquished that project and devoted himself to literary work, his first important publication being a study of Goethe's *Wilhelm Meister*. In 1852 he travelled, by way of Corsica, to Italy, and the result was a brilliant book (1857) entitled *Wanderjahre in Italien*, besides a volume on Corsica. He settled at Rome, and between 1859 and 1872 produced his *magnum opus*, the *History of Rome in the Middle Ages*, a work steeped in mediæval learning. Gregorovius was a voluminous writer, and his list of publications is a long one, including a tragedy, *The Death of Tiberias*, an epic, *Euphorion* (1858), and *Athens in the Middle Ages*, the last a historical work which resulted from his travels in Greece and the East in 1880. He died at Munich, 1st May 1891.

Greifswald, a town of Prussia, province of Pomerania, near the head of Greifswald Bay on the Baltic, on which, 2½ miles distant, are the little seaside resorts of Wieck (population 800), which is also the port for Greifswald, and Eldena (1050). In front of the university, which had 808 students and 95 professors in 1900, stands a monument commemorative of its four hundredth anniversary. The university institutions embrace a zoological museum, a gynæcological institute, an ophthalmological school, a psychological school, physical, physiological, and

pharmaceutical institutes, a botanical garden, and (at Eldena) an agricultural school. Population (1885), 20,345; (1900), 22,940.

Greiz, a town of Germany, capital of the principality of Reuss the Elder, on the White Elster, 66 miles by rail south from Leipzig. It consists of two parts, the old town on the right bank, and the new town on the left bank, rapidly growing and regularly laid out. There are monuments to the Emperor William I. (1888), Bismarck (1895), and the war of 1870–71. Population (1885), 17,288; (1900), 22,345.

Grenada, since 1885 the seat of government of the Windward Islands, and the most southerly of the group, situated about 90° N. of Trinidad, between 11° 58′ and 12° 30′ N. lat. and 61° 20′ and 61° 35′ W. long. It is about 21 miles long by 12 miles broad, with an area of 133 square miles. The island is very mountainous, and the hills (the highest of which, Mount Catherine, is 2749 feet), running off in spurs from the centre, form valleys of great beauty and fertility. Included in the government of the Windward Islands are also a number of small islands called GRENADINES, some of which are attached to the local government of St Vincent and some to that of Grenada. Of the latter the chief is Carriacou, with an area of nearly 7000 acres and a population of over 6000. Population of Grenada (1877), 41,355; (1899), 64,098. The birth-rate per 1000 of the mean estimated population was 42·17, and the death-rate 20·85. The climate is very healthy, epidemic diseases are rare, and the temperature is equable. The hottest months are August, September, and October. The mean temperature of 1898 at 500 feet above the sea was 79·0° at 9 A.M. The rainfall is very heavy, amounting in some parts to 200 inches a year. During 1898 it was 162·45 inches in the centre of Grenada and 80·28 at Carriacou. The rain lasts, on and off, from May to the end of the year, September and November being especially wet. The island is singularly free from the visitations of hurricanes. It is a favourite health resort for the neighbouring colony of Trinidad. A new sanatorium was opened at Grand Etang (1800 feet) in 1899. There are practically no Crown lands for disposal. Good roads and by-ways intersect the island in every direction. The value of imports in 1877 was £127,204; in 1899 it was £226,828. The value of exports in 1877 was £145,906; in 1899 it was £267,738. The imports were derived as follows:—United Kingdom, £101,921; British colonies, £64,603; foreign countries (mainly United States), £60,303. The exports go in the following proportions:—To the United Kingdom, 94 per cent.; to the British colonies, 1 per cent.; to foreign countries (principally the United States), 4 per cent. The chief articles of export in 1898 were cacao (£234,610) and spices (£21,761), with smaller values of cotton, live stock, kola nuts, coffee, and logwood, the sugar-cane being now chiefly prepared for local consumption as sugar, molasses, or rum. An excellent oyster is obtained at Carriacou, and turtle and fresh fish are plentiful. The revenue in 1877 was £29,084; in 1899 it was £68,757. The expenditure in 1877 was £29,581; in 1899 it was £59,358. The tonnage of vessels entered in 1898 was 216,192, of which 209,455 was British and 6737 foreign. There is no military force, but there is a police force of sixty-five officers and men. The elementary schools were in 1899 partly Government (9) and partly grant-in-aid schools (32) under the management of the ministers of the different religious denominations (Roman Catholics, 19; Anglican, 7; Wesleyan, 4; Church of Scotland, 2), the whole being under a Board of Education nominated by the governor. The 41 schools had 9240 pupils on the roll, with an average daily attendance of about 52 per cent. There are a grammar-school for boys and two high schools for girls in St George (the capital) receiving grants-in-aid. The bishopric of the Windward Islands forms part of the West Indian province of the Church of England. English is universally spoken, but the peasantry speak amongst themselves a French patois, a legacy of French occupation. The Legislative Council consists of the governor with six official and seven unofficial members, all nominated by the crown. (F. CU.)

Grenadier.—Grenadiers were soldiers, part of whose duty it was to throw hand-grenades. Du Bellay says grenades were made in large numbers at Arles in 1536. The Comte de Rendan was killed by one at the siege of Rouen, 1562. They were used at the siege of Famagusta in Cyprus, 1571. Four or five grenadiers were attached to each French company in 1667, and in 1670 they were increased and formed in companies. Evelyn tells us in his *Diary* that, on 29th June 1678, he saw at the Hounslow camp certain soldiers "called granadiers, who were dexterous in flinging hand-granades." Eventually each English battalion had a company.

Two excellent plates of grenadiers of the 2nd Regiment of Foot (Royal West Surrey), 1714–27, taken from picture-board dummies in the County Hotel, Carlisle, will be found in the *Archæological Journal*, xlvii. 321, 324. The same journal, xxiii. 222, gives a plate, "Blow your Match," after a sketch by Lens, "limner to His Majesty" George II., which represents a grenadier of the 1st Regiment of the Guards in 1735, grenade in hand.

Grenoble, chief town of department Isère, France, 393 miles south-east of Paris, on the railway from Paris to Marseilles, at the confluence of the Drac with the Isère. The city is extending in the direction of the Drac, and in the north-east, enclosed by a bend of the Isère, is the peninsula of Île Verte, a rapidly growing suburb. The lycée was opened in 1886. There are several monuments, among them one (1890) commemorating the commencement of the Revolution in Dauphiné. Grenoble is the head-quarters of the 14th Army Corps, is the seat of a Court of Appeal, and has a chamber and a tribunal of commerce, and an assay office. Notwithstanding the application of machinery to many of the processes employed in the glove manufacture, and the consequent reduction of manual labour, the number of the persons engaged in the trade has been more than maintained. Some 4000 men and 21,000 women and children produce annually about 1,200,000 dozen pairs of gloves, valued at from £1,400,000 to £1,440,000. There is a large establishment employing about 360 workpeople in the manufacture of metal buttons, &c. As much as 1,540,000 ℔ of copper are used in a year, yielding daily about 1,500,000 button pieces, the finished product being 8000 buttons daily. This factory not only supplies buttons for the Grenoble industry, and for export to other glove manufacturing centres, but also the principal machines required in the making of gloves. Other manufactures are silk and linen, hosiery, heavy iron goods, alimentary paste, artificial flowers, and mosaics, and there are coal mines and quarries. Population (1881), 41,154; (1901), 68,052.

Grévy, François Paul Jules (1807–1891), third President of the French Republic, was born at Mont-sous-Vaudrey in the Jura, on 15th August 1807. He became an advocate in 1837, and, having steadily maintained republican principles under the Orleans monarchy, was elected by his native department to the Constituent Assembly of 1848. Foreseeing that Louis Bonaparte would be elected president by the people, he proposed to vest the chief authority in a president of the Council elected and removable by the Assembly. After the *coup d'état* this proposition gained M. Grévy a reputation for sagacity,

and upon his return to public life in 1869 he took a prominent place. After the fall of the Empire he was chosen president of the Assembly on the 16th of February 1871, and occupied this position till the 2nd of April 1876, when he resigned on a question of discipline. On the 8th of March 1876 he was elected president of the Chamber of Deputies, a post which he filled with such efficiency that upon the resignation of Marshal MacMahon he seemed to step naturally into the Presidency of the Republic (30th January 1879). Quiet, shrewd, attentive to the public interest and his own, but without any particular distinction, he would have left an unblemished reputation if he had not unfortunately accepted a second term (18th December 1885). Shortly afterwards the traffic of his son-in-law (M. Wilson) in the decorations of the Legion of Honour came to light. M. Grévy was not accused of personal participation in these scandals, but he was somewhat obstinate in refusing to realize that he was responsible indirectly for the use which his relative had made of the Elysée, and it had to be unpleasantly impressed upon him that his resignation was inevitable (2nd December 1887). He died at Mont-sous-Vaudrey, 9th September 1891. He owed both his success and his failure to the completeness with which he represented the particular type of the thrifty, generally sensible and patriotic, but narrow-minded and frequently egoistic bourgeois. (See also FRANCE, *History*.)

Grey, Sir George (1812–1898), British colonial governor and statesman, only son of Lieutenant-Colonel Grey of the 30th Foot, was born in Lisbon on 14th April 1812, eight days after the death of his father at the storming of Badajoz. He passed through Sandhurst with credit, and received his commission in 1829. His lieutenancy was dated 1833, and his captaincy 1839, in which year he sold out and left the army. In the early 'thirties he was quartered in Ireland, where the wretchedness of the poorer classes left a deep impression on his mind. In 1836 the Royal Geographical Society accepted his offer to explore the north-west region of West Australia, and accordingly he landed at Hanover Bay at the end of 1837. The surrounding country he found broken and difficult, and his hardships were aggravated by the tropical heat and his ignorance of the continent. In a skirmish with the natives, in which he was speared near the hip, he showed great courage, and put the assailants to flight, shooting the chief, who had wounded him. After a brave endeavour to continue his journey his wound forced him to retreat to the coast, whence he sailed to Mauritius to recruit. Next year he again essayed exploration, this time on the coast to the north and south of Shark's Bay. He had three whale-boats and an ample supply of provisions, but by a series of disasters his stores were spoilt by storms, his boats wrecked in the surf, and the party had to tramp on foot from Gantheaume Bay to Perth, where Grey, in the end, walked in alone, so changed by suffering that friends did not know him. In 1839 he was appointed Governor-Resident at Albany, and during his stay there married Harriett, daughter of Admiral Spencer, and also prepared for publication an account, in two volumes, of his expeditions. In 1840 he returned to England, to be immediately appointed by Lord John Russell to succeed Colonel Gawler as Governor of South Australia. Reaching the colony in May 1841, he found it in the depths of a depression caused by mismanagement and insane land speculation. By rigorously reducing public expenditure, and forcing the settlers to quit the town and betake themselves to tilling their lands, and with the opportune help of valuable copper discoveries, Grey was able to aid the infant colony to emerge from the slough. So striking were his energy and determination that when, in 1845, the little settlements in New Zealand were found to be involved in a native war, and on the verge of ruin, he was sent to save them. The Maori chiefs in open rebellion were defeated, and made their submission. Another powerful leader suspected of fomenting discontent was arrested, and friendly chieftains were subsidized and honoured. Bands of the natives were employed in making government roads, and were paid good wages. The governor gained the veneration of the Maori tribes, in whose welfare he took a close personal interest, and of whose legends and myths he made a valuable and scholarly collection, published in New Zealand in 1855 and reprinted thirty years afterwards. With peace prosperity came to New Zealand, and the Colonial Office desired to give the growing settlements full self-government. Grey, arguing that this would renew war with the Maori, returned the constitution to Downing Street. But though the Colonial Office sustained him, he became involved in harassing disputes with the colonists, who organized an active agitation for autonomy. In the end a second constitution, partly framed by Grey himself, was granted them, and Grey, after eight years of despotic but successful rule, was transferred to Cape Colony. He had been knighted for his services, and had undoubtedly shown strength, dexterity, and humanity in dealing with the whites and natives. In South Africa his success continued. He thwarted a formidable Kaffir rebellion in the East Provinces, and pushed on the work of settlement by bringing out men from the German Legion and providing them with homes. He gained the respect of the British, the confidence of the Boers, the admiration and the trust of the natives. The Dutch of the Free State and the Basutos chose him as arbitrator of their quarrels. When the news of the Indian Mutiny reached Cape Town he strained every nerve to help Lord Canning, despatching men, horses, stores, and £60,000 in specie to Bombay. He persuaded a detachment, then on its way round the Cape as a reinforcement for Lord Elgin in China, to divert its voyage to Calcutta. Finally, in 1859, Grey almost reached what would have been the culminating point of his career by federating South Africa. Persuaded by him, the Orange Free State passed resolutions in favour of this great step, and their action was welcomed by Cape Town. But the Colonial Office disapproved of the change, and when Grey attempted to persevere with it Sir Edward Bulwer Lytton recalled him. A change of Ministry during his voyage to England displaced Sir Edward Bulwer Lytton. But though the Duke of Newcastle reinstated Grey, it was with instructions to let federation drop. In 1861 the Colonial Office sent him, for the fourth time in succession, to take up a post of exceptional difficulty by again entrusting him with the governorship of New Zealand, where an inglorious native war in Taranaki had just been succeeded by an armed truce. Grey did his best to make terms with the rebels and to re-establish friendship with the Maori king and the land league of tribes formed to stop further sales of land to the whites. But the Maori had got guns and powder, and were suspicious and truculent. In vain Grey, supported by Bishop Selwyn and by Fox and the peace party among the settlers, strove to avert war. It came in 1863, and spread from province to province. Ten thousand regulars and as many colonial riflemen were employed to put it down. The imperial troops were badly handled, and Grey, losing patience, became involved in bitter disputes with their commanders, Generals Cameron and Tuke. As an example to the former he himself attacked and captured Weraroa, the strongest of the Maori stockades, with a handful of militia,

a feat which delighted the colonists, but made him as much disliked at the War Office as he now was at Downing Street. Moreover, Grey had no longer real control over the islands. New Zealand had become a self-governing colony, and though he vindicated the colonists generally when libellous imputations of cruelty and land-grabbing were freely made against them in London, he crossed swords with his ministers when the latter confiscated three million acres of tribal land belonging to the insurgent Maori. Yet through all these troubles progress was made; many successes were gained in 1866, chiefly by the colonial militia, and a condition of something like tranquillity had been reached in 1867, when he received a curt intimation from the Duke of Buckingham that he was about to be superseded. The colonists, who believed he was sacrificed for upholding their interests and good name, bade farewell to him in 1868 in an outburst of gratitude and sympathy; but his career as a servant of the empire was at an end. Returning to England, he tried to enter public life, delivered many able speeches advocating what later came to be termed Imperialism, and stood for Newark. Discouraged, however, by the official Liberals, he withdrew and turned again to New Zealand. In 1872 he was given a pension of £1000 a year, and settled down on the island of Kawau, not far from Auckland, which he bought, and where he passed his leisure in planting, gardening, and collecting books. In 1875, on the invitation of the Auckland settlers, he became superintendent of their province, and entered the New Zealand House of Representatives to resist the abolition of the provincial councils of the colony, a change then being urged on by Sir Julius Vogel in alliance with the Centralist Party. In this he failed, but his eloquence and courage drew round him a strong Radical following, and gave him the Premiership in 1877. Manhood suffrage, triennial parliaments, a land-tax, the purchase of large estates, and the popular election of the governor, were leading points of his policy. All these reforms, except the last, he lived to see carried; none of them were passed by him. A commercial depression in 1879 shook his popularity, and on the fall of his Ministry in 1879 he was deposed, and for the next fifteen years remained a solitary and pathetic figure in the New Zealand Parliament, respectfully treated, courteously listened to, but never again invited to lead. In 1891 he came before Australia as one of the New Zealand delegates to the Federal Convention at Sydney, and characteristically made his mark by standing out almost alone for "one man one vote" as the Federal franchise. This point he carried, and the Australians thronged to hear him, so that his visits to Victoria and South Australia were personal triumphs. When, too, in 1894, he quitted New Zealand for London, some reparation was at last made him by the Imperial Government; he was called to the Privy Council, and graciously received by Queen Victoria on his visit to Windsor. Thereafter he lived in London, and died on the 20th of September 1898. He was given a public funeral at St Paul's. Grey was all his life a collector of books and manuscripts. After leaving Cape Colony, he gave his library to Cape Town in 1862; his subsequent collection, which numbered 12,000 volumes, he presented to the citizens of Auckland in 1887. In gratitude, the people of Cape Town erected a statue of him opposite their library building. (W. P. R.)

Grey, Henry Grey, 3rd Earl (1802–1894), English statesman, born 28th December 1802, was the fifth son of the Earl Grey who was prime minister at the time of the Reform Bill of 1832. He entered Parliament in 1826 under the title of Viscount Howick as member for Winchilsea, which constituency he left in 1831 for Northumberland. On the accession of the Whigs to power in 1830 he was made Under-Secretary for the Colonies, and laid the foundation of his intimate acquaintance with colonial questions. He belonged at the time to the more advanced party of colonial reformers, sharing the views of Edward Gibbon Wakefield on questions of land and emigration, and resigned in 1834 from dissatisfaction that slave emancipation was made gradual instead of immediate. In 1835 he entered Lord Melbourne's Cabinet as Secretary at War, and effected some valuable administrative reforms, especially by suppressing malpractices detrimental to the troops in India. After the partial reconstruction of the ministry in 1839 he again resigned, disapproving of the more advanced views of some of his colleagues. These repeated resignations gave him a reputation for crotchetiness, which he did not decrease by his disposition to embarrass his old colleagues by his action on Free Trade questions in the session of 1841. During the exile of the Liberals from power he went still farther on the path of Free Trade, and anticipated Lord John Russell's declaration against the Corn Laws. When, on Sir Robert Peel's resignation in December 1845, Lord John Russell was called upon to form a ministry, Howick, who had become Earl Grey by the death of his father in the preceding July, refused to enter the new Cabinet if Lord Palmerston were Foreign Secretary. He was greatly censured for perverseness, and particularly when in the following July he accepted Lord Palmerston as a colleague without remonstrance. His conduct, nevertheless, afforded Lord John Russell an escape from an embarrassing situation. Becoming Colonial Secretary in 1846, he found himself everywhere confronted with arduous problems, which in the main he encountered with success. His administration formed an epoch. He was the first minister to proclaim that the colonies were to be governed for their own benefit and not for the mother-country's; the first systematically to accord them self-government so far as then seemed possible; the first to introduce free trade into their relations with Great Britain and Ireland. The concession by which colonies were allowed to tax imports from the mother-country *ad libitum* was not his; he protested against it, but was overruled. In the West Indies he suppressed, if he could not overcome, discontent; in Ceylon he put down rebellion; in New Zealand he suspended the constitution he had himself accorded, and yielded everything into the masterful hands of Sir George Grey. The least successful part of his administration was his treatment of the convict question at the Cape of Good Hope, which seemed an exception to his rule that the colonies were to be governed for their own benefit and in accordance with their own wishes, and subjected him to a humiliating defeat. After his retirement he wrote a history and defence of his colonial policy in the form of letters to Lord John Russell, a dry but instructive book. He resigned with his colleagues in 1852. No room was found for him in the Coalition Cabinet of 1853, and although during the Crimean struggle public opinion pointed to him as the fittest man as Minister for War, he never again held office. During the remainder of his long life he exercised a vigilant criticism on public affairs. In 1858 he wrote a work (republished in 1864) on parliamentary reform; in 1888 he wrote another on the state of Ireland; and in 1892 one on the United States tariff. In his latter years he was a frequent contributor of weighty letters to *The Times* on land, tithes, currency, and other public questions. His principal parliamentary appearances were when he moved for a committee on Irish affairs in 1866, and when in 1878 he passionately opposed the policy of the Beaconsfield Cabinet in India.

He nevertheless supported Lord Beaconsfield at the dissolution, regarding Mr Gladstone's accession to power with much greater alarm. He was a determined opponent of Mr Gladstone's Home Rule policy. He died on 9th October 1894. None ever doubted his capacity or his conscientiousness, but he was generally deemed impracticable and disagreeable. Prince Albert, however, who expressed himself as ready to subscribe to all Grey's principles, and applauded him for having principles, told Stockmar that, although dogmatic, he was amenable to argument; and Sir Henry Taylor credits him with "more freedom from littlenesses of feeling than I have met before in any public man." His chief defect was perceived and expressed by his original tutor and subsequent adversary in colonial affairs, Edward Gibbon Wakefield, who wrote, "With more than a common talent for understanding principles, he has no originality of thought, which compels him to take all his ideas from somebody; and no power of working out theory in practice, which compels him to be always in somebody's hands as respects decision and action." (R. G.)

Grieg, Edvard Hagerup (1843-——), Norwegian musical composer, was born at Bergen, 15th June 1843. In spite of the fact that his family was of Scottish origin, Alexander Greig (*sic*) and his wife having emigrated from Fraserburgh to Norway more than a century ago, Grieg is the foremost and most typical representative of Scandinavian music. After the completion of his musical studies at the Leipzig Conservatorium, whither he went on the advice of Ole Bull, and where he passed, like all his contemporaries, under the influence of the Mendelssohn and Schumann school of romantics, he studied for a short time with Gade and Emil Hartmann in Copenhagen. Together with another young Norwegian composer, Richard Nordraak, Grieg made a kind of crusade in favour of national music, and even his earliest works show his strong affinity for a style built upon the tradition ballads of his country. He visited Italy in 1865 and 1870, and from 1867 till 1880 conducted a musical union in Christiania. More recently he has appeared in the capital as an orchestral conductor, but the greater part of his life has been spent at Bergen. In 1888 he played his pianoforte concerto and conducted his "two melodies for strings" at a Philharmonic Concert in London, and visited England again in 1891, 1894, and 1896, receiving the degree of Mus.D. from the University of Cambridge in 1894. His works include a large number of songs, and pianoforte solos of "lyrical" form; three violin sonatas; a string quartet; a sonata for piano and violoncello; *Aus Holberg's Zeit;* a suite for stringed orchestra, and also for pianoforte solo; the pianoforte concerto already mentioned; a concert-overture, *Im Herbst*, and other smaller pieces for orchestra; and several works for chorus and orchestra, with or without solos. His incidental music to Ibsen's *Peer Gynt* is widely known through the two suites selected from it, the first of which was originally published as a duet for pianoforte, and afterwards scored for full orchestra. Grieg has enshrined the characteristics of Scandinavian music in works of undying beauty, though for the most part of somewhat small calibre. In the use of these elements he departs very far from the recognized rules of form, and he has always succeeded best in the class of compositions where such departure is most readily excused. His songs may be said to be always the more spontaneous the more closely they conform to the simple model of the volkslied; the pianoforte concerto is brilliant and spontaneous, and the first and second of his violin sonatas are perennially agreeable, so free and artless is the flow of their melody. In his numerous piano pieces and in those of his songs where a definitely national style of treatment is avoided, the impression made is less permanent, for, apart from the national characteristics which he employs so adroitly, his individuality is not strongly pronounced, and in the rare cases where he has attempted the treatment of subjects not specially national in type on the conventional lines, he has shown himself somewhat of a mannerist.

Griffin, capital of Spalding county, Georgia, U.S.A., 43 miles south of Atlanta, on the Southern and the Central of Georgia railways, at an altitude of 975 feet. It has cotton factories and a large cotton trade. Population (1880), 3620; (1890), 4503; (1900), 6857, of whom 25 were foreign-born and 3258 negroes.

Grimsby, Great, a parliamentary, county, and municipal borough, mercantile and fishing seaport of England, in the county of Lincoln, situated on the east coast, near the mouth of the Humber, and 155 miles north by east from London by the Great Northern Railway. It also has a station on the Great Central Railway. The port possesses five docks (104 acres) and three graving docks. These are reached through a tidal basin of 15 acres, protected on the east and west by breakwaters. The weight of fish sent from Grimsby by rail increased from 26,324 tons in 1870 to 114,292 tons in 1899. In 1899 the fishing fleet consisted of 522 vessels, mostly steam trawlers, of 31,512 tons, manned by nearly 4650 hands. In 1900 the mercantile fleet belonging to the port numbered 622 vessels of 50,540 tons. The value of the imports increased from £3,544,449 in 1881 to £7,957,414 in 1900; that of the exports from £7,342,458 in 1881 to £11,007,937 in 1900. The most important items amongst the imports are butter, woollens, timber, cereals, eggs, glass, cottons, preserved meat, wool, sugar, and bacon. The exports consist chiefly of woollen yarn, woollens, cotton goods, cotton yarn, machinery, &c., and coal. The port was cleared by 926 vessels of 416,651 tons in 1885, and by 1748 of 960,236 tons in 1899. There is in addition a coasting trade of some 500,000 tons annually. To the industries must be added the manufacture of ship tackle, ropes, ice, turnery, flour, linseed cake, artificial manure, and sawmills, bone and corn mills, and creosote works. The church of St John the Divine was built, in the Early English style, in 1892; the church of All Saints' in 1891; St Barnabas's in 1900; St Paul's in 1884; the Roman Catholic church in 1883; the Sailors' and Fishermen's Harbour of Refuge in 1890; and the Grimsby, Cleethorpes, and East Coast Orphan Home in 1892. The church of St James's was restored between 1882 and 1885. The Wesleyans and Congregationalists have also built new chapels. In 1899–1900 the Mechanics' Institution was converted into the Free Public Library. The Constitutional Club dates from 1892. The Duke of York public gardens were opened in 1894, and a new cemetery in 1889. There has been a technical school since 1893. The sewage works, with a pumping station, were completed in 1895. In 1889 Grimsby was extended by the inclusion of part of the township of Clee with Weelsby, and in 1891 was made a county borough, with a separate court of quarter sessions. It is governed by a mayor, 12 aldermen, and 36 councillors, and is represented in Parliament by one member. Area, 2832 acres. Population (1891), 51,934; (1901), 63,138. Birth-rate, 30·0 (1898); death-rate, 15·9 (1898). The second half of the year 1901 was marked by a serious wages dispute between the owners and crews of the fishing-vessels of the port, which was eventually settled by the intervention of the Board of Trade and an arbi tration before Sir Edward Fry.

Grimthorpe, Edmund Beckett, 1st Baron (1816- ——), son of Sir Edmund Beckett Denison, was born 12th May 1816. He was educated at Doncaster and Eton, whence he proceeded to Trinity College, Cambridge, and graduated thirtieth wrangler in 1838. Having adopted the law as his profession, he was called to the bar at Lincoln's Inn, 1841. Upon succeeding to the baronetcy in 1874 he dropped the name of Denison, which his father had assumed in 1816. From 1877 to 1900 he was chancellor and vicar-general of York, and he was raised to the peerage in 1886. He was made a Q.C. in 1854, and was for many years a leader of the Parliamentary Bar. He devoted himself to the study of astronomy, horology, and architecture, more especially Gothic ecclesiastical architecture. As early as 1850 he had become a recognized authority on clocks, watches, and bells, and in particular on the construction of turret clocks, for it was well known that he had designed Dent's Great Exhibition clock, and his *Rudimentary Treatise* was a notable book that went through many editions. It was therefore natural that in 1851 he should be called upon, in conjunction with the Astronomer Royal (Mr, afterwards Sir, G. B. Airy) and Mr Dent, to design a suitable clock for the new Houses of Parliament. The present clock, "Big Ben," was the result. In every burning question during his time, such as marriage with a deceased wife's sister, the revision of the New Testament, or the views of Huxley and the modern school on miracles, Lord Grimthorpe took a prominent part, either in the form of pamphlets or of letters to *The Times*. It is, however, in connexion with the restoration of St Albans Abbey that he is most widely known. The St Albans Abbey Reparation Committee, which had been in existence since 1871, and for which Sir Gilbert Scott had carried out some admirable repairs, obtained a faculty from the Diocesan Court in 1877 to repair and restore the church and fit it for cathedral and parochial services. Very soon, however, the committee found itself deeply involved and unable to raise the necessary funds, and it was at this juncture that a new faculty was granted to Lord Grimthorpe (then Sir Edmund Beckett) to "restore, repair, and refit" the abbey at his own expense. Lord Grimthorpe made it an express stipulation that the work should be done according to his own designs and under his own supervision. Lord Grimthorpe's public spirit in undertaking the burden of the work was undeniable, but his treatment of the roof, the new west front, and the windows inserted in the terminations of the transepts, excited a storm of adverse criticism and was the subject of vigorous protests from the professional architectural world.

Grindelwald, a valley in the Bernese Oberland in Switzerland, and one of the chief resorts of tourists in Switzerland. It is shut in on the south by the precipices of the Wetterhorn, Mettenberg, and Eiger, between which flow two famous glaciers. On the north it is sheltered by the Faulhorn range, while on the east the Great Scheidegg Pass leads over to Meiringen, and on the south-west the Little Scheidegg or Wengern Alp (railway 11¼ miles across) divides it from Lauterbrunnen. The main village is connected with Interlaken by a cog-wheel railway (12½ miles). The valley is very green, and possesses excellent pastures, as well as fruit trees, though but little corn is grown. It is watered by the Black Lütschine, a tributary of the Aar. The height of the church above the sea-level is 3468 feet. The population in 1900 was 3342, practically all Protestant and German-speaking, and shows a slight increase. The glacier guides are the best in the Alps. The valley was originally inhabited by the serfs of various great lords in summer for the sake of pasturage. A chapel in a cave was superseded in about 1146 by a wooden church, replaced in about 1180 by a stone church, which was pulled down in 1793 to erect the present building. Gradually the Austin canons of Interlaken bought out all the other owners in the valley, but when that house was suppressed in 1528 by the town of Bern the inhabitants gained their freedom. The church hamlet, with the neighbouring houses, bears the name of Gydisdorf. Grindelwald is very much frequented by visitors in winter.

See W. A. B. Coolidge. *Walks and Excursions in the Valley of Grindelwald* (also in French and German). Grindelwald, 1900. —E. F. von Mülinen. *Beiträge zur Heimathkunde des Kantons Bern, deutschen Theils*, vol. i. (Bern, 1879), pp. 24-26.—G. Strasser. *Der Gletschermann*. Grindelwald, 1888-90. Scattered notices may be found in the new edition (London, 1899) of the "General Introduction" (entitled "Hints and Notes for Travellers in the Alps") to Mr John Ball's *Alpine Guide*. (W. A. B. C.)

Grinstead, East, a market-town and railway station in the East Grinstead parliamentary division of Sussex, England, 12 miles west of Tunbridge Wells. St Swithin's church has ancient memorials. There are a literary and scientific institution, a cottage hospital, Sackville College (an almshouse founded in 1608), St Margaret's Home and Orphanage, a Roman Catholic church, and an isolation hospital. Brewing and brick and tile making are carried on. In the vicinity (nearest station, Forest Row) is the golf-course of the Royal Ashdown Forest Golf Club, one of the most beautiful and also one of the most sporting of English inland links. Area of urban district, 6415 acres. Population (1881), 4783; (1901), 6094.

Griqualand. See Kaffraria.

Grisons, or Graubünden, the largest of the Swiss cantons. It has a total area of 2773 square miles. Of this only 1488 square miles are classed as "productive," forests covering no fewer than 490 square miles, and vineyards but 1 square mile. Of the "unproductive" area 139 square miles (more than in any other canton save the Valais) are occupied by glaciers, while a good deal of space is taken up by lakes, though of no great size. The valley of Juf (6998 feet) is the loftiest permanently inhabited village in the entire chain of the Alps. In 1888 the population was 94,810, or 35 inhabitants to each square mile, the lowest rate of density in the whole of Switzerland. In that year the Protestants numbered 51,937, the Roman Catholics 42,797, and the Jews 13. In 1900 the population was 104,510, of whom 48,937 were German-speaking, 38,677 Romónsch- or Ladin-speaking, 13,883 Italian-speaking, and only 535 French-speaking.

The capital of Grisons is Coire or Chur. There are fourteen administrative districts in the canton. The existing cantonal constitution dates from 1892. The legislature (numbers not fixed by the constitution) is elected for two years by a popular vote, by which also the five members of the executive are chosen for three years. For all laws the "obligatory referendum" obtains, while with regard to resolutions and ordinances made by the legislature, 3000 citizens can demand the "facultative referendum." In 1892 the right of "initiative" as to legislative projects was given to 3000 citizens, but 5000 are required in the case of a revision of the cantonal constitution. In 1897 the state revenue of the canton was 1,147,679 francs (a rise of 9½ per cent. since 1885), and the state expenditure 1,935,564 francs (a rise of 20¼ per cent. since 1885). But in these sums the taxes are not reckoned, which always causes a deficit that is carried to the capital account and is met by the land tax—a complicated system. Really there is thus never a deficit, as the amount of the land tax varies annually according to the amount which *must* be covered. This singular system of accounts is quite unique in Switzerland, but is prescribed by the cantonal constitution (Article 19). Apart

from the special loan of 10,000,000 francs for the construction of railways, the public debt in 1897 was 5,992,161 francs. There is a railway up the main Rhine valley to Coire and thence to Thusis, and another from Landquart up to Davos, and others are in construction. Davos-Platz (5115 feet) and St Moritz (6089 feet) are the most famous "air cures" in Grisons. A newer resort is Arosa (6108 feet) in the Schanfigg valley, above Coire.

See *Codex Diplomaticus ad Historiam Raeticam*, 4 vols. Coire, 1848-63.—LORRIA and MARTEL. *Le Massif de la Bernina.* Zürich, 1894.—VON PLANTA. *Das alte Raetien* (Berlin, 1872), and *Die Curraetischen Herrschaften in d. Feudalzeit* (Bern, 1881), and *Geschichte von Graubünden* (Bern, 1892).—WAGNER and VON SALIS. *Rechtsquellen d. Cant. Graubünden.* Basel, 1877-92.

(W. A. B. C.)

Grivegnée, a town of Belgium, in the province and 3 miles S.E. of the town of Liége. It was in the ironworks of this town that English methods of treating the metal were first introduced into Belgium. Population (1899), 10,565.

Gródek, the chief town of a government district in Galicia, Austria, about 18 miles to the S.W. of Lemberg. It is a station on the railway between the latter town and Cracow. It is an important corn market and centre of the trade in flax, of which large quantities are grown in the district. Population (1890), 10,742; (1900), 11,845 (69 per cent. Polish, 30 per cent. Ruthenian, 1 per cent. German; 36 per cent. Roman Catholic)

Grodno, one of the Lithuanian governments of North-western Russia. It is hilly in the north (highest altitude 924 feet), but otherwise is a vast plain. Granites and gneisses appear on the river Bug; Cretaceous, and especially Tertiary, deposits elsewhere. The soil is mostly sandy, assuming the character of drifting sands in Grodno district and along the rivers; the remainder is of moderate fertility, and in places marshy. Great marshes occur in the Byelovyezhsk and Grodno *pushchas* (forests). Forests cover nearly one-fifth of the total area. Peat-bog, sometimes four to seven feet thick, is widely met with. The climate is wet and cold, the average temperatures at Grodno being for the year, 42° F.; for January, 22°; for July, 73°; the yearly rainfall is 20·5 inches. The population in 1897 numbered 1,617,859 (789,801 women, 255,946 living in towns), and consists of White and Little Russians (54 per cent.), Poles (a little over 20 per cent., chiefly in south-west), and Jews (19 per cent.). The Lithuanians and Tatars proper number but a few thousands each. Agriculture is the main occupation. The peasants own 42 per cent. of the land, *i.e.*, 4,046,900 acres, of which 2,327,400 acres are arable. The crops are moderately good. Cattle-breeding is carried on, there being in 1891 176,245 horses, 484,110 horned cattle, and 685,200 sheep. In respect of woollen cloth factories Grodno occupies in Russia the third place; there are about 150, employing some 4754 persons, with a yearly production of £330,600. Tobacco factories, silk and shoddy mills, and tanneries come next, the total number of factories being 3671, employing over 21,600 persons in 1897, with a yearly return of £1,537,840. There were besides over 25,000 artizans. The annual aggregate tonnage of the navigation in the drainage areas of both the Niemen and the Vistula is 257,450 tons. Grodno is divided into nine districts, the chief towns of which are: Grodno, Brest Litovsk (46,542 inhabitants), Byelsk (7461), Byelostok (63,927), Kobrin (10,365), Pruzhany (7634), Slonim (15,893), Sokolka (7595), and Volkovysk (10,584). GRODNO, capital of the government, is situated on the right bank of the Niemen, which is spanned by an iron bridge, 533 miles S.W. of St Petersburg by rail. It is well provided with secondary schools for boys and girls. Only the tobacco factories are of importance; but there is considerable trade in wood and timber, and various goods are shipped on the Niemen. The population in 1897 was 46,871, of whom nearly two-thirds were Jews.

(P. A. K.)

Groen Van Prinsterer, Guillaume (1801–1876), Dutch politician and historian, was born at Voorburg, near The Hague, on the 21st of August 1801. He studied at Leyden University, and graduated in 1823 both as Doctor of Literature and LL.D. From 1829 to 1833 he acted as secretary to King William I. of Holland, afterwards took a prominent part in Dutch home politics, and gradually became the leader of the so-called anti-revolutionary party, both in the Second Chamber, of which he was for many years a member, and outside. In Groen the doctrines of Guizot and Stahl found an eloquent exponent. They permeate his controversial and political writings and historical studies, of which his *Handbook of Dutch History* (in Dutch) and *Maurice et Barnevelt* (in French, 1875, a criticism of Motley's Life of Van Olden-Barnevelt) are the principal. Groen was violently opposed to Thorbecke, whose principles he denounced as ungodly and revolutionary. Although he lived to see these principles triumph, yet he never ceased to oppose them until his death, which occurred at The Hague on the 19th of May 1876. He is best known as the editor of the *Archives et Correspondance de la Maison d'Orange* (12 vols., 1835–45), a great work of patient erudition, which procured for him the title of the "Dutch Gachard." Mr J. L. Motley acknowledges his indebtedness to Groen's *Archives* in the preface to his *Rise of the Dutch Republic*, at a time when the American historian had not yet made the acquaintance of King William's archivist, and also bore emphatic testimony to Groen's worth as a writer of history in the correspondence published after his death. At the first reception, in 1858, of Mr Motley at the royal palace at The Hague, the King presented him with a copy of Groen's *Archives* as a token of appreciation and admiration of the work done by the "worthy vindicator of William I., Prince of Orange." This copy, bearing the King's autograph inscription, afterwards came into the possession of Sir William Vernon Harcourt, Mr Motley's son-in-law.

(H. Tr.)

Groningen, a province and town in the Netherlands. Clay, and clay and sand mixed, predominate in the north and north-east part of the province, the high fens of the southern portion lying on diluvial sand. The former is an agricultural district, growing wheat and oil-seeds; on the latter cattle are bred, rye, potatoes, and buckwheat grown, peat is cut, and industries and shipping flourish. The area of the province is 904 square miles, and its population in 1900 was 299,033. The town of GRONINGEN is situated 45½ miles east of Harlingen, with which it is connected by rail, at the end of the sandy tongue (the *Hondsrug*) which stretches from the plateau of Drenthe to the clay soil in the centre of the province, while it communicates by rivers and canals with the sea and adjoining provinces. To the advantages of its natural position the town as capital of the province has added those of commercial and political supremacy and monopoly, and this accounts for the fact that the small towns (Winschoten, Appingedam, Delfzijl) of the province are few in number. Considerable trade is done in grain, wood, turf, and cattle with Great Britain, Germany, Scandinavia, and Russia. The industries are unchanged since 1874. The Nordeschool was founded in 1893. There are also a new archæological society and a central bureau for collecting information concerning the province. The university in 1898–99 had 397 students. Population (1874), 39,284; (1900), 66,537.

Gross-Jedlersdorf. See JEDLERSDORF.

Gross-Meseritsch, the chief town of a government district in North-east Moravia, on the Oslawa. It has considerable linen industry and leather manufactures, horse fairs, and important trade in fruit, vegetables, and flax. Population, chiefly Czech (1900), 5236.

Groton, a town of New London county, Connecticut, U.S.A., on the eastern bank of the river Thames, at its mouth. The town has an area of 35 square miles, level near the coast, but rising into hills inland. The principal village, of the same name as the town, is situated on the Thames opposite New London, and on the New York, New Haven, and Hartford Railway. Population of the town (1880), 5128; (1890), 5539; (1900), 5962, of whom 936 were foreign-born and 96 negroes.

Grottaglie, a town of the province of Lecce, Apulia, Italy, 12 miles east by north of Taranto by the railway to Brindisi. It is celebrated for a white-glaze pottery, and has also a ceramic school (1887), and olive-oil presses. Population, about 10,000.

Groups, Theory of.—The conception of an operation to be carried out on some object or set of objects underlies all mathematical science. Thus in elementary arithmetic there are the fundamental operations of the addition and the multiplication of integers; in algebra a linear transformation is an operation which may be carried out on any set of variables; while in geometry a translation, a rotation, or a projective transformation are operations which may be carried out on any figure.

In speaking of an operation, an object or a set of objects to which it may be applied is postulated; and the operation may, and generally will, have no meaning except in regard to such a set of objects. If two operations, which can be performed on the same set of objects, are such that, when carried out in succession on any possible object, the result, whichever operation is performed first, is to produce no change in the object; then each of the operations is spoken of as a *definite* operation, and each of them is called the *inverse* of the other. Thus the operations which consist in replacing x by nx and x/n respectively, in any rational function of x, are definite inverse operations, if n is any assigned number except zero. On the contrary, the operation of replacing x by an assigned number in any rational function of x is not, in the present sense, although it leads to a unique result, a definite operation; there is in fact no unique inverse operation corresponding to it. It is to be noticed that the question whether an operation is a definite operation or no may depend on the range of the objects on which it operates. For example, the operations of squaring and extracting the square root are definite inverse operations if the objects are restricted to be real positive numbers, but not otherwise.

If O, O′, O″,... is the totality of the objects on which a definite operation S and its inverse S′ may be carried out, and if the result of carrying out S on O is represented by O.S, then O.S.S′, O.S′.S, and O are the same object whatever object of the set O may be. This will be represented by the equations $SS' = S'S = 1$. Now O.S.S′ has a meaning only if O.S is an object on which S′ may be performed. Hence whatever object of the set O may be, both O.S and O.S′ belong to the set. Similarly O.S.S, O.S.S.S,... are objects of the set. These will be represented by $O.S^2$, $O.S^3$,... Suppose now that T is another definite operation with the same set of objects as S, and that T′ is its inverse operation. Then O.S.T is a definite operation of the set, and therefore the result of carrying out S and then T on the set of objects is some operation U with a unique result. Represent by U′ the result of carrying out T′ and then S′. Then

$$O.UU' = O.S.T.T'.S' = O.SS' = O,$$

and

$$O.U'U = O.T'.S'.S.T = O.T'T = O,$$

whatever object O may be. Hence

$$UU' = U'U = 1;$$

and U, U′ are definite inverse operations.

If S, U, V are definite operations, and if S′ is the inverse of S, then

$$SU = SV$$

implies $S'SU = S'SV$,

or $U = V$.

Similarly $US = VS$

implies $U = V$.

Let $S, T, U, \ldots$

be a set of definite operations, capable of being carried out on a common object or set of objects, and let the set contain— *Definition of a group.*

(i.) the operation ST, S and T being any two operations of the set;

(ii.) the inverse operation of S, S being any operation of the set;

the set of operations is then called a group.

The number of operations in a group may be either finite or infinite. When it is finite, the number is called the *order* of the group, and the group is spoken of as a *group of finite order.*

If the number of operations is infinite, there are three possible cases. When the group is represented by a set of geometrical operations, for the specification of an individual operation a number of measurements will be necessary. In more analytical language, each operation will be specified by the values of a set of parameters. If no one of these parameters is capable of continuous variation, the group is called a *discontinuous group.* If all the parameters are capable of continuous variation, the group is called a *continuous group.* If some of the parameters are capable of continuous variation and some are not, the group is called a *mixed group.*

If S′ is the inverse operation of S, a group which contains S must contain SS′, which produces no change on any possible object. This is called the *identical operation*, and will always be represented by 1. Since

$$S^pS^q = S^{p+q}$$

when p and q are positive integers, and

$$S^pS' = S^{p-1}$$

while no meaning at present has been attached to S^q when q is negative, S′ may be consistently represented by S^{-1}. Since

$$S, S^2, S^3, \ldots$$

all belong to a group which contains S, it follows that for every operation of a group of finite order there must be some smallest integer m such that

$$S^m = 1;$$

m is then called the order of the operation S, which is spoken of as an operation of finite order. Operations of finite order may, of course, occur in groups containing an infinite number of operations, but do not necessarily do so. In any case the set of operations

$$\ldots, S^{-2}, S^{-1}, 1, S, S^2, .$$

obviously constitute a group. Such a group is called a *cyclical* group, whether S is of finite order or not.

It will be convenient, before giving some illustrations of the general group idea, to add a number of further definitions and explanations which apply to all groups alike. If from among the set of operations

Subgroups, conjugate operations, isomorphism, &c

$$S, T, U, \ldots$$

which constitute a group G, a smaller set

$$S', T', U', \ldots$$

can be chosen which themselves constitute a group H, the group H is called a *subgroup* of G. Thus, in particular, if S is an operation of G, the cyclical group constituted by

$$\ldots, S^{-2}, S^{-1}, 1, S, S^2, \ldots$$

is a subgroup of G, except in the special case when it coincides with G itself.

If H is a subgroup of G, and S an operation of G, which is not contained in H, the totality of the operations formed by combining in every way S and its positive and negative powers with the operations of H necessarily forms a group. This is contained in or coincides with G. By first taking for H the cyclical subgroups of G, and continually building up in this way fresh subgroups, all possible subgroups of G will arise.

If S and T are any two operations of G, the two operations S and $T^{-1}ST$ are called *conjugate* operations, and $T^{-1}ST$ is spoken of as the result of *transforming* S by T. Since

$$(T^{-1}ST)^2 = T^{-1}ST \,.\, T^{-1}ST = T^{-1}S^2T,$$

and

$$(T^{-1}ST)^n = T^{-1}S^nT,$$

it follows that if S is an operation of finite order, $T^{-1}ST$ is an operation of the same finite order, and conversely. It is to be noted that since

$$ST = T^{-1} \,.\, TS \,.\, T,$$

ST and TS are always conjugate operations in any group containing both S and T. If T transforms S into itself, that is, if

$$S = T^{-1}ST \text{ or } TS = ST,$$

S and T are called *permutable* operations. A group whose operations are all permutable with each other is called an *Abelian* group. If S is transformed into itself by every operation of G, or, in other words, if it is permutable with every operation of G, it is called a *self-conjugate* operation of G.

The conception of operations being conjugate to each other may be extended to subgroups. If

$$S', T', U', \ldots$$

are the operations of a subgroup H, and if R is any operation of G, then the operations

$$R^{-1}S'R, R^{-1}T'R, R^{-1}U'R, \ldots$$

belong to G, and constitute a subgroup of G. For if

$$S'T' = U',$$

then

$$R^{-1}S'R \,.\, R^{-1}T'R = R^{-1}S'T'R = R^{-1}U'R.$$

This subgroup may be identical with H. In particular, it is necessarily the same as H if R belongs to H. If it is not identical with H, it is said to be *conjugate* to H; and it is in any case represented by the symbol $R^{-1}HR$. If

$$H = R^{-1}HR,$$

the operation R is said to be permutable with the subgroup H. (It is to be noticed that this does not imply that R is permutable with each operation of H.)

If

$$H = R^{-1}HR,$$

when for R is taken in turn each of the operations of G, then H is called a *self-conjugate* subgroup of G.

A group is spoken of as *simple* when it has no self-conjugate subgroup other than that constituted by the identical operation alone. A group which has a self-conjugate subgroup is called composite.

Let G be a group constituted of the operations

$$S, T, U, \ldots$$

and g a second group constituted of

$$s, t, u, \ldots$$

and suppose that to each operation of G there corresponds a single operation of g in such a way that if

$$ST = U,$$

then

$$st = u,$$

where s, t, u are the operations corresponding to S, T, U respectively. The groups are then said to be *isomorphic*, and the correspondence between their operations is spoken of as an *isomorphism* between the groups. It is clear that there may be two distinct cases of such isomorphism. To a single operation of g there may correspond either a single operation of G or more than one. In the first case the isomorphism is spoken of as *simple*, in the second as *multiple*.

Two simply isomorphic groups considered abstractly—that is to say, in regard only to the way in which their operations combine among themselves, and apart from any concrete representation of the operations—are clearly indistinguishable.

If G is multiply isomorphic with g, let

$$A, B, C, \ldots$$

be the operations of G which correspond to the identical operation of g. Then to the operations A^{-1} and AB of G there corresponds the identical operation of g; so that A, B, C,... constitute a subgroup H of G. Moreover, if R is any operation of G, the identical operation of g corresponds to every operation of $R^{-1}HR$, and therefore H is a self-conjugate subgroup of G. Since S corresponds to s, and every operation of H to the identical operation of g, therefore every operation of the set

$$SA, SB, SC, \ldots$$

which may be represented by SH, corresponds to s. Also these are the only operations that correspond to s; for if there were another such operation T, then $T^{-1}S$ would correspond to the identical operation of g, which is not the case. The operations of G may therefore be divided into sets, no two of which contain a common operation, such that the correspondence between the operations of G and g connects each of the sets

$$H, SH, TH, UH, \ldots$$

with the single operations

$$1, \quad s, \quad t, \quad u, \ldots$$

written below them. The sets into which the operations of G are thus divided combine among themselves by exactly the same laws as the operations of g. For if

$$st = u,$$

then

$$SH \,.\, TH = UH,$$

in the sense that any operation of the set SH followed by any operation of the set TH gives an operation of the set UH.

The group g, abstractly considered, is therefore completely defined by the division of the operations of G into sets in respect of the self-conjugate subgroup H. From this point of view it is spoken of as the *factor-group* of G

in respect of H, and is represented by the symbol G/H. Any composite group in a similar way defines abstractly a factor-group in respect of each of its self-conjugate subgroups.

It follows from the definition of a group that it must always be possible to choose from its operations a set such that every operation of the group can be obtained by combining the operations of the set and their inverses. If the set is such that no one of the operations belonging to it can be represented in terms of the others, it is called a set of *independent generating* operations. Such a set of generating operations may be either finite or infinite in number. If A, B,...,E are the generating operations of a group, the group generated by them is represented by the symbol $\{A, B, \ldots, E\}$. An obvious extension of this symbol is used such that $\{A, H\}$ represents the group generated by combining an operation A with every operation of a group H; $\{H_1, H_2\}$ represents the group obtained by combining in all possible ways the operations of the groups H_1 and H_2; and so on. The independent generating operations of a group may be subject to certain relations connecting them, but these must be such that it is impossible by combining them to obtain a relation expressing one operation in terms of the others. For instance,

$$AB = BA$$

is a relation conditioning the group $\{A, B\}$; it does not, however, enable A to be expressed in terms of B, so that A and B are independent generating operations

Let

$$O, O', O'', \ldots$$

be a set of objects which are interchanged among themselves by the operations of a group G, so that if S is any operation of the group, and O any one of the objects, then O . S is an object occurring in the set. If it is possible to find an operation S of the group such that O . S is any assigned one of the set of objects, the group is called *transitive* in respect of this set of objects. When this is not possible the group is called *intransitive* in respect of the set. If it is possible to find S so that any arbitrarily chosen n objects of the set, $O_1, O_2, \ldots, O_n$ are changed by S into $O'_1, O'_2, \ldots, O'_n$ respectively, the latter being also arbitrarily chosen, the group is said to be n-ply transitive.

Transitivity and primitivity.

If

$$O, O', O'', \ldots$$

is a set of objects in respect of which a group G is transitive, it may be possible to divide the set into a number of subsets, no two of which contain a common object, such that every operation of the group either interchanges the objects of a subset among themselves, or changes them all into the objects of some other subset. When this is the case the group is called *imprimitive* in respect of the set; otherwise the group is called *primitive.* A group which is doubly-transitive, in respect of a set of objects, obviously cannot be imprimitive.

If G is a group which is transitive in respect of a set of objects

$$O, O', O'', \ldots$$

no portion of the set less than the whole can be interchanged among themselves by all the operations of G. It may, however, be possible to choose a portion of the set, such that the objects it contains are interchanged among themselves by some of the operations of G. If S and T are two operations of G which have this property in respect of the portion, then ST has it also. The operations of G, which interchange among themselves the objects forming a portion of the set, constitute therefore a subgroup. In many particular cases, as will be seen in the examples presently to be dealt with, this consideration of the invariance of a portion of a transitive set of objects lends itself readily to the determination of the subgroups of the group under examination.

The foregoing general definitions and explanations will now be illustrated by a consideration of certain particular groups. To begin with, as the operations involved are of the most familiar nature, the group of rational arithmetic may be considered. The fundamental operations of elementary arithmetic consist in the addition and subtraction of integers, and multiplication and division by integers, division by zero alone omitted. Multiplication by zero is not a definite operation, and it must therefore be omitted in dealing with those operations of elementary arithmetic which form a group. The operation that results from carrying out additions, subtractions, multiplications, and divisions, of and by integers a finite number of times, is represented by the relation

Illustrations of the group idea.

$$x = ax + b,$$

where a and b are rational numbers of which a is not zero, x is the object of the operation, and x' is the result. The totality of operations of this form obviously constitutes a group; for if

$$x'' = a_1x' + b_1$$

is a second operation of the same kind, the operation that results from carrying out the first and then the second is

$$x'' = aa_1x + a_1b + b_1,$$

which belongs to the set. Moreover, the inverse of the first operation is

$$x' = \frac{1}{a}x - \frac{b}{a},$$

which also belongs to the set.

If S and T represent respectively the operations

$$x' = ax + b$$

and

$$x' = cx + d,$$

then $T^{-1}ST$ represents

$$x' = ax + d - ad + bc.$$

When a and b are given rational numbers, c and d may be chosen in an infinite number of ways as rational numbers, so that $d - ad + bc$ shall be any assigned rational number. Hence the operations given by

$$x' = ax + b,$$

where a is an assigned rational number and b is any rational number, are all conjugate; and no two such operations for which the a's are different can be conjugate. If a is unity and b zero, S is the identical operation which is necessarily self-conjugate. If a is unity and b different from zero, the operation

$$x' = x + b$$

is an addition. The totality of additions forms, therefore, a single conjugate set of operations. Moreover, the totality of additions with the identical operation, *i.e.*, the totality of operations of the form

$$x' = x + b,$$

where b may be any rational number or zero, obviously constitutes a group. The operations of this group are interchanged among themselves when transformed by any operation of the original group. It is therefore a self-conjugate subgroup of the original group.

The totality of multiplications, with the identical operation, *i.e.*, all operations of the form

$$x' = ax,$$

where a is any rational number other than zero, again obviously constitutes a group. This, however, is not a

self-conjugate subgroup of the original group. In fact, if the operations

$$x' = ax$$

are all transformed by

$$x' = cx + d,$$

they give rise to the set

$$x' = ax + d(1 - a).$$

When d is a given rational number, the set constitutes a subgroup which is conjugate to the group of multiplications. It is to be noticed that the operations of this latter subgroup may be written in the form

$$x' - d = a(x - d).$$

A complete discussion of all the subgroups of the group under consideration is not here called for, as the present object is merely to illustrate the definitions and general properties that apply to all groups alike; but further subgroups will immediately suggest themselves to the reader. For instances, all operations of the form

$$x' = a^n x + b,$$

where a is a given rational number, n a positive or negative integer, and b any rational number, obviously constitute a subgroup which is self-conjugate.

The totality of rational numbers, including zero, forms a set of objects which are interchanged among themselves by all operations of the group.

If x_1 and x_2 are any pair of distinct rational numbers, and y_1 and y_2 any other pair, there is just one operation of the group which changes x_1 and x_2 into y_1 and y_2 respectively. For the equations

$$y_1 = ax_1 + b,$$
$$y_2 = ax_2 + b,$$

determine a and b uniquely. The group is therefore doubly transitive in respect of the set of rational numbers. If H is the subgroup that leaves unchanged a given rational number x_1, and S an operation changing x_1 into x_2, then every operation of $S^{-1}HS$ leaves x_2 unchanged. The subgroups, each of which leaves a single rational number unchanged, therefore form a single conjugate set. The group of multiplications leaves zero unchanged; and, as has been seen, this is conjugate with the subgroup formed of all operations

$$x' - d = a(x - d),$$

where d is a given rational number. This subgroup leaves d unchanged.

The group of multiplications is clearly generated by the operations

$$x' = px,$$

where for p negative unity and each prime is taken in turn. Every addition is obtained on transforming

$$x' = x + 1$$

by the different operations of the group of multiplications. Hence

$$x' = x + 1, \text{ and } x' = px, \ (p = -1, 3, 5, 7, \ldots)$$

form a set of independent generating operations of the group. It is a discontinuous group.

As a second example the group of motions in three-dimensional space will be considered. The totality of motions, *i.e.*, of space displacements which leave the distance of every pair of points unaltered, obviously constitutes a set of operations which satisfies the group definition. From the elements of kinematics it is known that every motion is either (i.) a translation which leaves no point unaltered, but changes each of a set of parallel lines into itself; or (ii.) a rotation which leaves every point of one line unaltered and changes every other point and line; or (iii.) a twist which leaves no point and only one line (its axis) unaltered, and may be regarded as a translation along, combined with a rotation round, the axis. Let S be any motion consisting of a translation l along and a rotation α round a line AB, and let T be any other motion. There is some line CD into which T changes AB; and therefore $T^{-1}ST$ leaves CD unchanged. Moreover, $T^{-1}ST$ clearly effects the same translation along and rotation round CD that S effects for AB. Two motions, therefore, are conjugate if and only if the amplitudes of their translation and rotation components are respectively equal. In particular, all translations of equal amplitude are conjugate, as also are all rotations of equal amplitude. Any two translations are permutable with each other, and give when combined another translation. The totality of translations constitutes, therefore, a subgroup of the general group of motions; and this subgroup is a self-conjugate subgroup, since a translation is always conjugate to a translation.

All the points of space constitute a set of objects which are interchanged among themselves by all operations of the group of motions. So also do all the lines of space and all the planes. In respect of each of these sets the group is simply transitive. In fact, there is an infinite number of motions which change a point A to A′, but no motion can change A and B to A′ and B′ respectively unless the distance AB is equal to the distance A′B′.

The totality of motions which leave a point A unchanged forms a subgroup. It is clearly constituted of all possible rotations about all possible axes through A, and is known as the group of rotations about a point. Every motion can be represented as a rotation about some axis through A followed by a translation. Hence if G is the group of motions and H the group of translations, G/H is simply isomorphic with the group of rotations about a point

The group of rotations round a point is an example of a simple group. To verify this, suppose that a self-conjugate subgroup of the group of rotations round A contains a rotation through an angle α about $A\alpha$. Since the group of rotations round A has operations which change any one line through A into any other, the self-conjugate subgroup contains rotations of amplitude α round every line through A. Now a pair of lines AB, AC can always be chosen so that a rotation of amplitude α round AB followed by one of amplitude $-\alpha$ round AC is equivalent to a rotation of arbitrarily chosen amplitude round some other line AD. The self-conjugate subgroup then contains rotations of all possible amplitudes about all possible lines through A. In other words, it coincides with the group of rotations about A.

The totality of the motions which leave a given line unchanged forms a subgroup. It is constituted of all the twists which have the given line for axis, and of rotations through two right angles about all lines which meet the given line at right angles.

Similarly, the totality of motions which leave a given plane unaltered forms a subgroup. It is constituted of all translations parallel to the plane, all rotations about lines perpendicular to the plane, and rotations through two right angles about all lines in the plane.

The totality of the motions which bring a given solid to congruence with itself again constitutes a subgroup of the group of motions. This will in general be the trivial subgroup formed of the identical operation above, but may in the case of a symmetrical body be more extensive. For a sphere or a right circular cylinder the subgroups are those that leave the centre and the axis respectively unaltered. For a solid bounded by plane faces the subgroup is clearly one of finite order. In particular, to each of the regular solids there corresponds such a group. That for the tetrahedron has 12 for its order; for the

cube (or octahedron) 24, and for the icosahedron (or dodecahedron) 60.

The determination of a particular operation of the group of motions involves six distinct measurements; namely, four to give the axis of the twist, one for the magnitude of the translation along the axis, and one for the magnitude of the rotation about it. Each of the six quantities involved may have any value whatever, and the group of motions is therefore a continuous group. On the other hand, a subgroup of the group of motions which leaves a line or a plane unaltered is a mixed group.

Continuous Groups.

We shall discuss separately continuous groups, discontinuous groups, and groups of finite order; and, as they are in a sense the most general, we shall begin with the theory of continuous groups.

The determination of a particular operation of a given continuous group depends on assigning special values to each one of a set of parameters which are capable of continuous variation. The first distinction regards the number of these parameters. If this number is finite, the group is called a *finite* continuous group; if infinite, it is called an *infinite* continuous group. In the latter case arbitrary functions must appear in the equations defining the operations of the group when these are reduced to an analytical form. The theory of infinite continuous groups has not hitherto received the same amount of attention, nor is it yet so completely developed as that of finite continuous groups. The latter theory will mainly occupy us here, and the former will not be entered upon in any detail.

Sophus Lie, to whom the foundation and a great part of the development of the theory of continuous groups are due, undoubtedly approached the subject from a geometrical standpoint. His conception of an operation is to regard it as a geometrical transformation, by means of which each point of (n-dimensional) space is changed into some other definite point.

The representation of such a transformation in analytical form involves a system of equations,

$$x'_s = f_s(x_1, x_2, \ldots, x_n), \quad (s = 1, 2, \ldots, n),$$

expressing $x_1', x_2', \ldots, x'_n$, the co-ordinates of the transformed point in terms of $x_1, x_2, \ldots, x_n$, the co-ordinates of the original point. In these equations the functions f_s are analytical functions of their arguments. Within a properly limited region they must be one-valued, and the equations must admit a unique solution with respect to $x_1, x_2, \ldots, x_n$; since the operation would not otherwise be a definite one.

From this point of view the operations of a continuous group, which depends on a set of r parameters, will be defined analytically by a system of equations of the form

$$x'_s = f_s(x_1, x_2, \ldots, x_n;\ a_1, a_2, \ldots, a_r), \quad (s = 1, 2, \ldots, n), \tag{i.}$$

where $a_1, a_2, \ldots, a_r$ represent the parameters. If this operation be represented by A, and that in which $b_1, b_2, \ldots, b_r$ are the parameters by B, then the operation AB is represented by the elimination (assumed to be possible) of $x'_1, x'_2, \ldots, x'_n$ between the equations

$$x'_s = f_s(x_1, x_2, \ldots, x_n;\ a_1, a_2, \ldots, a_r), \quad (s = 1, 2, \ldots, n),$$

and

$$x''_s = f_s(x'_1, x'_2, \ldots, x'_n;\ b_1, b_2, \ldots, b). \quad (s = 1, 2, \ldots, n).$$

Since AB belongs to the group, the result of the elimination must be

$$x''_s = f_s(x_1, x_2, \ldots, x_n;\ c_1, c_2, \ldots, c_r),$$

where $c_1, c_2, \ldots, c_r$ represent another definite set of values of the parameters. Moreover, since A^{-1} belongs to the group, the result of solving equations (i.) with respect to $x_1, x_2 \ldots, x_n$ must be

$$x_s = f_s(x'_1, x'_2, \ldots, x'_n;\ d_1, d_2, \ldots, d_r), \quad (s = 1, 2, \ldots, n).$$

Conversely, if equations (i.) are such that these two conditions are satisfied, they do in fact define a finite continuous group.

It will be assumed that the r parameters which enter in equations (i.) are independent, *i.e.*, that it is impossible to choose r' $(<r)$ quantities in terms of which $a_1, a_2, \ldots, a_r$ can be expressed. Where this is the case the group will be spoken of as a "group of order r." Lie uses the term "*r-gleidrige Gruppe.*" It is to be noticed that the word order is used in quite a different sense from that given to it in connexion with groups of finite order.

As examples of systems of equations thus defining continuous groups, the following simple instances may be considered. First

$$x' = a_1 x + a_2,$$

where a_1 and a_2 are continuously varying parameters, subject to the condition

$$a_1 \neq 0.$$

This equation agrees in form with that already considered in connexion with the arithmetical group, and does not require further comment. Its geometrical signification as defining a projective transformation of a straight line, which leaves the point at infinity unaltered, will be obvious to the reader. Secondly,

$$x' = x\cos a_1 - y\sin a_1 + a_2,$$
$$y' = x\sin a_1 + y\cos a_1 + a_3,$$

where a_1, a_2, a_3 are the parameters.

That these equations actually satisfy the conditions may be easily verified directly. Their geometrical meaning, as representing in analytical form the most general "motion" in a plane, is again obvious. Thirdly,

$$x' = \frac{a^2x - a(x^2+y^2)}{(x-a)^2+y^2},$$
$$y' = \frac{a^2y}{(x-a)^2+y^2},$$

where a is the single parameter. It will be found that the result of combining two pairs of equations of this form, in which the parameters are a and b, leads to a new pair of equations of the same form in which the parameter is $ab/(a+b)$. Also that the result of solving the two given equations with respect to x and y leads again to a pair of equations of the same form with $-a$ for parameter. The equations therefore define a continuous group with a single parameter.

Infinitesimal operations of a continuous group.

Returning now to equations (i.), which define the general operation of the group, it is to be noticed that, since the group contains the identical operation, these equations must for some definite set of values of the parameters reduce to

$$x'_1 = x_1,\ x'_2 = x_2, \ldots, x'_n = x_n.$$

This set of values may, without loss of generality, be assumed to be simultaneous zero values. For if $i_1, i_2, \ldots, i_r$ be the values of the parameters which give the identical operation, and if we write

$$a_s = i_s + \alpha_s, \quad (s = 1, 2, \ldots, r),$$

then zero values of the new parameters $\alpha_1, \alpha_2, \ldots, \alpha_r$ give the identical operation.

To infinitesimal values of the parameters, thus chosen, will correspond operations which cause an infinitesimal change in each of the variables. These are called

infinitesimal operations. The most general infinitesimal operation of the group is that given by the system

$$x'_s - x_s = \delta x_s = \frac{\partial f_s}{\partial a_1}\cdot\delta a_1 + \frac{\partial f_s}{\partial a_2}\cdot\delta a_2 + \ldots + \frac{\partial f_s}{\partial a_r}\cdot\delta a_r,$$
$$(s = 1,\ 2,\ldots,\ n),$$

where, in $\frac{\partial f_s}{\partial a_i}$, zero values of the parameters are to be taken. Since a_1, $a_2,\ldots,a_r$ are independent, the ratios of δa_1, δa_2, ..., δa_r are arbitrary. Hence the most general infinitesimal operation of the group may be written in the form

$$\delta x_s = \left(e_1\frac{\partial f_s}{\partial a_1} + e_2\frac{\partial f_s}{\partial a_2} + \ldots + e_r\frac{\partial f_s}{\partial a_r}\right)\delta t,$$
$$(s = 1,\ 2,\ldots,\ n),$$

where e_1, $e_2,\ldots,e_r$ are arbitrary constants, and δt is an infinitesimal.

If $F(x_1, x_2,\ldots,x_n)$ is any function of the variables, and if an infinitesimal operation of the group be carried out on the variables in F, the resulting increment of F will be

$$\frac{\partial F}{\partial x_1}\cdot\delta x_1 + \frac{\partial F}{\partial x_2}\cdot\delta x_2 + \ldots + \frac{\partial F}{\partial x_n}\cdot\delta x_n.$$

When in this expression their values are written for δx_1, $\delta x_2,\ldots$, it becomes

$$\begin{aligned}
&e_1\left(\frac{\partial f_1}{\partial a_1}\frac{\partial F}{\partial x_1} + \frac{\partial f_2}{\partial a_1}\frac{\partial F}{\partial x_2} + \ldots + \frac{\partial f_n}{\partial a_1}\frac{\partial F}{\partial x_n}\right)\delta t\\
+\,&e_2\left(\frac{\partial f_1}{\partial a_2}\frac{\partial F}{\partial x_1} + \frac{\partial f_2}{\partial a_2}\frac{\partial F}{\partial x_2} + \ldots + \frac{\partial f_n}{\partial a_2}\frac{\partial F}{\partial x_n}\right)\delta t\\
+\,&\quad\cdot\qquad\cdot\qquad\cdot\qquad\cdot\qquad\cdot\\
+\,&\quad\cdot\qquad\cdot\qquad\cdot\qquad\cdot\qquad\cdot\\
+\,&e_r\left(\frac{\partial f_1}{\partial a_r}\frac{\partial F}{\partial x_1} + \frac{\partial f_2}{\partial a_r}\frac{\partial F}{\partial x_2} + \ldots + \frac{\partial f_n}{\partial a_r}\frac{\partial F}{\partial x_n}\right)\delta t.
\end{aligned}$$

If now the differential operator

$$\frac{\partial f_1}{\partial a_i}\frac{\partial}{\partial x_1} + \frac{\partial f_2}{\partial a_i}\frac{\partial}{\partial x_2} + \ldots + \frac{\partial f_n}{\partial a_i}\frac{\partial}{\partial x_n}$$

be represented by

$$X_i,$$
$$(i = 1,\ 2,\ldots,\ r),$$

then the increment of F when an infinitesimal operation of the group is carried out on the variables is given by

$$(e_1X_1 + e_2X_2 + \ldots + e_rX_r)F\ \ \delta t.$$

When the equations (i.) defining the general operation of the group are given, the co-efficients $\frac{\partial f_s}{\partial a_i}$ which enter in these differential operators are functions of the variables which can be directly calculated.

The differential operator

$$e_1X_1 + e_2X_2 + \ldots + e_rX_r$$

may be regarded as defining the most general infinitesimal operation of the group. In fact, if it be for a moment represented by X, then $(1 + \delta t X)F$ is the result of carrying out the infinitesimal operation on F; and by putting $x_1, x_2,\ldots,x_n$ in turn for F, the actual infinitesimal operation is reproduced. By a very convenient, though perhaps hardly justifiable, phraseology, this differential operator is itself spoken of as the general infinitesimal operation of the group. The sense in which this phraseology is to be understood will be made clear by the foregoing explanations.

We suppose now that the constants e_1, $e_2,\ldots,e_r$ have assigned values. Then the result of repeating the particular infinitesimal operation

$$e_1X_1 + e_2X_2 + \ldots + e_rX_r$$

or X, an infinite number of times is some finite operation of the group. The effect of this finite operation on F may be directly calculated. In fact, if δt is the infinitesimal already introduced, then

$$\frac{dF}{dt} = X.F,\ \frac{d^2F}{dt^2} = X.X.F,\ldots$$

Hence

$$\begin{aligned}F' &= F + t\frac{dF}{dt} + \frac{t^2}{1.2}\frac{d^2F}{dt^2} + \ldots\\ &= F + tX.F + \frac{t^2}{1.2}X.X.F + \ldots\end{aligned}$$

It must, of course, be understood that in this analytical representation of the effect of the finite operation on F, it is implied that t is taken sufficiently small to ensure the convergence of the (in general) infinite series.

When x_1, $x_2,\ldots$ are written in turn for F, the system of equations

$$x'_s = (1 + tX + \frac{t^2}{1.2}X.X + \ldots)x_s \qquad \text{(ii.)}$$
$$(s = 1,\ 2,\ ..,\ n)$$

represent the finite operation completely. If t is here regarded as a parameter, this set of operations must in themselves constitute a group, since they arise by the repetition of a single infinitesimal operation. That this is really the case results immediately from noticing that the result of eliminating F′ between

$$F' = F + tX.F + \frac{t^2}{1.2}X.X.F + \ldots$$

and

$$F'' = F' + t'X.F' + \frac{t'^2}{1.2}X.X.F' + \ldots$$

is

$$F'' = F + (t + t')X.F + \frac{(t + t')^2}{1.2}X.X.F + \ldots$$

The group thus generated by the repetition of an infinitesimal operation is called a *cyclical* group; so that a continuous group contains a cyclical subgroup corresponding to each of its infinitesimal operations.

The system of equations (ii.) represents an operation of the group whatever the constants e_1, $e_2,\ldots,e_r$ may be. Hence if e_1t, $e_2t,\ldots$, e_rt be replaced by a_1, $a_2,\ldots$, a_r the equations (ii.) represent a set of operations, depending on r parameters and belonging to the group. They must, therefore, be a form of the general equations for any operation of the group, and are therefore equivalent to the equations (i.). The determination of the finite equations of a cyclical group, when the infinitesimal operation which generates it is given, will always depend on the integration of a set of simultaneous ordinary differential equations. As a very simple example we may consider the case in which the infinitesimal operation is given by

$$X = x^2\frac{\partial}{\partial x},$$

so that there is only a single variable. The relation between x' and t is given by

$$\frac{dx'}{dt} = x'^2,$$

with the condition that $x' = x$, when $t = 0$. This gives at once

$$x' = \frac{x}{1 - tx},$$

which might also be obtained by the direct use of (ii.).

Relations between the infinitesimal operations of a finite continuous group.

When the finite equations (i.) of a continuous group of order r are known, it has now been seen that the differential operator which defines the most general infinitesimal operation of the group can be directly constructed, and that it contains r arbitrary constants. This is equivalent to saying that the group contains r linearly independent infinitesimal operations; and that the most general infinitesimal operation is obtained by combining these linearly with constant coefficients. Moreover, when any r independent infinitesimal operations of the group are known, it has been seen how the general finite operation of the group may be calculated. This obviously suggests that it must

be possible to define the group by means of its infinitesimal operations alone; and it is clear that such a definition would lend itself more readily to some applications (for instance, to the theory of differential equations) than the definition by means of the finite equations.

On the other hand, r arbitrarily given linear differential operators will not, in general, give rise to a finite continuous group of order r; and the question arises as to what conditions such a set of operators must satisfy in order that they may, in fact, be the independent infinitesimal operations of such a group. A system of necessary relations between the infinitesimal operations may be directly deduced from the point of view already taken. Let X and Y be two infinitesimal operations of a finite group, and let X_t, $Y_{t'}$, be finite operations which result from repeating X and Y an infinite number of times. Then it has already been seen that

$$1 + tX + \frac{t^2}{1.2}X.X + \dots$$

and

$$1 + t'Y + \frac{t'^2}{1.2}Y.Y + \dots$$

are the differential operators which give the effect of X_t and $Y_{t'}$ on any function of the variables. The differential operator for $X_tY_{t'}X_{-t}Y_{-t'}$ will now be calculated. That for $X_tY_{t'}$ is

$$\left(1 + t'Y + \frac{t'^2}{1.2}Y.Y + \dots\right)\left(1 + tX + \frac{t^2}{1.2}X.X + \dots\right)$$
$$= 1 + tX + t'Y + \frac{t^2}{1.2}X.X + tt'Y.X + \frac{t'^2}{1.2}Y.Y + \dots$$

where the unwritten terms are of the 3rd order in t and t' combined. Similarly that for $X_{-t}Y_{-t'}$ is

$$1 - tX - t'Y + \frac{t^2}{1.2}X.X + tt'Y.X + \frac{t'^2}{1.2}Y.Y + \dots$$

Hence the differential operator which gives the effect of $X_tY_{t'}X_{-t}Y_{-t'}$ is $1 - tt'(X.Y - Y.X) +$ terms of the 3rd order in t and t'. If t and t' are here regarded as infinitesimals of the order $\frac{1}{2}$, the unwritten terms vanish in comparison with that written, and therefore

$$1 - \delta t(X.Y - Y.X)$$

must give the effect of an infinitesimal operation of the group on any function of the variables. In other words,

$$X.Y - Y.X$$

is an infinitesimal operation of the group. That $X.Y - Y.X$ is a linear differential operator is evident when for X and Y their actual values are written. This operator is represented by (XY), and is called the *combinant* of X and Y. Lie uses the expression *Klammerausdruck*. The result thus arrived at may be expressed in words by saying that among the infinitesimal operations of any finite continuous group must be included the combinant of every pair of infinitesimal operations.

Let

$$X_1, X_2, \dots, X_r$$

be a set of independent infinitesimal operations of a continuous group of order r, so that every infinitesimal operation can be represented by combining them linearly with constant coefficients. Then the above conditions will be expressed by the system of equations

$$(X_iX_j) = \sum_{s=1}^{s=r} c_{ijs}X_s, \qquad \text{(iii.)}$$
$$(i, j = 1, 2, \dots, r).$$

In these equations c_{ijs} are constants, among which certain relations hold. In fact, if X_i, X_j, X_k are any three linear operators, the identity (known as Jacobi's)

$$(X_i(X_jX_k)) + (X_j(X_kX_i)) + (X_k(X_iX_j)) = 0$$

holds among them; while from the definition of the combinant

$$(X_iX_j) + (X_jX_i) = 0.$$

When the values of the combinants are substituted from (iii.) in these relations, it is found that the c's are subject to the relations

$$\left.\begin{array}{l} c_{ijt} + c_{jit} = 0 \\ \text{and} \\ \sum_s (c_{jks}c_{ist} + c_{kis}c_{jst} + c_{ijs}c_{kst}) = 0 \end{array}\right\} \qquad \text{(iv.)}$$

for all values of i, j, k, and t.

The fundamental theorem of the theory of finite continuous groups is now that these conditions, which have been shown to be necessary in order that $X_1, X_2, \dots, X_r$ may generate, as infinitesimal operations, a continuous group of order r, are also sufficient.

For the general proof of this fundamental theorem the reader must be referred to Lie's works (cf. Lie-Engel, i. chap. 9; iii. chap. 25: see Bibliography at the end of this article), as it would take up more room than can be spared in this necessarily brief account of group-theory. The general lines on which the proof runs, and the essential geometrical ideas which underlie it, can, however, be made clear to the reader by considering the particular case $n = 1$ and $r = 2$.

Let

$$X_1 = f_1(x)\frac{d}{dx}$$

and

$$X_2 = f_2(x)\frac{d}{dx}$$

be two infinitesimal operations in a single variable. Then if

$$X = a_1X_1 + a_2X_2,$$
$$x' = (1 + X + \frac{1}{1.2}X.X + \dots)x$$

is a set of transformations with two parameters, or a set of ∞^2 transformations of the variable x. This set contains the identical transformation corresponding to $a_1 = a_2 = 0$.

If T and T′ are any two transformations of the set, then the condition that the set shall constitute a group is that TT′ shall belong to the set. Now when TT′ is actually formed it will in general depend on more than two parameters. If, however, the set TT′ depends only on two independent parameters, it must coincide with the set T, since for T′ the identical transformation may be chosen. Hence the sufficient condition that the set of transformations

$$x' = (1 + X + \frac{1}{1.2}X.X + \dots)x \dots (a)$$

should be a group is that the operation, which results from carrying out in succession any two operations of the set, should contain only two independent parameters.

The set of transformations (a) may be regarded geometrically as effecting a transformation of the points of a straight line. An arbitrarily chosen point of the line will be changed successively by the operations of the set into ∞^1 new positions. A pair of arbitrarily chosen points must, however, be changed into ∞^2 new positions by the operations of the set. For if every operation of the set which brings A to a definite new position A′ at the same time brings a second arbitrarily chosen point B to a definite new position B′, the totality of points on the line only takes up ∞^1 new positions, and the set could only contain ∞^1 distinct transformations. *À fortiori* three or more arbitrarily chosen points on the line are changed into ∞^2 new positions by the set of transformations.

Let now x, y, z be the symbols defining a set of three arbitrarily chosen points on the line. These three symbols may also be regarded as the co-ordinates of a point P in three-dimensional space. Hence under the set of transforma-

tions the point P takes up ∞^2 new positions in space; in other words, P is displaced on a certain surface. This surface may either be changed into itself by every transformation of the set TT′, or it may be changed into ∞^1 or into ∞^2 new surfaces. In the two latter cases the point P will be changed into ∞^3 new positions by the transformations of the set TT′. Hence the set of transformations TT′ will contain just two independent parameters if, and only if, each of a singly-infinite set of surfaces is changed into itself by every operation of the set T. Now the infinitesimal operations of the set, when regarded as affecting the set of three symbols x, y, z, are

$$f_1(x)\frac{\partial}{\partial x}+f_1(y)\frac{\partial}{\partial y}+f_1(z)\frac{\partial}{\partial z},$$

or

$$X_1+Y_1+Z_1, \text{ or } U_1;$$

and

$$f_2(x)\frac{\partial}{\partial x}+f_2(y)\frac{\partial}{\partial y}+f_2(z)\frac{\partial}{\partial z},$$

or

$$X_2+Y_2+Z_2, \text{ or } U_2.$$

Let

$$F(x, y, z)-C=0,$$

where C is an arbitrary constant, be the set of surfaces, each of which is changed into itself by every operation of the set, then F must be a common solution of the two linear partial differential equations

$$U_1F=0,\ U_2F=0.$$

Conversely, by tracing the argument backwards, it follows that if these differential equations have a common solution, then the set of operations forms a group.

Now the well-known condition that these equations should have a common solution is that functions α, β, of x, y, z should exist such that

$$(U_1U_2)=\alpha U_1+\beta U_2.$$

But, by direct calculation

$$(U_1U_2)=(X_1X_2)+(Y_1Y_2)+(Z_1Z_2),$$

where (X_1X_2), (Y_1Y_2), (Z_1Z_2) contain respectively only differentiations with respect to x, y, and z.

Hence

$$(X_1X_2)=\alpha X_1+\beta X_2,$$
$$(Y_1Y_2)=\alpha Y_1+\beta Y_2,$$
$$(Z_1Z_2)=\alpha Z_1+\beta Z_2.$$

From the first of these equations it follows that α and β do not depend on y or z, and from the second that they do not depend on z or x. Hence they are constants. Finally, then, the sufficient condition that X_1 and X_2 should generate a continuous group of order two is that it may be possible to find constants α and β, such that

$$(X_1X_2)=\alpha X_1+\beta X_2.$$

In the more elaborate proof of the general theorem, a set of $(r+1)$ points in space of n dimensions and a single point in space of $(r+1)n$ dimensions replace the set of three points on a line and the one point in three-dimensional space here considered.

Determination of the distinct types of continuous groups of a given order.

If two continuous groups of order r are such that, for each, a set of linearly independent infinitesimal operations

$$X_1, X_2, \dots, X_r,$$

and

$$Y_1, Y_2, \dots, Y_r,$$

can be chosen, so that in the relations

$$(X_iX_j)=\Sigma c_{ijs}X_s, \qquad \text{(iii.)}$$

and

$$(Y_iY_j)=\Sigma d_{ijs}Y_s,$$

the constants c_{ijs} and d_{ijs} are the same for all values of i, j, and s, the two groups are simply isomorphic, X_s and Y_s being corresponding infinitesimal operations. This follows from noticing that the two groups have necessarily corresponding systems of subgroups. In fact, the problem of determining all the subgroups of the continuous group generated by

$$X_1, X_2, \dots, X_r$$

is clearly the same as that of finding all systems of s $(<r)$ infinitesimal operations

$$X'_1=a_{11}X_1+a_{12}X_2+\dots+a_{1r}X_r,$$
$$X'_2=a_{21}X_1+a_{22}X_2+\dots+a_{2r}X_r,$$
$$\cdot\quad\cdot\quad\cdot\quad\cdot$$
$$X'_s=a_{s1}X_1+a_{s2}X_2+\dots+a_{sr}X_r,$$

such that each combinant $(X'_iX'_j)$, $(i, j=1, 2\dots, s)$ can be expressed linearly in terms of $X'_1, X'_2\dots, X'_s$. Corresponding to each solution of this problem for the X's there is clearly one with the same set of constants for the Y's.

Two continuous groups of order r, whose infinitesimal operations obey the same system of equations (iii.), may be of very different *form*; for instance, the number of variables for the one may be different from that for the other. They are, however, said to be of the same *type*, in the sense that the laws according to which their operations combine are the same for both.

The problem of determining all distinct types of groups of order r is then contained in the purely algebraical problem of finding all the systems of r^3 quantities c_{ijs} which satisfy the relations

$$c_{ijt}+c_{jit}=0,$$
$$\sum_s(c_{ijs}c_{skt}+c_{jks}c_{sit}+c_{kis}c_{sjt})=0,$$

for all values of i, j, k, and t. To two distinct solutions of the algebraical problem, however, two distinct types of group will not necessarily correspond. In fact,

$$X_1, X_2, \dots, X_r$$

may be replaced by any r independent linear functions of themselves, and the c's will then be transformed by a linear substitution containing r^2 independent parameters. This, however, does not alter the type of group considered

For a single parameter there is, of course, only one type of group, which has been called cyclical.

For a group of order two there is a single relation

$$(X_1X_2)=\alpha X_1+\beta X_2.$$

If α and β are not both zero, let α be finite. The relation may then be written

$$(\alpha X_1+\beta X_2, \tfrac{1}{\alpha}X_2)=\alpha X_1+\beta X_2.$$

Hence if

$$\alpha X_1+\beta X_2=X'_1,$$
$$\tfrac{1}{\alpha}X_2=X'_2,$$

then

$$(X'_1X'_2)=X'_1.$$

There are, therefore, just two types of group of order two, the one given by the relation last written, and the other by

$$(X_1X_2)=0.$$

Lie has determined all distinct types of continuous groups of orders three or four; and all types of non-integrable groups (a term which will be explained immediately) of orders five and six (cf. Lie-Engel, iii. pp. 713–744).

A problem of fundamental importance in connexion

with any given continuous group is the determination of the self-conjugate subgroups which it contains. Closely related to this is the determination of all distinct types of simple groups. We shall proceed to deal shortly with the first of these two questions, and to state the results which have been arrived at with respect to the second.

Self-conjugate subgroups. Simple groups.

If A is a given operation of the group, and B any other operation, the operations $B^{-1}AB$ have been defined as those which are conjugate to A. The actual form of the infinitesimal operations which are conjugate to a given one may be determined thus.

Let X be the differential operator defining an infinitesimal operation A, and let Y be any infinitesimal operation. If B is the result of repeating Y an infinite number of times, the differential operator which gives the effect of $B^{-1}AB$ on any function of the variables is

$$(1 - t'Y + \frac{t'^2}{1.2}Y^2\ldots)\ (1 + \delta tX)\ (1 + t'Y + \frac{t'^2}{1.2}Y^2 + \ldots).$$

On actual calculation this is found to be

$$1 + \delta t[X + t'(XY) + \frac{t'^2}{1.2}((XY)Y) + \frac{t'^3}{1.2.3}(((XY)Y)Y) + \ldots],$$

and therefore the general form of the set of infinitesimal operations which are conjugate to X is

$$X + t'(XY) + \frac{t'^2}{1.2}((XY)Y) + \frac{t'^3}{1.2.3}(((XY)Y)Y) + \ldots$$

Hence $(XY) = 0$ is the sufficient condition that B may be permutable with A; and when this condition is satisfied every operation of the cyclical group generated by Y is permutable with every operation of that generated by X. Now a self-conjugate subgroup which contains X must contain all the operations conjugate to X, and therefore it must contain (XY), where Y is any infinitesimal operation of the group. Hence if $X'_1, X'_2, \ldots, X'_s$ are s linearly independent operations of the group which generate a self-conjugate subgroup of order s, then for *every* infinitesimal operation Y of the group relations of the form

$$(X'_iY) = \sum_{e=1}^{e=s} a_{ie}X'_e$$
$$(i = 1,\ 2, \ldots, s)$$

must be satisfied. Conversely, if such a set of relations is satisfied, $X'_1, X'_2, \ldots, X'_s$ generate a subgroup of order s, which contains every operation conjugate to each of the infinitesimal generating operations, and is therefore a self-conjugate subgroup. A specially important self-conjugate subgroup is that generated by the combinants of the r infinitesimal generating operations. That these generate a self-conjugate subgroup follows from the relations (iii.). In fact,

$$((X_iX_j)X_k) = \sum_s c_{ijs}\ (X_sX_k).$$

Of the $\frac{1}{2}r(r-1)$ combinants not more than r can be linearly independent. When exactly r of them are linearly independent, the self-conjugate group generated by them coincides with the original group. If the number that are linearly independent is less than r, the self-conjugate subgroup generated by them is actually a subgroup; *i.e.*, its order is less than that of the original group. This subgroup is known as the derived group, and Lie has called a group *perfect* when it coincides with its derived group. A simple group, since it contains no self-conjugate subgroup distinct from itself, is necessarily a perfect group.

If G is a given continuous group, G_1 the derived group of G, G_2 that of G_1, and so on, the series of groups

$$G,\ G_1,\ G_2, \ldots$$

will terminate either with the identical operation or with a perfect group; for the order of G_{s+1} is less than that of G_s unless G_s is a perfect group. When the series terminates with the identical operation, G is said to be an *integrable* group; in the contrary case G is called *non-integrable.*

If G is an integrable group of order r, the infinitesimal operations

$$X_1,\ X_2, \ldots,\ X_r$$

which generate the group may be chosen so that

$$X_1,\ X_2, \ldots,\ X_{r_1},\ (r_1 < r)$$

generate the first derived group,

$$X_1,\ X_2, \ldots,\ X_{r_2},\ (r_2 < r_1)$$

the second derived group, and so on. When they are so chosen the constants c_{ijs} are clearly such that if

$$r_p < i \leqq r_{p+1},\ r_q < j \leqq r_{q+1},\ p \geqq q,$$

then c_{ijs} vanishes unless

$$s \leqq r_{p+1}.$$

In particular the generating operations may be chosen so that c_{ijs} vanishes unless s is equal to or less than the smaller of the two numbers i, j; and conversely, if the c's satisfy these relations, the group is integrable.

The derived group is not the only self-conjugate subgroup of a given continuous group whose definition is independent of the particular type.

If

$$a_k = \sum_s c_{kss}$$

the infinitesimal operations

$$e_1X_1 + e_2X_2 + \ldots + e_rX_r,$$

where

$$a_1e_1 + a_2e_2 + \ldots + a_re_r = 0$$

generate a self-conjugate subgroup (Lie-Engel, iii. p. 692). If the a's are not all identically zero, the set of infinitesimal operations contains $r-1$ that are linearly independent, and therefore $r-1$ is the order of the subgroup. If, however, the a's all vanish, there is no relation among the e's, and the subgroup coincides with the original group.

In illustration of the present section, non-integrable groups of order three may be considered. It has been seen that all groups of order two are integrable, and therefore a group of order three must be either integrable or simple. If X_1, X_2, X_3 are the infinitesimal operations,

$$(X_1,\ \lambda X_2 + \mu X_3) = (\lambda c_{121} + \mu c_{131})X_1 + (\lambda c_{122} + \mu c_{132})X_2 + (\lambda c_{123} + \mu c_{133})X_3.$$

Hence if

$$\mu(\lambda c_{122} + \mu c_{132}) = \lambda(\lambda c_{123} + \mu c_{133}),$$

then X_1 and $\lambda X_2 + \mu X_3$ generate a group of order two. New generators may therefore be taken such that

$$(Y_1Y_2) = aY_1, \text{ where } a \text{ is 0 or 1.}$$

If a were zero the order of the derived group could not exceed two, as it must if the group is simple.

Now if

$$(Y_1Y_2) = Y_1,$$

the identity

$$((Y_1Y_2)Y_3) + ((Y_2Y_3)Y_1) + ((Y_3Y_1)Y_2) = 0$$

gives

$$(c_{131} + c_{232})\ Y_1 + (c_{233} - 1)(Y_1Y_3) + c_{133}(Y_2Y_3) = 0.$$

Hence if

$$c_{133} = 0,$$

then

$$c_{233} = 1,\ c_{131} + c_{232} = 0.$$

Now

$$(Y_2 + xY_1,\ uY_1 + vY_2 + wY_3) = (xv - u + wc_{231} + xwc_{131})Y_1 + w(c_{232} + xc_{132})Y_2 + w(c_{233} + xc_{133})Y_3.$$

Hence if

$$c_{233}+xc_{133}=1,$$
$$w(c_{232}+xc_{132})=v,$$
$$xv+w(c_{231}+xc_{131})=u,$$

then

$$(Y_2+xY_1,\ uY_1+vY_2+wY_3)=uY_1+vY_2+wY_3;$$

and, from the relations obtained above, the equations for x and for the ratios of u, v, w are always capable of finite solution.

If then

$$Y_1=Z_1,\ Y_2+xY_1=Z_2,\ uY_1+vY_2+wY_3=Z_3,$$

we have

$$(Z_1Z_2)=Z_1,\ (Z_2Z_3)=Z_3.$$

Jacobi's identity then gives

$$((Z_1Z_3)Z_2)=0,$$

or

$$(Z_1Z_3)=\alpha Z_2.$$

Moreover, on replacing Z_1 and Z_3 by arbitrary multiples of themselves, α may be made any constant except zero.

There is therefore a single type of simple continuous group of order three, and it is defined by

$$(X_1X_2)=X_1,\ (X_2X_3)=X_3,\ (X_1X_3)=\alpha X_2,$$

where α is any constant other than zero.

A particular form of the group is given by

$$X_1=\frac{d}{dx},\quad X_2=x\frac{d}{dx},\quad X_3=x^2\frac{d}{dx}.$$

In regard to the enumeration and classification of simple continuous groups, it is impossible here to do more than to give the results that have been arrived at. It is very remarkable that this enumeration has been completely carried out, for in the case of groups of finite order such is far from being the case. Lie himself has demonstrated the existence of four great classes of simple groups. These are:—

(i.) The groups simply isomorphic with the general projective group in space of n dimensions. Such a group is defined analytically as the totality of the transformations of the form

$$x'_s=\frac{a_{s,1}x_1+a_{s,2}x_2+\ldots+a_{s,n}x_n+a_{s,n+1}}{a_{n+1,1}x_1+a_{n+1,2}x_2+\ldots+a_{n+1,n}x_n+1},$$
$$(s=1,\ 2,\ldots,\ n),$$

where the a's are parameters. The order of this group is clearly $n(n+2)$.

(ii.) The groups simply isomorphic with the totality of the projective transformations which transform a non-special linear complex in space of $2n-1$ dimensions with itself. The order of this group is $n(2n+1)$.

(iii.) and (iv.) The groups simply isomorphic with the totality of the projective transformations which change a quadric of non-vanishing discriminant into itself. It is found that these fall into two distinct classes of types according as n is even or odd. In either case the order is $\frac{1}{2}n(n+1)$. The case $n=3$ forms an exception in which the corresponding group is not simple. It is also to be noticed that a cyclical group is a simple group, since it has no continuous self-conjugate subgroup distinct from itself.

Killing and Cartan have separately proved the very remarkable fact that outside these four great classes there exist only five distinct types of simple groups, whose orders are 14, 52, 78, 133, and 248; thus completing the enumeration of all possible types.

To prevent any misapprehension as to the bearing of these very general results, it is well to point out explicitly that there are no limitations on the parameters of a continuous group as it has been defined above. They are to be regarded as taking in general complex values. If in the finite equations of a continuous group the imaginary symbol does not explicitly occur, the finite equations will usually define a group (in the general sense of the original definition) when both parameters and variables are limited to real values. Such a group is, in a certain sense, a continuous group; and such groups have been considered shortly by Lie (cf. Lie-Engel, iii. pp. 360–392), who calls them *real* continuous groups. To these real continuous groups the above statement as to the totality of simple groups does not apply; and indeed, in all probability, the number of types of real simple continuous groups admits of no such complete enumeration. The effect of limitation to real transformations may be illustrated by considering the groups of projective transformations which change

$$x^2+y^2+z^2-1=0$$

and

$$x^2+y^2-z^2-1=0$$

respectively into themselves. Since one of these quadrics is changed into the other by the imaginary transformation

$$x'=x,\ y'=y,\ z'=z\sqrt{-1},$$

the general continuous groups which transform the two quadrics respectively into themselves are simply isomorphic. This is not, however, the case for the *real* continuous groups. In fact, the second quadric has two real sets of generators; and therefore the real group which transforms it into itself has two self-conjugate subgroups, either of which leaves unchanged each of one set of generators. The first quadric having imaginary generators, no such self-conjugate subgroups can exist for the real group which transforms it into itself; and this real group is in fact simple.

The adjunct group.

Among the groups isomorphic with a given continuous group there is one of special importance which is known as the *adjunct* group. This is a homogeneous linear group in a number of variables equal to the order of the group, whose infinitesimal operations are defined by the relations

$$X_j=\sum_{i,s}c_{ijs}x_i\frac{\partial}{\partial x_s},$$
$$(j=1,\ 2,\ldots,\ r),$$

where c_{ijs} are the often-used constants, which give the combinants of the infinitesimal operations in terms of the infinitesimal operations themselves.

That the r infinitesimal operations thus defined actually generate a group isomorphic with the given group is most readily verified by forming their combinants. We have

$$\begin{aligned}(X_pX_q)&=\Big(\sum_{i,s}c_{ips}x_i\frac{\partial}{\partial x_s}\Big)\Big(\sum_{j,t}c_{jqt}x_j\frac{\partial}{\partial x_t}\Big)\\&\quad-\Big(\sum_{j,t}c_{jqt}x_j\frac{\partial}{\partial x_t}\Big)\Big(\sum_{i}c_{ips}x_i\frac{\partial}{\partial x_s}\Big)\\&=\sum_{i,t,s}(c_{ips}c_{sqt}+c_{qis}c_{spt})x_i\frac{\partial}{\partial x_t}.\end{aligned}$$

But the c's are subject to the relation

$$\sum_s(c_{ips}c_{sqt}+c_{qis}c_{spt}+c_{pqs}c_{sit})=0$$

for all suffixes i, p, q, and t.

Hence

$$\begin{aligned}(X_pX_q)&=\sum_{i,t,s}c_{pqs}c_{ist}x_i\frac{\partial}{\partial x_t},\\&=\sum_s c_{pqs}X_s,\end{aligned}$$

and therefore the r infinitesimal operations actually generate a group isomorphic with the given group. The X's, however, are not necessarily linearly independent. In fact, the sufficient condition that

$$\sum_j a_j X_j$$

should be identically zero is that

$$\sum_j a_j c_{ijs}$$

should vanish for all values of i and s. Hence if the equations

$$\sum_j a_j c_{ijs} = 0$$

for all values of i and s, have r' linearly independent solutions, only $r-r'$ of the X's are linearly independent, and the isomorphism of the two groups is multiple. If

$$Y_1, Y_2, \ldots, Y_r$$

are the infinitesimal operations of the given group, the equations

$$\sum_j a_j c_{ijs} = 0, \ (s, i = 1, 2, \ldots, r)$$

express the condition that the operations of the cyclical group generated by

$$\sum_j a_j Y_j$$

should be permutable with every operation of the group; in other words, that they should be self-conjugate operations. In the case supposed, therefore, the given group contains a subgroup of order r' each of whose operations is self-conjugate. The adjunct group of a given group will, therefore, be simply isomorphic with the group, unless the latter contains self-conjugate operations; and when this is the case the order of the adjunct will be less than that of the given group by the order of the subgroup formed of the self-conjugate operations.

Continuous groups of the line of the plane, and of three-dimensional space.

We have been thus far mainly concerned with the abstract theory of continuous groups, in which no distinction is made between two simply isomorphic groups. It is now time to give some account of what has been accomplished in the classification and theory of groups when their form is regarded as essential; and this is a return to a more geometrical point of view.

It is natural to begin with the projective groups, which are the simplest in form and at the same time are of supreme importance in geometry. The general projective group of the straight line is the group of order three given by

$$x' = \frac{ax+b}{cx+1}.$$

This group is triply-transitive as regards the points of the line. In fact, if x_1, x_2, x_3 are the co-ordinates of three points on the line

$$\frac{x'_3 - x'_2}{x'_3 - x'_1} \cdot \frac{x' - x'_1}{x' - x'_2} = \frac{x_3 - x_2}{x_3 - x_1} \cdot \frac{x - x_1}{x - x_2}$$

is an equation of the above form which changes x_1, x_2, x_3 into x'_1, x'_2, x'_3.

If $x'_1 = x_1$ and $x'_2 = x_2$, the last written transformation is of the form

$$\frac{x' - x_1}{x' - x_2} = a\frac{x - x_1}{x - x_2},$$

and when a is regarded as a parameter, the totality of transformations of this form, x_1 and x_2 being given distinct points, forms a cyclical group. The totality of the transformations which keep two distinct points fixed constitutes therefore a cyclical subgroup. When the fixed points are 0 and ∞, the form of this subgroup is

$$x' = ax,$$

and all such subgroups are clearly conjugate within the general group.

When x_2 is infinite and x_1 an arbitrarily assigned point, the form of the subgroup is

$$x' = ax + (1-a)x_1;$$

and if here x_1 approaches ∞, and b is written for the limit of $(1-a)x_1$, so that a must approach unity, the limiting form is

$$x' = x + b.$$

The totality of the transformations which keep two coincident points fixed forms, therefore, again a cyclical subgroup, which, when the fixed double point is at infinity, has the last given form. All such subgroups again are conjugate.

If in

$$\frac{x'_3 - x'_2}{x'_3 - x'_1} \frac{x' - x'_1}{x' - x'_2} = \frac{x_3 - x_2}{x_3 - x_1} \frac{x - x_1}{x - x_2}.$$

$$x_2 = x'_2 = \infty$$

the transformation has the form

$$x' = ax + b,$$

and transformations of this form, where a and b are parameters, constitute a group of order two. Hence the totality of the transformations, which keep a single point fixed, constitutes a subgroup of order two; such subgroups form a single conjugate set; and when the fixed point is at infinity the subgroup has the last written form.

A group of order two is not simple, and therefore every subgroup of order two of the general projective group of the straight line must contain a cyclical group as a self-conjugate subgroup. Every subgroup of order two must therefore keep at least one point fixed, namely, the fixed point of its self-conjugate cyclical subgroup. Hence the subgroups above determined exhaust all the subgroups of the projective group of the line.

The analysis of the general projective group must obviously increase very rapidly in complexity, as the dimensions of the space to which it applies increase. This analysis has been completely carried out for the projective group of the plane, with the result of showing that there are thirty distinct types of subgroup. Excluding the general group itself, every one of these leaves either a point, a line, or a conic section unaltered. For space of three dimensions Lie has also carried out a similar investigation, but the results are extremely complicated. One general result of great importance at which Lie arrives in this connexion is that every projective group in space of three dimensions, other than the general group, leaves either a point, a curve, a surface, or a linear complex unaltered.

For space of more than three dimensions, it is only certain special types of projective groups which have been hitherto investigated. For instance, Lie has determined those projective groups in n variables whose degree of transitivity is as great as possible.

Returning now to the case of a single variable, it can be shown that any finite continuous group in one variable is either cyclical or of order two or three, and that by a suitable transformation any such group may be changed into a projective group.

The genesis of an infinite as distinguished from a finite continuous group may be well illustrated by considering it in the case of a single variable. The infinitesimal operations of the projective group in one variable are

$$\frac{d}{dx}, \ x\frac{d}{dx}, \ x^2\frac{d}{dx}.$$

If these combined with

$$x^3\frac{d}{dx}$$

be taken as infinitesimal operations from which to generate a continuous group among the infinitesimal operations of the group, there must occur the combinant of $x^2\frac{d}{dx}$ and $x^3\frac{d}{dx}$. This is $x^4\frac{d}{dx}$. The combinant of this and $x^2\frac{d}{dx}$ is

$2x^5\frac{d}{dx}$ and so on. Hence $x^r\frac{d}{dx}$, where r is any positive integer, is an infinitesimal operation of the group. The general infinitesimal operation of the group is therefore $f(x)\frac{d}{dx}$ where $f(x)$ is an arbitrary integral function of x.

In the classification of the groups, projective or non-projective, of two or more variables, the distinction between primitive and imprimitive groups immediately presents itself. For groups of the plane the question that then arises is the following. Is there or is there not a singly-infinite family of curves

$$f(x, y) = C,$$

where C is an arbitrary constant such that every operation of the group interchanges the curves of the family among themselves? In accordance with the previously given definition of imprimitivity, the group is called imprimitive or primitive according as such a set exists or not. In space of three dimensions there are two possibilities; namely, there may either be a singly infinite system of surfaces

$$F(x, y, z) = C$$

which are interchanged among themselves by the operations of the group; or there may be a doubly-infinite system of curves

$$G(x, y, z) = a,\ H(x, y, z) = b,$$

which are so interchanged.

In regard to primitive groups Lie has shown that any primitive group of the plane can, by a suitably chosen transformation, be transformed into one of three definite types of projective groups; and that any primitive group of space of three dimensions can be transformed into one of eight definite types, which, however, cannot all be represented as projective groups in three dimensions.

The results which have been arrived at for imprimitive groups in two and three variables do not admit of any such simple statement; but in this case, again, the classification is complete in the sense that all possible types are divided into a number of classes, while methods are given which enable the complete determination of the groups belonging to a given class to be carried out.

No account of the theory of continuous groups would be complete without some reference, however short, to the conception of contact-transformations and groups of contact-transformations. This conception, like that of continuous groups, owes its origin to the genius of Sophus Lie.

Contact-transformations

From a purely analytical point of view a contact-transformation may be defined as a point-transformation in $2n+1$ variables, $z, x_1, x_2, \ldots, x_n, p_1, p_2, \ldots, p_n$ which leaves unaltered the equation

$$dz - p_1dx_1 - p_2dx_2 - \ldots - p_ndx_n = 0.$$

Such a definition as this, however, gives no direct clue to the geometrical properties of the transformation, nor does it explain the name given.

In dealing with contact-transformations we shall restrict ourselves to space of two or of three dimensions; and it will be necessary to begin with some purely geometrical considerations. An infinitesimal surface-element in space of three dimensions is completely specified, apart from its size, by its position and orientation. If x, y, z are the co-ordinates of some one point of the element, and if $p, q, -1$ give the ratios of the direction-cosines of its normal, x, y, z, p, q are five quantities which completely specify the element. There are, therefore, ∞^5 surface elements in three-dimensional space. The surface-elements of a surface form a system of ∞^2 elements, for there are ∞^2 points on the surface, and at each a definite surface-element. The surface-elements of a curve form, again, a system of ∞^2 elements, for there are ∞^1 points on the curve, and at each ∞^1 surface-elements containing the tangent to the curve at the point. Similarly the surface-elements which contain a given point clearly form a system of ∞^2 elements. Now each of these systems of ∞^2 surface-elements has the property that if (x, y, z, p, q) and $(x+dx,\ y+dy,\ z+dz,\ p+dp,\ q+dq)$ are consecutive elements from any one of them, then

$$dz - pdx - qdy = 0.$$

In fact, for a system of the first kind dx, dy, dz are proportional to the direction-cosines of a tangent line at a point of the surface, and p, q, -1 are proportional to the direction-cosines of the normal. For a system of the second kind dx, dy, dz are proportional to the direction-cosines of a tangent to the curve, and p, q, -1 give the direction-cosines of the normal to a plane touching the curve; and for a system of the third kind dx, dy, dz are zero. Now the most general way in which a system of ∞^2 surface-elements can be given is by three independent equations between x, y, z, p and q. If these equations do not contain p, q, they determine one or more (a finite number in any case) points in space, and the system of surface-elements consists of the elements containing these points; *i.e.*, it consists of one or more systems of the third kind.

If the equations are such that two distinct equations independent of p and q can be derived from them, the points of the system of surface-elements lie on a curve. For such a system the equation

$$dz - pdx - qdy = 0$$

will hold for each two consecutive elements only when the plane of each element touches the curve at its own point.

If the equations are such that only one equation independent of p and q can be derived from them, the points of the system of surface-elements lie on a surface. Again, for such a system the equation

$$dz - pdx - qdy = 0$$

will hold for each two consecutive elements only when each element touches the surface at its own point. Hence, when all possible systems of ∞^2 surface-elements in space are considered, the equation

$$dz - pdx - qdy = 0,$$

is characteristic of the three special types in which the elements belong, in the sense explained above, to either a point, a curve, or a surface.

Let us consider now the geometrical bearing of any transformation

$$x' = f_1(x, y, z, p, q), \ldots, q' = f_5(x, y, z, p, q),$$

of the five variables. It will interchange the surface-elements of space among themselves, and will change any system of ∞^2 elements into another system of ∞^2 elements. A special system, *i.e.*, a system which belongs to a point, curve, or surface, will not, however, in general be changed into another special system. The necessary and sufficient condition that a special system should always be changed into a special system is that the equation

$$dz' - p'dx' - q'dy' = 0$$

should be a consequence of the equation

$$dz - pdx - qdy = 0;$$

or, in other words, that this latter equation should be invariant for the transformation.

When this condition is satisfied the transformation is such as to change the surface-elements of a surface in general into surface-elements of a surface, though in particular cases they may become the surface-elements of

a curve or point; and similar statements may be made with respect to a curve or point. The transformation is therefore a veritable geometrical transformation in space of three dimensions. Moreover, two special systems of surface-elements which have an element in common are transformed into two new special systems with an element in common. Hence two curves or surfaces which touch each other are transformed into two new curves or surfaces which touch each other. It is this property which leads to the transformations in question being called contact-transformations. It will be noticed that an ordinary point-transformation is always a contact-transformation, but that a contact-transformation (in space of n dimensions) is not in general a point-transformation (in space of n dimensions), though it may always be regarded as a point-transformation in space of $2n+1$ dimensions. In the analogous theory for space of two dimensions a line-element, defined by (x, y, p), where $1:p$ gives the direction-cosines of the line, takes the place of the surface-element; and a transformation of x, y, and p which leaves the equation

$$dy - pdx = 0$$

unchanged transforms the ∞^1 line-elements, which belong to a curve, into ∞^1 line-elements which again belong to a curve; while two curves which touch are transformed into two other curves which touch.

One of the simplest instances of a contact-transformation that can be given is the transformation by reciprocal polars. By this transformation a point P and a plane p passing through it are changed into a plane p' and a point P′ upon it; *i.e.*, the surface-element defined by P, p is changed into a definite surface-element defined by P′, p'. The totality of surface-elements which belong to a (non-developable) surface is known from geometrical considerations to be changed into the totality which belongs to another (non-developable) surface. On the other hand, the totality of the surface-elements which belong to a curve is changed into another set which belong to a developable. The analytical formulæ for this transformation, when the reciprocation is effected with respect to the paraboloid $x^2+y^2-2z=0$, are

$$x'=p,\ y'=q,\ z'=px+qy-z,\ p'=x,\ q'=y.$$

That this is, in fact, a contact-transformation is verified directly by noticing that

$$\begin{aligned} dz'-p'dx'-q'dy' &= -d(z-px-qy)-xdp-ydq \\ &= -(dz-pdx-qdy). \end{aligned}$$

A second simple example is that in which every surface-element is displaced, without change of orientation, normal to itself through a constant distance t. The analytical equations in this case are easily found in the form

$$x'=x+\frac{pt}{\sqrt{1+p^2+q^2}},\quad y'=y+\frac{qt}{\sqrt{1+p^2+q^2}},\quad z'=z-\frac{t}{\sqrt{1+p^2+q^2}},$$
$$p'=p,\ q'=q.$$

That this is a contact-transformation is seen geometrically by noticing that it changes a surface into a parallel surface. Every point is changed by it into a sphere of radius t. Also from the analytical form of the transformation, it follows at once that

$$dz'-p'dx'-q'dy'=dz-pdx-qdy.$$

The symbol of a general infinitesimal operation in the five variables x, y, z, p, q is

$$\zeta\frac{\partial}{\partial z}+\xi\frac{\partial}{\partial x}+\eta\frac{\partial}{\partial y}+\pi\frac{\partial}{\partial p}+\kappa\frac{\partial}{\partial q},$$

where $\xi, \eta, \zeta, \pi, \kappa$, are functions of the variables.

The increment of

$$dz-pdx-qdy$$

given by this infinitesimal operation is

$$(d\zeta-\pi dx-pd\xi-\kappa dy-qd\eta)\delta t.$$

Hence the necessary and sufficient condition that the transformation should be a contact-transformation in space (x, y, z) is

$$d\zeta-\pi dx-pd\xi-\kappa dy-qd\eta=\sigma(dz-pdx-qdy),$$

where σ is some function of x, q, z, q, q.

This equation is equivalent to

$$\frac{\partial}{\partial z}(\zeta-p\xi-q\eta)=\sigma,$$
$$\frac{\partial}{\partial x}(\zeta-p\xi-q\eta)=\pi-\sigma p,$$
$$\frac{\partial}{\partial y}(\zeta-p\xi-q\eta)=\kappa-\sigma q,$$
$$\frac{\partial}{\partial p}(\zeta-p\xi-q\eta)=-\xi,$$
$$\frac{\partial}{\partial q}(\zeta-p\xi-q\eta)=-\eta.$$

Hence if

$$p\xi+q\eta-\zeta=\omega,$$
$$\xi=\frac{\partial\omega}{\partial p},\ \eta=\frac{\partial\omega}{\partial q},\ \pi=-\frac{\partial\omega}{\partial x}-p\frac{\partial\omega}{\partial z},\ \kappa=-\frac{\partial\omega}{\partial y}-q\frac{\partial\omega}{\partial z}$$
$$\zeta=p\frac{\partial\omega}{\partial p}+q\frac{\partial\omega}{\partial q}-\omega,$$

where the function ω is quite arbitrary. If ω is zero the transformation is the identical transformation, but for any value of ω other than zero an actual transformation distinct from identity arises. Every infinitesimal contact-transformation is thus completely defined by a function ω of the variables, which is called its characteristic function. It will be noticed that ξ, η and ζ are independent of p and q if, and only if, ω is linear in p and q. In these cases only is the transformation an ordinary point-transformation.

If

$$\xi\frac{\partial}{\partial x}+\eta\frac{\partial}{\partial y}+\zeta\frac{\partial}{\partial z}$$

is an infinitesimal point-transformation in three-dimensional space, so that ξ, η, ζ are functions of x, y, z only, the characteristic function for the transformation regarded as a contact-transformation is

$$p\xi+q\eta-\zeta.$$

Hence

$$\pi=\frac{\partial\zeta}{\partial x}+p\left(\frac{\partial\zeta}{\partial z}-\frac{\partial\xi}{\partial x}\right)-q\frac{\partial\eta}{\partial x}-pq\frac{\partial\eta}{\partial z}-p^2\frac{\partial\xi}{\partial z},$$
$$\kappa=\frac{\partial\zeta}{\partial y}-p\frac{\partial\xi}{\partial y}+q\left(\frac{\partial\zeta}{\partial z}-\frac{\partial\eta}{\partial y}\right)-pq\frac{\partial}{\partial z}-q^2\frac{\partial\eta}{\partial z},$$

and these expressions give the infinitesimal changes that arise in p and q from the point-transformation. As a transformation of the five variables the point-transformation may be written

$$\xi\frac{\partial}{\partial x}+\eta\frac{\partial}{\partial y}+\zeta\frac{\partial}{\partial z}+\pi\frac{\partial}{\partial p}+\kappa\frac{\partial}{\partial q},$$

and this is called the *extended* point-transformation.

Since a contact-transformation in space of n dimensions may be regarded as a point-transformation in space of $2n+1$ dimensions, which leaves invariant the equation

$$dz-pdx,-\ldots-p_n dx_n=0,$$

two contact-transformations carried out in succession give rise to another contact-transformation. Hence arises naturally the conception of a group of contact-transformations. Thus the totality of the transformations that arise on repeating an infinitesimal contact-transformation constitutes a (continuous) cyclical group. For example, if the characteristic function of the infinitesimal transformation is $\sqrt{1+p^2+q^2}$, the finite equations of the resulting cyclical group are

$$x' = x + \frac{pt}{\sqrt{1+p^2+q^2}},\ y' = y + \frac{qt}{\sqrt{1+p^2+q^2}},\ z' = z - \frac{t}{\sqrt{1+p^2+q^2}},$$
$$p' = p, \quad q' = q;$$

where t is the arbitrary parameter.

The formal theory of continuous groups of contact-transformations is, of course, in no way distinct from the formal theory of continuous groups in general. On what may be called the geometrical side, the theory of groups of contact-transformations has been developed with very considerable detail in the second volume of Lie-Engel; and to this work the reader may be referred. As an example of the way in which a continuous group may be defined by a system of differential equations we will conclude the present section by the determination of those contact-transformations in the plane for which the equation

$$\frac{d^3y}{dx^3} = 0$$

is invariant. Let

$$\xi\frac{\partial}{\partial x} + \eta\frac{\partial}{\partial y} + \omega\frac{\partial}{\partial p}$$

be an infinitesimal contact-transformation, and let $\kappa\tau$ and $\rho\tau$, where τ is infinitesimal, be the increments of $\frac{d^2y}{dx^2}$ and $\frac{d^3y}{dx^3}$, or of q and r. Then

$$q + \kappa\tau = \frac{d(p+\omega\tau)}{d(x+\xi\tau)}$$
$$= q + (\omega_x + \omega_y p + \omega_p q - \xi_x q - \xi_y pq - \xi_p q^2)\tau,$$

or

$$\kappa = \omega_x + \omega_y p + \omega_p q - \xi_x q - \xi_y pq - \xi_p q^2,$$

where the suffixes denote partial differentiation. So

$$r + \rho\tau = \frac{d(q+\kappa\tau)}{d(x+\xi\tau)},$$

and

$$\rho = \kappa_x + \kappa_y p + \kappa_p q + \kappa_q r - \xi_x r - \xi_y rp - \xi_p rq.$$

If the equation

$$r = 0$$

is to be invariant for the given infinitesimal transformation, then $\rho = 0$ must be a consequence of $r = 0$. Hence

$$\kappa_x + \kappa_y p + \kappa_p q = 0.$$

In this equation the coefficient of each power of q must vanish. Hence

$$\xi_{pp} = 0,\ \omega_{xx} + 2p\omega_{xy} + p^2\omega_{yy} = 0,$$
$$\omega_y + 2\omega_{xp} + 2p\omega_{yp} - \xi_{xx} - 2p\xi_{xy} - p^2\xi_{yy} = 0,$$
$$-\xi_y + \omega_{pp} - 2\xi_{xp} - 2p\xi_{yp} = 0.$$

If W is the characteristic function of the infinitesimal transformation, then

$$\xi = \mathrm{W}_p,\ \omega = -\mathrm{W}_x - p\mathrm{W}_y;$$

and when expressed in terms of W the four equations become

$$\frac{\partial^3\mathrm{W}}{\partial p^3} = 0,\ \left(\frac{\partial}{\partial x} + p\frac{\partial}{\partial y}\right)^3\mathrm{W} = 0,$$
$$\frac{\partial^2\mathrm{W}}{\partial y\partial p} + \left(\frac{\partial}{\partial x} + p\frac{\partial}{\partial y}\right)\frac{\partial^2\mathrm{W}}{\partial p^2} = 0,$$
$$\left(\frac{\partial}{\partial x} + p\frac{\partial}{\partial y}\right)\frac{\partial}{\partial p}\left(\frac{\partial}{\partial x} + p\frac{\partial}{\partial y}\right)\mathrm{W} = 0.$$

From the first and third of these equations it immediately follows that

$$\mathrm{W} = \tfrac{1}{2}p^2\mathrm{X}_1 + p\left(\mathrm{X}_2 - y\frac{d\mathrm{X}_1}{dx}\right) + f(x, y),$$

where X_1 and X_2 are functions of x only. The fourth equation then gives

$$f(x, y) = y^2\frac{d^2\mathrm{X}_1}{dx^2} + y\mathrm{X}_3 + \mathrm{X}_4,$$

and the second equation leads to

$$\frac{d^3\mathrm{X}_1}{dx^3} = 0,\ \frac{d^3\mathrm{X}_2}{dx^3} = 0,\ \frac{d^3\mathrm{X}_4}{dx^3} = 0,\ \frac{d\mathrm{X}_3}{dx} + \frac{d^2\mathrm{X}_2}{dx^2} = 0.$$

Hence W contains ten arbitrary constants, and in fact it is found on completing the calculation that W is an arbitrary integral function of the second degree of x, p, and $y - \frac{1}{2}px$.

The most general infinitesimal contact-transformation, for which the equation $r = 0$ is invariant, therefore contains 10 arbitrary constants; and the totality of such operations constitutes a continuous group of order 10. It should be noticed that that part of ω which does not contain p^2 has 7 arbitrary constants, so that the greatest group of point-transformations in the plane for which $r = 0$ is invariant has 7 for its order.

Applications of the theory of continuous groups.

To the manifold applications of the theory of continuous groups in various branches of pure and applied mathematics it is impossible here to refer in any detail. It must suffice to indicate a few of them very briefly. In some of the older theories a new point of view is obtained which presents the results in a fresh light, and suggests the natural generalization. As an example, the theory of the invariants of a binary form may be considered.

If in the form

$$f = a_0x^n + na_1x^{n-1}y + \dots + a_ny^n,$$

the variables be subjected to a homogeneous substitution

$$x' = \alpha x + \beta y, \quad y' = \gamma x + \delta y, \qquad \text{(i.)}$$

and if the coefficients in the new form be represented by accenting the old coefficients, then

$$\left.\begin{aligned} a'_0 &= a_0\alpha^n + a_1n\alpha^{n-1}\gamma + \dots + a_n\gamma^n, \\ a'_1 &= a_0\alpha^{n-1}\beta + a_1(\overline{n-1}\,\alpha^{n-2}\beta\gamma + \alpha^{n-1}\delta) + \dots + a_n\gamma^{n-1}\delta, \\ &\cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \\ a'_n &= a_0\beta^n + a_1n\beta^{n-1}\delta + \dots + a_n\delta^n; \end{aligned}\right\}\text{(ii.)}$$

and this is a homogeneous linear substitution performed on the coefficients. The totality of the substitutions (i.), for which $\alpha\delta - \beta\gamma = 1$, constitutes a continuous group of order 3, which is generated by the two infinitesimal transformations

$$y\frac{\partial}{\partial x} \text{ and } x\frac{\partial}{\partial y}.$$

Hence with the same limitations on α, β, γ, δ the totality of the substitutions (ii.) forms a simply isomorphic continuous group of order 3, which is generated by the two infinitesimal transformations

$$a_0\frac{\partial}{\partial a_1} + 2a_1\frac{\partial}{\partial a_2} + 3a_2\frac{\partial}{\partial a_3} + \dots + na_{n-1}\frac{\partial}{\partial a_n},$$

and

$$na_1\frac{\partial}{\partial a_0} + \overline{n-1}\,a_2\frac{\partial}{\partial a_1} + \overline{n-2}\,a_3\frac{\partial}{\partial a_2} + \dots + a_n\frac{\partial}{\partial a_{n-1}}.$$

The invariants of the binary form, *i.e.*, those functions of the coefficients which are unaltered by all homogeneous substitutions on x, y of determinant unity, are therefore identical with the functions of the coefficients which are invariant for the continuous group generated by the two infinitesimal operations last written. In other words, they are given by the common solutions of the differential equations

$$a_0\frac{\partial f}{\partial a_1} + 2a_1\frac{\partial f}{\partial a_2} + 3a_2\frac{\partial f}{\partial a_3} + \dots = 0,$$
$$na_1\frac{\partial f}{\partial a_0} + \overline{n-1}\,a_2\frac{\partial f}{\partial a_1} + \overline{n-2}\,a_3\frac{\partial f}{\partial a_2} + \dots = 0.$$

Both this result and the method by which it is arrived at are well known, but the point of view by which we pass from the transformation group of the variables to the isomorphic transformation group of the coefficients, and regard the invariants as invariants rather of the group than of the forms, is a new and a fruitful one.

The general theory of curvature of curves and surfaces may in a similar way be regarded as a theory of their

invariants for the group of motions. That something more than a mere change of phraseology is here implied will be evident in dealing with minimum curves, *i.e.*, with curves such that at every point of them

$$dx^2 + dy^2 + dz^2 = 0.$$

For such curves the ordinary theory of curvature has no meaning, but they nevertheless have invariant properties in regard to the group of motions.

The curvature and torsion of a curve, which are invariant for all transformations by the group of motions, are special instances of what are known as *differential invariants*. If

$$\xi \frac{\partial}{\partial x} + \eta \frac{\partial}{\partial y}$$

is the general infinitesimal transformation of a group of point-transformations in the plane, it has been already seen how to extend the transformation so as to indicate its effect on the successive differential coefficients $y_1, y_2, \ldots$ of y. If

$$\xi \frac{\partial}{\partial x} + \eta \frac{\partial}{\partial y} + \eta_1 \frac{\partial}{\partial y_1} + \eta_2 \frac{\partial}{\partial y_2} + \cdots$$

be the extended transformation, it may be regarded as a transformation of the variables

$$x, y, y_1, y_2, \ldots$$

By including a sufficient number of these variables the group must be intransitive in them, and must therefore have one or more invariants. Such invariants are known as differential invariants of the original group, being necessarily functions of the differential coefficients of the original variables. For groups of the plane it may be shown that not more than two of these differential invariants are independent, all others being formed from these by algebraical processes and differentiation. For groups of point-transformations in more than two variables there will be more than one set of differential invariants. For instance, with three variables, one may be regarded as independent, and the other two as functions of it, or two as independent and the remaining one as a function. Corresponding to these two points of view, the differential invariants for a curve or for a surface will arise.

If a differential invariant of a continuous group of the plane be equated to zero, the resulting differential equation remains unaltered when the variables undergo any transformation of the group. Conversely, if an ordinary differential equation

$$f(x, y, y_1, y_2, \ldots) = 0$$

admits the transformations of a continuous group, *i.e.*, if the equation is unaltered when x and y undergo any transformation of the group, then $f(x, y, y_1, y_2, \ldots)$ or some multiple of it must be a differential invariant of the group. Hence it must be possible to find two independent differential invariants α, β of the group, such that when these are taken as variables the differential equation takes the form

$$\mathrm{F}\left(\alpha, \beta, \frac{d\beta}{d\alpha}, \frac{d^2\beta}{d\alpha^2}, \ldots\right) = 0.$$

This equation in α, β will be of lower order than the original equation, and in general simpler to deal with. Supposing it solved in the form

$$\beta = \phi(\alpha),$$

where for α, β their values in terms of $x, y, y_1, y_2, \ldots$ are written, this new equation, containing arbitrary constants, is necessarily again of lower order than the original equation. The integration of the original equation is thus divided into two steps. This will show how, in the case of an ordinary differential equation, the fact that the equation admits a continuous group of transformations may be taken advantage of for its integration.

The most important of the applications of continuous groups are to the theory of systems of differential equations, both ordinary and partial; in fact, Lie states that it was with a view to systematizing and advancing the general theory of differential equations that he was led to the development of the theory of continuous groups. It is quite impossible here to give any account of all that Lie and his followers have done in this direction. An entirely new mode of regarding the problem of the integration of a differential equation has been opened up, and in the classification that arises from it all those apparently isolated types of equations which in the older sense are said to be integrable take their proper place. It may, for instance, be mentioned that the question as to whether Monge's method will apply to the integration of a partial differential equation of the second order is shown to depend on whether or not a contact-transformation can be found which will reduce the equation to either

$$\frac{\partial^2 z}{\partial x^2} = 0 \text{ or } \frac{\partial^2 z}{\partial x \partial y} = 0.$$

It is in this direction that further advance in the theory of partial differential equations must be looked for. Lastly, it may be remarked that one of the most thorough discussions of the axioms of geometry hitherto undertaken is founded entirely upon the theory of continuous groups.

Discontinuous Groups.

We go on now to the consideration of discontinuous groups. Although groups of finite order are necessarily contained under this general head, it is convenient for many reasons to deal with them separately, and it will therefore be assumed in the present section that the number of operations in the group is not finite. Many large classes of discontinuous groups have formed the subject of detailed investigation, but a general formal theory of discontinuous groups can hardly be said to exist as yet. For instance, there is in this connexion no system of theorems concerning possible types of simple groups analogous to those stated above for continuous groups. In fact no discontinuous group (with a finite number of independent generating operations), whose order is not finite, has yet been recognized as a simple group; though, on the other hand, the non-existence of such simple discontinuous groups, if true, has still to be demonstrated. It will thus be obvious that in considering discontinuous groups it is necessary to proceed on different lines from those followed with continuous groups, and in fact to deal with the subject almost entirely by way of example. An operation of a discontinuous group must necessarily be specified analytically by a system of equations of the form

$$x'_s = f_s(x_1, x_2, \ldots, x_n;\ a_1, a_2, \ldots, a_r) \qquad \text{(i.)}$$
$$(s = 1, 2, \ldots, n),$$

Properly and improperly discontinuous groups.

and the different operations of the group will be given by different sets of values of the parameters $a_1, a_2, \ldots, a_r$. No one of these parameters is susceptible of continuous variations, but at least one must be capable of taking a number of values which is not finite, if the group is not one of finite order. If $b_1, b_2, \ldots, b_r$ is another set of values of the parameters, then the result of eliminating $x'_1, x'_2, \ldots, x'_n$ between (i.) and

$$x''_s = f_s(x'_1, x'_2, \ldots, x'_n;\ b_1, b_2, \ldots, b_r)$$
$$(s = 1, 2, \ldots, n)$$

must lead to

$$x''_s = f_s(x_1, x_2, \ldots, x_n;\ c_1, c_2, \ldots, c_r),$$
$$(s = 1, 2, \ldots, n),$$

where $c_1, c_2, \ldots, c_r$ is a third set of admissible values of the parameters. Among the sets of values of the para-

meters there must be one which gives the identical transformation. No other transformation makes each of the differences $x'_1 - x_1$, $x'_2 - x_2, \ldots, x'_n - x_n$ vanish. Let d be an arbitrary assigned positive quantity. Then if a transformation of the group can be found such that the modulus of each of these differences is less than d when the variables have arbitrary values within an assigned range of variation, however small d may be chosen, the group is said to be *improperly* discontinuous. In the contrary case the group is called *properly* discontinuous. The range within which the variables are allowed to vary may clearly affect the question whether a given group is properly or improperly discontinuous. For instance, the group defined by the equation

$$x' = ax + b,$$

where a and b are any rational numbers, is improperly discontinuous; and the group defined by

$$x' = x + a,$$

where a is an integer, is properly discontinuous, whatever the range of the variable. On the other hand, the group, to be later considered, defined by the equation

$$x' = \frac{ax+b}{cx+d},$$

where a, b, c, d are integers satisfying the relation

$$ad - bc = 1,$$

is properly discontinuous when x may take any complex value, and improperly discontinuous when the range of x is limited to real values.

Among the discontinuous groups that occur in analysis, a large number may be regarded as arising by imposing limitations on the range of variation of the parameters of continuous groups. If

$$x'_s = f_s(x_1, x_2, \ldots, x_n; a_1, a_2, \ldots, a_r), \quad \text{(i.)}$$
$$(s = 1, 2, \ldots, n),$$

are the finite equations of a continuous group, and if C with parameters $c_1, c_2, \ldots, c_r$ is the operation which results from carrying out A and B with corresponding parameters in succession, then the c's are determined uniquely by the a's and the b's. If the c's are rational functions of the a's and b's, and if the a's and b's are arbitrary rational numbers of a given corpus (see NUMBER), the c's will be rational numbers of the same corpus. If the c's are rational integral functions of the a's and b's, and the latter are arbitrarily chosen integers of a corpus, then the c's are integers of the same corpus. Hence in the first case the equations (i.), when the a's are limited to be rational numbers of a given corpus, will define a discontinuous group; and in the second case they will define such a group when the a's are further limited to be integers of the corpus. A most important class of discontinuous groups are those that arise in this way from the general linear continuous group in a given set of variables. For n variables the finite equations of this continuous group are

Linear discontinuous groups.

$$x'_s = a_{s1}x_1 + a_{s2}x_2 + \ldots + a_{sn}x_n, \quad \text{(ii.)}$$
$$(s = 1, 2, \ldots, n),$$

where the determinant of the a's must not be zero. In this case the c's are clearly integral lineo-linear functions of the a's and b's. Moreover, the determinant of the c's is the product of the determinant of the a's and the determinant of the b's. Hence equations (ii.), where the parameters are restricted to be integers of a given corpus, define a discontinuous group; and if the determinant of the coefficients is limited to the value unity, they define a discontinuous group which is a (self-conjugate) subgroup of the previous one.

The simplest case which thus presents itself is that in which there are two variables while the coefficients are rational integers. This is the group defined by the equations

$$\left.\begin{aligned} x' &= ax + by, \\ y' &= cx + dy, \end{aligned}\right\} \quad \text{(iii.)}$$

where a, b, c, d are integers such that

$$ad - bc = 1.$$

To every operation of this group there corresponds an operation of the set defined by

$$z' = \frac{az+b}{cz+d}, \quad \text{(iv.)}$$

in such a way that to the product of two operations of the group there corresponds the product of the two analogous operations of the set. The operations of the set (iv.), where $ad - bc = 1$, therefore constitute a group which is isomorphic with the previous group. The isomorphism is multiple, since to a single operation of the second set there correspond the two operations of the first for which a, b, c, d and $-a$, $-b$, $-c$, $-d$ are parameters. These two groups, which are of fundamental importance in the theory of quadratic forms and in the theory of modular functions, have been the object of very many investigations. From the present point of view they may be used to illustrate how, by further limitations on the parameters, subgroups of a discontinuous group arise.

If a'', b'', c'', d'' are the parameters of the operation which results from carrying out in succession those with parameters a, b, c, d and a', b', c', d', then

$$\begin{aligned} a'' &= aa' + b'c, \\ b'' &= a'b + b'd, \\ c'' &= ac' + cd', \\ d'' &= bc' + dd'. \end{aligned}$$

Hence if

$$a \equiv d \equiv a' \equiv d' \equiv 1, \text{ mod. } n$$
$$b \equiv c \equiv b' \equiv c' \equiv 0,$$

then

$$a'' \equiv d'' \equiv 1,\ b'' \equiv c'' \equiv 0, \text{ mod. } n.$$

The totality of the operations of either group for which a and d are congruent to unity, while b and c are congruent to zero, mod. n, therefore constitutes a subgroup; and it is easy to verify that this subgroup is a self-conjugate subgroup. Again, the totality of the operations for which b is zero constitutes a subgroup; as also do those for which c is zero. These are not self-conjugate subgroups.

Another point of fundamental importance in connexion with discontinuous groups may be illustrated by the groups here under consideration. For each of them a pair of operations may be found such that every operation of the group can be formed by the combination and repetition of the two. It may, in fact, be easily verified that

Generating operations.

$$\begin{aligned} x' &= x + y, \\ y' &= y, \end{aligned} \quad \text{and} \quad \begin{aligned} x' &= -y, \\ y' &= x, \end{aligned}$$

is such a pair of operations for the first group, while

$$z' = z + 1, \text{ and } z' = -\frac{1}{z},$$

is the corresponding pair for the second. As has been already stated, such a set of operations is called a set of generating operations for the group; and when, as in the present instance, no one of them can be formed from the remaining ones, the generating operations are said to be independent. Such a set of necessity exists for every discontinuous group, but their number is not necessarily finite. Moreover, except in the case of a cyclical group, which is formed by the repetition of a single operation, such a set of generating operations is

never unique; for if A, B, C,... generate the group, so also do either A, AB, AC,... ; or $S^{-1}AS$, $S^{-1}BS$, $S^{-1}CS$,... where S is any operation of the group.

The consideration of a discontinuous group as arising from a set of independent generating operations suggests a purely abstract point of view in which any two simply isomorphic groups are indistinguishable. The number of generating operations may be either finite or infinite, but the former case alone will be here considered. Suppose then that

$$S_1, S_2, \ldots, S_n$$

is a set of independent operations from which a group G is generated. The general operation of the group will be represented by the symbol

$$S_a^\alpha S_b^\beta \ldots S_d^\delta, \text{ or } \Sigma,$$

where $a, b, \ldots, d$ are chosen from $1, 2, \ldots, n$, and $\alpha, \beta, \ldots, \delta$ are any positive or negative integers. It may be assumed that no two successive suffixes in Σ are the same, for if $b=a$, then $S_a^\alpha S_b^\beta$ may be replaced by $S_a^{\alpha+\beta}$. If there are no relations connecting the generating operations and the identical operation, every distinct symbol Σ represents a distinct operation of the group. For if

$$\Sigma = \Sigma_1,$$

or

$$S_a^\alpha S_b^\beta \ldots S_d^\delta = S_{a_1}^{\alpha_1} S_{b_1}^{\beta_1} \ldots S_{d_1}^{\delta_1},$$

then

$$S_{d_1}^{-\delta_1} \ldots S_{b_1}^{-\beta_1} S_{a_1}^{-\alpha_1} S_a^\alpha S_b^\beta \ldots S_d^\delta = 1\ ;$$

and unless

$$\begin{matrix} a=a_1, & b=b_1, \\ \alpha=\alpha_1, & \beta=\beta_1, \end{matrix} \ \&c.,$$

this is a relation connecting the generating operations.

Suppose now that $T_1, T_2, \ldots$ are operations of G, and that H is that self-conjugate subgroup of G which is generated by $T_1, T_2, \ldots$ and the operations conjugate to them. Then, of the operations that can be formed from

$$S_1, S_2, \ldots, S_n,$$

the set ΣH, and no others, reduce to the same operation Σ when the conditions

$$T_1 = 1,\ T_2 = 1, \ldots$$

are satisfied by the generating operations. Hence the group which is generated by the given operations, when subjected to the conditions just written, is simply isomorphic with the factor-group G/H. Moreover, this is obviously true even when the conditions are such that the generating operations are no longer independent. Hence any discontinuous group may be defined abstractly, that is, in regard to the laws of combination of its operations apart from their actual form, by a set of generating operations and a system of relations connecting them. Conversely, when such a set of operations and system of relations are given arbitrarily they define in abstract form a single discontinuous group. It may, of course, happen that the group so defined is a group of finite order, or that it reduces to the identical operation only; but in regard to the general statement these will be particular and exceptional cases.

As an example of this abstract mode of defining a group, the group generated by

$$z' = z + 1,\ z' = -\frac{1}{z}$$

may be considered. If these operations are represented by S_1 and S_2, the operation S_1S_2 or

$$z' = \frac{-1}{z+1}$$

is an operation of order three; while S_2 itself is an operation of order two. Among the relations which S_1 and S_2 must satisfy, there must therefore occur

$$(S_1S_2)^3 = 1,\ S_2{}^2 = 1\ ;$$

and these are in fact sufficient. The proof of this statement will occur more naturally later.

We shall now proceed to consider shortly certain special classes of discontinuous groups which occur in plane geometry, and in the theory of functions of a single variable. In the first place, the properly discontinuous groups of motions in a plane will be investigated.

Discontinuous groups of motions.

Any set of finite displacements in a plane generate, by their combination and repetition, a group of motions; but such a group will in general be improperly discontinuous. If the group leaves one point unchanged it must consist of rotations round this point; and it will be either a group of finite order or improperly discontinuous. If it leaves no point unaltered it must contain operations arising from equal and opposite rotations about different points, *i.e.*, it must contain translations. A properly discontinuous group of motions in the plane whose order is not finite must therefore contain translations. If the axis of x be taken parallel to the direction of a translation, and if a be the magnitude of the smallest translation in the group, parallel to the axis of x, then

$$x' = x + ma,\ y' = y,$$

or

$$z' = z + ma,$$

where

$$z = x + iy,$$

represents the cyclical subgroup generated by the translation a.

Suppose first that the group contains no other translations than these. If it contain rotations, the origin may be chosen so as to be the fixed point of a rotation. If α is the angle, the rotation is represented by

$$x' = x\cos\alpha - y\sin\alpha,\ y' = x\sin\alpha + y\cos\alpha,$$

or

$$z' = e^{i\alpha}z.$$

If the translation be represented by T and the rotation by R, then $R^{-1}TR$ is

$$z = z + ae^{i\alpha},$$

a translation in a direction inclined at an angle α to the axis of a. Hence α must be π, and the rotation must be through two right angles. A second rotation R′, with h, k for a fixed point, contained in the group, is represented by

$$z' - h - ik = -(z - h - ik)\ ;$$

and RR′ is

$$z' = z + 2(h + ik).$$

Hence k must be zero, and $2h$ a multiple of a, or

$$R' = T^{-n}RT^n$$

where n is some integer.

It follows that when there is a single set of translations the group must be either

(i.) . . . $z' = z + ma$,

or

(ii.) . . . $z' = \pm z + ma$.

Suppose next that the group contains translations in more than one direction. It may then be assumed without loss of generality that the subgroup formed of its translations, since it is properly discontinuous, is generated by

$$z' = z + a,\ z' = z + be^{i\beta}.$$

If

$$z' = z + ce^{i\gamma}$$

is any other translation of the group, it must be possible to find integers m and n such that

$$ce^{i\gamma} = ma + nbe^{i\beta}.$$

Let R be a rotation of the group whose angle is α, and whose fixed point may be taken to be the origin. Then if T is the general translation $R^{-p}TR^{p}$, or

$$z' = z + mae^{ip\alpha} + nbe^{i(p\alpha+\beta)}$$

is a translation belonging to the group. Hence, whatever integers m and n and p may be, it must be possible to find two integers m' and n', such that

$$m'a + n'be^{i\beta} = mae^{ip\alpha} + nbe^{i(p\alpha+\beta)}.$$

A discussion of this relation will show that if a and b are unequal α must be π. If, however, a and b are equal, the further values $\beta = \frac{\pi}{2}$, $\alpha = \frac{\pi}{2}$; $\beta = \frac{2\pi}{3}$, $\alpha = \frac{2\pi}{3}$; $\beta = \frac{2\pi}{3}$, $\alpha = \frac{\pi}{3}$, are admissible. It may be shown, as in the former case, that if R′ is another rotation of the group, then R′ is the result of transforming R (or one of its powers) by a suitable translation. The remaining types of properly discontinuous groups of motions in the plane may now be written down. They are

(iii.) . . $z' = z + ma + nbe^{i\beta}$,

(iv.) . . $z' = \pm z + ma + nbe^{i\beta}$,

(v.) . . $z' = e^{\frac{ip\pi}{2}} z + (m + in)a$,

(vi.) . . $z' = e^{\frac{2ip\pi}{3}} z + \left(m + ne^{\frac{2i\pi}{3}}\right)a$,

(vii.) . . $z = e^{\frac{ip\pi}{3}} z + \left(m + ne^{\frac{2i\pi}{3}}\right)a$,

where m, n, p, are any integers.

In connexion with each of these groups the whole plane may be divided into congruent portions which are interchanged among themselves by the operations of the group. In the simpler cases this is obvious. For instance, for the group (iii.) the parallelograms into which the plane is divided by the lines

$$y = mb \sin \beta,$$
$$x \sin \beta - y \cos \beta = na \sin \beta,$$

m and n taking all integral values, are clearly such a set of regions. In general such regions may be constructed as follows:—Let P be any point in the plane and P′, P″,... the points to which the various operations of the group displace P. With P, P′, P″,... as centres, suppose circles to be described with the same radius, this being taken at first so small that no two circles meet. Let the radii increase at the same rate, continuing to do so till the circles begin to meet. Wherever the circles meet let the radii cease increasing. In this way a region will be formed round each of the points P, P′, P″,... bounded by straight lines. From their mode of formation these regions are necessarily all congruent; and the operations of the group, which interchange the points P, P′, P″,... among themselves, also interchange the regions. The regions thus constructed are susceptible of an infinite variety of form owing to the arbitrary position of P. No two points in any one region can be displaced, the one into the other, by an operation of the group; and corresponding to any given point within one region there is just one point within any other region to which it may be brought by an operation of the group. Any one region with these properties is called a *fundamental* region for the group; and the same phrase is used in connexion with discontinuous groups of plane and space transformations other than groups of motions. For an improperly discontinuous group no region of finite size exists with the properties of a fundamental region.

Discontinuous groups arising from inversions.

As a second class of examples certain groups of the plane will be considered which arise from the plane transformation known as inversion. Let $A_1A_2\ldots A_n$ be a polygon whose sides are circular arcs, and suppose that each of the internal angles of the polygon is either a submultiple of two right angles or zero. If this polygon be inverted at one of its sides A_1A_2, a new polygon is formed with the same properties as the original, and having the side A_1A_2 only in common with it. The result of inverting at any one of the sides of the new polygon is equivalent to that of successive inversions at three (properly chosen) sides of the original polygon. Suppose now that new polygons are continually formed by inverting those already constructed at their sides. From the mode of formation, no two polygons thus constructed can have any area in common unless they coincide entirely. The original polygon is therefore a fundamental region for the group generated by inversions at its sides; and this group is therefore a properly discontinuous group. Let the polygons be divided into two sets such that the fundamental polygon and all that are derived from it by an even number of inversions form the first set, while those derived from the fundamental polygon by an odd number of inversions form the second. Then both the first set and the second set of polygons are changed into itself by any operation of the group which is given by an even number of inversions. The totality of the operations which arise from an even number of inversions at the sides of the fundamental polygon therefore constitutes a discontinuous group G for which the region formed by the original polygon and its inverse at A_1A_2 is a fundamental region. If

$$R_1, R_2, \ldots, R_n$$

represent inversions at the sides

$$A_1A_2, A_2A_3, \ldots, A_nA_1$$

of the original polygon, the group G can be generated by the operations

$$R_nR_1, R_1R_2, \ldots, R_{n-2}R_{n-1},$$

or

$$S_1, S_2, \ldots, S_{n-1};$$

since from these any operation consisting of an even number of inversions can clearly be constructed. Now an inversion at a circle whose centre is (a_1, b_1) and radius c_1 is given analytically by the equations

$$\frac{x'-a_1}{x-a_1} = \frac{y'-b_1}{y-b_1} = \frac{c_1^2}{(x-a_1)^2+(y-b_1)^2}.$$

If

$$x + iy = z, \; a_1 + ib_1 = \alpha_1,$$
$$x - iy = \bar{z}, \; a_1 - ib_1 = \bar{\alpha}_1,$$

these are equivalent to the single equation

$$z' - \alpha_1 = \frac{c_1^2}{\bar{z} - \bar{\alpha}_1};$$

and similarly an inversion at a second circle is given by

$$z' - \alpha_2 = \frac{c_2^2}{\bar{z} - \bar{\alpha}_2}.$$

Hence the plane transformation that arises from the two inversions performed successively is

$$z' = \alpha_2 + \frac{c_2^2}{\bar{\alpha}_1 - \bar{\alpha}_2 + \dfrac{c_1^2}{z - \alpha_1}}$$

or

$$z' = \frac{\alpha z + \beta}{\gamma z + \delta}$$

where α, β, γ, δ are constants (in general complex) depending on the two circles. The generating operations $S_r (r = 1, 2, \ldots, n-1)$ of the group G are therefore $n-1$ fractional linear substitutions

$$z' = \frac{\alpha_r z + \beta_r}{\gamma_r z + \delta_r},\ (r = 1, 2, \ldots, n-1)$$

performed on the variable z; and since any two linear substitutions performed successively lead to another linear substitution, every operation of the group will be represented by a linear substitution. The linear substitution that results from successive inversions at two circles which intersect at an angle π/m, where m is an integer, is an operation of finite order m. Hence if

$$\frac{\pi}{m_1}, \frac{\pi}{m_2}, \ldots, \frac{\pi}{m_{n-1}}$$

are the internal angles of the original polygon at $A_1, A_2, \ldots, A_{n-1}$, the generating operations of the group are subject to the relations

$$S_1^{m_1} = 1,\ S_2^{m_2} = 1, \ldots, S_{n-1}^{m_{n-1}} = 1.$$

The operation consisting of successive inversions at A_nA_1 and $A_{n-1}A_n$ is represented in terms of the generating operations by $S_1S_2\ldots S_{n-1}$. Hence, if π/m_n is the internal angle of the polygon at A_n,

$$(S_1S_2\ldots S_{n-1})^{m_n} = 1.$$

If the fundamental polygon be taken to correspond to the identical operation, then each polygon in the figure will correspond to that operation of the group which transforms the fundamental polygon into it. The polygon which corresponds to any operation $S_a^\alpha S_b^\beta\ldots$ of the group may be found by drawing a line from the fundamental polygon to the polygon S_a^α; continuing it from the polygon S_a^α to that into which S_b^β transforms it, and so on. To any further relation between the generating operations, such as

$$S_a^\alpha S_b^\beta \ldots S_a^\delta = 1,$$

will correspond a closed path returning to the fundamental polygon. But any such closed path may be continuously deformed, without crossing any of the angular points, into a series of loops surrounding the angular points; and, therefore, any such relation is a consequence of the relations giving the periods of the generating operations and of their product $S_1S_2\ldots S_{n-1}$. The n relations

$$S_1^{m_1} = 1,\ S_2^{m_2} = 1, \ldots, S_{n-1}^{m_{n-1}} = 1,\ (S_1S_2\ldots S_{n-1})^{m_n} = 1,$$

therefore completely define the group. If one or more of the internal angles of the polygon are zero, the number of the relations will be diminished. In the extreme case when all the angles are zero the figure will represent graphically a perfectly general discontinuous group generated by $n-1$ operations which are subject to no relations.

As a particular example, the analytical form of the group will be calculated when the polygon is a triangle whose angles are 0, $\pi/2$, and $\pi/3$. The sides A_3A_1, A_1A_2, A_2A_3 of such a triangle may be taken to be

$$2x + 1 = 0,\ x = 0,\ x^2 + y^2 - 1 = 0$$

respectively. The operations R_1, R_2, R_3 are then

$$z' = -\bar{z},\ z' = \frac{1}{\bar{z}},\ z' = -1 - \bar{z};$$

and the operations S_1, S_2 are

$$z' = z + 1,\ z' = \frac{-1}{z}.$$

Moreover, the group is abstractly defined by the relations

$$S_2^2 = 1,\ (S_1S_2)^3 = 1.$$

It has been already seen that the operations S_1 and S_2 generate the discontinuous group constituted of all substitutions of the form

$$z' = \frac{az + b}{cz + d},$$

where a, b, c, d are integers for which

$$ad - bc = 1.$$

The geometrical origin now obtained for this group makes it clear that, when z is regarded as a complex variable, the group is properly discontinuous, and that the necessary and sufficient defining relations of the group are those previously stated. The class of properly discontinuous groups of linear substitutions here considered is only one from an infinite variety of such classes; and it has been chosen rather for the extreme simplicity of its geometrical form than for any other reason. For a more complete discussion the reader is referred to the memoirs of Poincaré and Klein mentioned later.

Returning now for a time to the discontinuous groups of motions in the plane, it is to be noticed that each one underlies and, in fact, is fundamental in the theory of a corresponding set of functions. In regard to any group of transformations of a single variable, the question may be asked, "What function of the variable is invariant for all the transformations of the group?" If the group is continuous or improperly discontinuous the only invariant uniform function is a constant. But if the group is properly discontinuous, invariant uniform functions other than constants will always exist. Thus for the group

$$z' = z + ma$$

any simply periodic function of period a is invariant, and for the group

$$z' = z + ma + nbe^{i\beta}$$

any doubly periodic function with a and $be^{i\beta}$ for its periods is invariant. In a similar way, to every properly discontinuous group of fractional linear substitutions there corresponds a class of uniform functions which are invariant for all substitutions of the group. These are the so-called automorphic functions. For the particular group generated by

$$z' = z + 1,\ z' = -\frac{1}{z}$$

the simplest automorphic function is the absolute invariant of a non-singular cubic curve for which z represents the ratio of the periods of the associated elliptic functions; and this group is therefore fundamental in the theory of the modular functions.

For space of three dimensions the theories, analogous to those that have been described for the plane, are, as is to be expected, more complicated. The investigation of the properly discontinuous groups of motions in space has been carried out completely, and forms the mathematical basis for the theory of crystallography. The result arrived at is that there are 65 distinct types of such groups. In their analytical form these groups must be represented as linear transformations of a set of three real variables; and they cannot, except in the cases already dealt with, be represented as transformations of one or of two variables. No detailed account of discontinuous groups of space transformations which arise from inversions can be entered on here, but their importance may be made clear by a simple illustration. The discontinuous group that arises from inversions at a given set of circles in a plane is simply isomorphic with that which arises from inversions at the spheres which have their centres in the plane and pass through the given circles. Now the group of space transformations arising from the spheres may be properly discontinuous though the group of plane transformations is not. For instance, if the circles in the plane are the three sides of an equilateral triangle and the circumscribing circle, the group of plane transformations is improperly

discontinuous. The corresponding spheres (three of them being in this case planes) meet in a spherical tetrahedron all of whose dihedral angles are $\pi/3$; and the group of space transformations is therefore properly discontinuous.

The special classes of discontinuous groups that have been so far dealt with arise directly from geometrical considerations. As a final example we shall refer briefly to a class of groups whose origin is essentially analytical. Let

Group of a linear differential equation.

$$\frac{d^ny}{dx^n}+\mathrm{P}_1\frac{d^{n-1}y}{dx^{n-1}}+\ldots+\mathrm{P}_{n-1}\frac{dy}{dx}+\mathrm{P}_ny=0$$

be a linear differential equation, the coefficients in which are rational functions of x, and let $y_1, y_2, \ldots, y_n$ be a linearly independent set of integrals of the equation. In the neighbourhood of a finite value x_0 of x, which is not a singularity of any of the coefficients in the equation, these integrals are ordinary power-series in $x-x_0$. If the analytical continuations of $y_1, y_2, \ldots, y_n$ be formed for any closed path starting from and returning to x_0, the final values arrived at when x_0 is again reached will be another set of linearly independent integrals. When the closed path contains no singular point of the coefficients of the differential equation, the new set of integrals is identical with the original set. If, however, the closed path encloses one or more singular points, this will not in general be the case. Let $y'_1, y'_2, \ldots, y'_n$ be the new integrals arrived at. Since in the neighbourhood of x_0 every integral can be represented linearly in terms of $y_1, y_2 \ldots, y_n$, there must be a system of equations

$$\begin{aligned}y'_1&=a_{11}y_1+a_{12}y_2+\ldots+a_{1n}y_n,\\ y'_2&=a_{21}y_1+a_{22}y_2+\ldots+a_{2n}y_n,\\ &\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\\ y'_n&=a_{n1}y_1+a_{n2}y_2+\ldots+a_{nn}y_n,\end{aligned}$$

where the a's are constants, expressing the new integrals in terms of the original ones. To each closed path described by x_0 there therefore corresponds a definite linear substitution performed on the y's. Further, if S_1 and S_2 are the substitutions that correspond to two closed paths L_1 and L_2, then to any closed path which can be continuously deformed, without crossing a singular point, into L_1 followed by L_2, there corresponds the substitution $\mathrm{S}_1\mathrm{S}_2$. Let $\mathrm{L}_1, \mathrm{L}_2, \ldots, \mathrm{L}_r$ be arbitrarily chosen closed paths starting from and returning to the same point, and each of them enclosing a single one of the (r) finite singular points of the equation. Every closed path in the plane can be formed by combinations of these r paths taken either in the positive or in the negative direction. Also a closed path which does not cut itself, and encloses all the r singular points within it, is equivalent to a path enclosing the point at infinity and no finite singular point. If $\mathrm{S}_1, \mathrm{S}_2, \mathrm{S}_3 \ldots, \mathrm{S}_r$ are the linear substitutions that correspond to these r paths, then the substitution corresponding to every possible path can be obtained by combination and repetition of these r substitutions, and they therefore generate a discontinuous group each of whose operations corresponds to a definite closed path. The group thus arrived at is called the group of the equation. For a given equation it is unique in type. In fact, the only effect of starting from another set of independent integrals is to transform every operation of the group by an arbitrary substitution, while choosing a different set of paths is equivalent to taking a new set of generating operations. The great importance of the group of the equation in connexion with the nature of its integrals cannot here be dealt with, but it may be pointed out that if all the integrals of the equation are algebraic functions, the group must be a group of finite order, since the set of quantities $y_1, y_2, \ldots, y_n$ can then only take a finite number of distinct values. As a simple example of the determination of the group from the differential equation, we may take the equation

$$x^3\frac{d^3y}{dx^3}+(x-x^2)\frac{dy}{dx}-y=0.$$

There is only one finite singular point, namely $x=0$, and therefore the group is cyclical. The determinantal equation at $x=0$ is

$$(n-1)^3=0,$$

and the form of the three independent integrals must therefore be

$$u,\ v+u\log x,\ w+2v\log x+u(\log x)^2,$$

where u, v, w are power-series of which u vanishes with x. If these are represented by y_1, y_2, y_3, the substitution given by a closed path surrounding $x=0$ is

$$y'_1=y_1,\ y'_2=y_2+2\pi iy_1,\ y'_3=y_3+4\pi iy_2-4\pi^2y_1,$$

and the group of the equation is the cyclical group generated by this substitution.

Groups of Finite Order.

We shall now pass on to the last division of the subject, that is, to groups of finite order. It is clear that here we must have to do with many properties which have no direct analogues in the theory of continuous groups or in that of discontinuous groups in general; those properties, namely, which depend on the fact that the number of distinct operations in the group is finite.

Let

$$\mathrm{S}_1, \mathrm{S}_2, \mathrm{S}_3, \ldots, \mathrm{S}_N,$$

denote the operations of a group G of finite order N, S_1 being the identical operation. The tableau

$$\begin{array}{llll}\mathrm{S}_1, & \mathrm{S}_2, & \mathrm{S}_3, \ldots, & \mathrm{S}_N,\\ \mathrm{S}_1\mathrm{S}_2, & \mathrm{S}_2\mathrm{S}_2, & \mathrm{S}_3\mathrm{S}_2, \ldots, & \mathrm{S}_N\mathrm{S}_2,\\ \mathrm{S}_1\mathrm{S}_3, & \mathrm{S}_2\mathrm{S}_3, & \mathrm{S}_3\mathrm{S}_3, \ldots, & \mathrm{S}_N\mathrm{S}_3,\\ \cdot & \cdot & \cdot & \cdot\\ \mathrm{S}_1\mathrm{S}_N, & \mathrm{S}_2\mathrm{S}_N, & \mathrm{S}_3\mathrm{S}_N, \ldots, & \mathrm{S}_N\mathrm{S}_N,\end{array}$$

when in it each compound symbol $\mathrm{S}_p\mathrm{S}_q$ is replaced by the single symbol S_r that is equivalent to it, is called the multiplication table of the group. It indicates directly the result of multiplying together in an assigned sequence any number of operations of the group. In each line (and in each column) of the tableau every operation of the group occurs just once. If the letters in the tableau are regarded as mere symbols, the operation of replacing each symbol in the first line by the symbol which stands under it in the pth line is a substitution performed on the set of N symbols. Thus to the N lines of the tableau there corresponds a set of N substitutions performed on the N symbols, which includes the identical substitution that leaves each unchanged. Moreover, if $\mathrm{S}_p\mathrm{S}_q=\mathrm{S}_r$, then the result of carrying out in succession the substitutions which correspond to the pth and qth lines gives the substitution which corresponds to the rth line. Hence the set of substitutions constitutes a group which is simply isomorphic with the given group.

Every group of finite order N can therefore be represented in concrete form as a group of substitutions on N symbols.

The order of any subgroup or operation of G is necessarily finite. If

$$\mathrm{T}_1(=\mathrm{S}_1),\ \mathrm{T}_2, \ldots, \mathrm{T}_n,$$

Properties of a group which depend on the order.

are the operations of a subgroup H of G, and if Σ is any operation of G which is not contained in H, the set of operations

$$\Sigma\mathrm{T}_1, \Sigma\mathrm{T}_2, \ldots, \Sigma\mathrm{T}_n,$$

or ΣH, are all distinct from each other and from the

operations of H. If the sets H and Σ'H do not exhaust the operations of G, and if Σ' is an operation not belonging to them, then the operations of the set ΣH are distinct from each other and from those of H and ΣH. This process may be continued till the operations of G are exhausted. The order n of H must therefore be a factor of the order N of G. The ratio N/n is called the *index* of the subgroup H. By taking for H the cyclical subgroup generated by any operation S of G, it follows that the order of S must be a factor of the order of G.

Every operation S is permutable with its own powers. Hence there must be some subgroup H of G of greatest possible order, such that every operation of H is permutable with S. Every operation of H transforms S into itself, and every operation of the set HΣ transforms S into the same operation. Hence, when S is transformed by every operation of G, just N/n distinct operations arise if n is the order of H. These operations, and no others, are conjugate to S within G; they are said to form a set of conjugate operations. The number of operations in every conjugate set is therefore a factor of the order of G. In the same way it may be shown that the number of subgroups which are conjugate to a given subgroup is a factor of the order of G. An operation which is permutable with every operation of the group is called a *self-conjugate* operation. The totality of the self-conjugate operations of a group forms a self-conjugate Abelian subgroup, each of whose operations is permutable with every operation of the group.

An Abelian group contains subgroups whose orders are any given factors of the order of the group. In fact, since every subgroup H of an Abelian group G and the corresponding factor groups G/H are Abelian, this result follows immediately by an induction from the case in which the order contains n prime factors to that in which it contains $n+1$. For a group which is not Abelian no general law can be stated as to the existence or non-existence of a subgroup whose order is an arbitrarily assigned factor of the order of the group. In this connexion the most important general result, which is independent of any supposition as to the nature of the group, is known as Sylow's theorem, which states that if p^{α} is the highest power of a prime p which divides the order of a group G, then G contains a single conjugate set of subgroups of order p^{α}, the number in the set being of the form $1+kp$. This theorem, which is of fundamental importance, may be established as follows:—

Let r be the number of distinct sets of conjugate operations in G, and let

Sylow's theorem.

$$h_1(=1),\ h_2,\ h_3,\ldots,\ h_r,$$

be the numbers of operations in each set, the first set consisting of the identical operation alone. Any operation of the sth set is contained as a self-conjugate operation in a subgroup of order n_s, where $n_s h_s = \mathrm{N}$, the order of the group.

The order of the group being equal to the sum of the numbers of operations in the different conjugate sets, it follows that

$$\mathrm{N}=1+\frac{\mathrm{N}}{n_2}+\frac{\mathrm{N}}{n_3}+\ldots+\frac{\mathrm{N}}{n_r}.$$

If G contains no self-conjugate operation except the identical operation, no one of the denominators on the right-hand side is N, and at least one of them must be divisible by p^{α}. In this case, then, G contains a subgroup whose order is divisible by p^{α}. If G has self-conjugate operations, the same result is arrived at by considering the factor group G/H, where H is the subgroup constituted of the totality of the self-conjugate operations; and G, therefore, in any case contains a subgroup whose order is divisible by p^{α}. The same reasoning may be repeated with this subgroup, and so ultimately a subgroup of order p^{α} must be arrived at. The existence within G of a subgroup P of order p^{α} is thus demonstrated. If this subgroup is not self-conjugate, let P$'$ be another subgroup of order p^{α} conjugate to it. When P$'$ is transformed by all the operations of P, the number of distinct groups, including P$'$, which arise is $p^{\alpha-\beta}$, where p^{β} is the order of the greatest group common to P and P$'$. If the $1+p^{\alpha-\beta}$ groups so obtained do not exhaust all the subgroups conjugate to P in G, let P$''$ be a new one. On transforming P$''$ by the operations of P, $p^{\alpha-\beta'}$ new groups arise, which are distinct from each other and from the previous $1+p^{\alpha-\beta}$. This process may be continued till the groups conjugate to P are exhausted. Their number is therefore of the form $1+kp$. The supposition that G contains a second conjugate set of subgroups of order p^{α} leads by a similar process to the obvious contradiction that the number of subgroups in the set is at once of the forms $1+kp$ and lp. The theorem is therefore completely proved. Sylow's theorem may be extended to show that if $p^{\alpha'}$ is a factor of the order of a group, the number of subgroups of order $p^{\alpha'}$ is of the form $1+kp$. If, however, $p^{\alpha'}$ is not the highest power of p which divides the order, these groups do not in general form a single conjugate set.

The importance of Sylow's theorem in discussing the structure of a group of given order need hardly be insisted on. Thus, as a very simple instance, a group whose order is the product p_1p_2 of two primes ($p_1<p_2$) must have a self-conjugate subgroup of order p_2, since the order of the group contains no factor, other than unity, of the form $1+kp_2$. The same again is true for a group of order $p_1^2p_2$, unless $p_1=2$, and $p_2=3$.

There is one other numerical property of a group connected with its order which is quite general. If N is the order of G, and n a factor of N, the number of operations of G, whose orders are equal to or are factors of n, is a multiple of n.

Composition-series of a group.

As already defined, a composite group is a group which contains one or more self-conjugate subgroups, whose orders are greater than unity. If H is a self-conjugate subgroup of G, the factor-group G/H may be either simple or composite. In the former case G can contain no self-conjugate subgroup K, which itself contains H; for if it did K/H would be a self-conjugate subgroup of G/H. When G/H is simple, H is said to be a maximum self-conjugate subgroup of G. Suppose now that G being a given composite group,

$$\mathrm{G},\ \mathrm{G}_1,\ \mathrm{G}_2,\ldots,\ \mathrm{G}_n,\ 1,$$

is a series of subgroups of G, such that each is a maximum self-conjugate subgroup of the preceding; the last term of the series consisting of the identical operation only. Such a series is called a *composition-series* of G. In general it is not unique, since a group may have two or more maximum self-conjugate subgroups. A composition-series of a group, however it may be chosen, has the property that the number of terms of which it consists is always the same, while the factor-groups

$$\mathrm{G}/\mathrm{G}_1,\ \mathrm{G}_1/\mathrm{G}_2,\ldots,\ \mathrm{G}_n,$$

differ only in the sequence in which they occur. Let G_1 and G'_1 be two maximum self-conjugate subgroups of G, and let H be the common subgroup of G_1 and G'_1. The group $\{\mathrm{G}_1, \mathrm{G}'_1\}$ generated by G_1 and G'_1 is contained self-conjugately in G, and must therefore coincide with G, since G_1 and G'_1 are maximum self-conjugate subgroups. Also H, being the common subgroup of two self-conjugate subgroups of G, is a self-conjugate subgroup of G,

G_1, and G'_1. Now the factor-group $\{G_1, G'_1\}/G_1$ is identical with $\{g_1, g'_1\}/g_1$, where g_1 and g'_1 represent G_1/H and G'_1/H. But $\{g_1, g'_1\}/g_1$ is identical with g'_1, since g_1 and g'_1 have no common operations. Hence G/G_1 is identical with G'_1/H; and similarly G/G'_1 is identical with G_1/H. Moreover, H is a maximum self-conjugate subgroup of both G_1 and G'_1. Suppose now that

$$G, G_1, G_2, \ldots, 1,$$

and

$$G, G'_1, G'_2, \ldots, 1,$$

are two composition-series of G. Since H is a maximum self-conjugate subgroup of both G_1 and G'_1, there must be two other composition-series of the form

$$G, G_1, H, I, J, \ldots, 1,$$

and

$$G, G'_1, H, I, J, \ldots, 1;$$

and for these the factor-groups are identical except as regards sequence.

The property stated of the composition-series may now be proved by an induction. Suppose it to have been established for all groups whose order does not exceed n, and let the order of G be not greater than $2n$, so that the orders of G_1 and G'_1 do not exceed n. Then the series

$$G_1, G_2, \ldots, 1,$$
$$G_1, H, \ldots, 1,$$

have the same number of terms, and apart from sequence the same factor-groups; as also have the series

$$G'_1, G'_2, \ldots, 1,$$
$$G'_1, H, \ldots, 1.$$

Hence the same is true for the series

$$G, G_1, G_2, \ldots, 1,$$
$$G, G'_1, G'_2, \ldots, 1.$$

For a group of sufficiently small order the property is obviously true, and it is thus established generally. It should be noticed that though a group defines uniquely the set of factor-groups that occur in its composition-series, the set of factor-groups do not conversely in general define a single type of group. When the orders of all the factor-groups are primes the group is said to be *soluble*.

If the series of subgroups

$$G, H, K, \ldots, L, 1$$

is chosen so that each is the greatest self-conjugate subgroup of G contained in the previous one, the series is called a chief composition-series of G. All such series derived from a given group may be shown to consist of the same number of terms, and to give rise to the same set of factor-groups, except as regards sequence. The factor-groups of such a series will not, however, necessarily be simple groups. From any chief composition-series a composition-series may be formed by interpolating between any two terms H and K of the series for which H/K is not a simple group, a number of terms $h_1, h_2, \ldots, h_r$; and it may be shown that the factor-groups $H/h_1, h_1/h_2, \ldots, h_r/K$ are all simply isomorphic with each other.

Isomorphism of a group with itself.

A group may be represented as isomorphic with itself by transforming all its operations by any one of them. In fact, if

$$S_pS_q = S_r,$$

then

$$S^{-1}S_pS \cdot S^{-1}S_qS = S^{-1}S_rS.$$

An isomorphism of the group with itself, established in this way, is called a *cogredient* isomorphism. It may be regarded as an operation carried out on the symbols of the operations, being indeed a substitution performed on these symbols. The totality of these operations clearly constitutes a group isomorphic with the given group, and this group is called the group of cogredient isomorphisms. A group is simply or multiply isomorphic with its group of cogredient isomorphisms according as it does not or does contain self-conjugate operations other than identity. It may be possible to establish a correspondence between the operations of a group other than those given by the cogredient isomorphisms, such that if S' is the operation corresponding to S, then

$$S'_pS'_q = S'_r$$

is a consequence of

$$S_pS_q = S_r.$$

The substitution on the symbols of the operations of a group resulting from such a correspondence is called a *contragredient* isomorphism. The totality of the isomorphisms of both kinds constitutes the group of isomorphisms of the given group, and within this the group of cogredient isomorphisms is a self-conjugate subgroup. Every set of conjugate operations of a group is necessarily transformed into itself by a cogredient isomorphism, but two or more sets may be interchanged by a contragredient isomorphism.

A group which has no self-conjugate operations except identity, and admits of no contragredient isomorphisms, is called a *complete* group. If a group G has a complete group H as a self-conjugate subgroup, then G contains a subgroup K simply isomorphic with G/H, such that every operation of K is permutable with every operation of H; and G is said to be the *direct product* of H and K.

A subgroup of a group G, which is transformed into itself by every isomorphism of G, is called a characteristic subgroup. A series of groups

$$G, G_1, G_2, \ldots, 1,$$

such that each is a maximum characteristic subgroup of G contained in the preceding, may be shown to have the same invariant properties as the subgroups of a composition series. A group which has no characteristic subgroup must be either a simple group or the direct product of a number of simply isomorphic simple groups.

Simple and composite groups. Soluble groups.

It is an obvious result from Sylow's theorem that, when a given number is assigned arbitrarily as the order of a group, there is not in general among the possible types of group a simple group. The examination of successive integers, from this point of view, has been carried as far as 1092, with the result of showing that 60, 168, 360, 504, 660, and 1092 are the only orders not exceeding 1092 corresponding to which simple groups exist, and that for each of these numbers as order there is a single type of simple group. On the other hand, the number of simple groups known to exist is infinite and is being continually added to. Thus for every order of the forms

$$\tfrac{1}{2}n\,!,\ \tfrac{1}{2}(p^{2n}-1)p^n \text{ and } \frac{1}{d}p^{\frac{n(n-1)}{2}}(p^n-1)(p^{n-1}-1)\ldots(p-1),$$

where n is any integer, p a prime, and d the highest common factor of n and $p-1$, a simple group is known to exist; and the same may be stated of several other forms for the order. Again, a series of forms for the order of a group are known corresponding to which there can be no simple group, and these also tend to increase with new investigations. Thus if $p, q, r, \ldots$ denote primes, groups of order p^n, p^nq, p^nq^2 and $pq\ldots r$ are always soluble; and a group of order $p^\alpha q^\beta \ldots r^\gamma$, where none of the indices exceed two, is always soluble unless twelve is a factor of the order. If the number of prime factors in the order of a group does not exceed five, the group is composite unless 60, 168, 660, or 1092 is the order. If the order of a group is twice an odd number, the group is always composite, containing a self-conjugate subgroup of index two. Finally, no simple group of odd order is at present known to exist.

It has been seen that every group of finite order can be represented as a group of substitutions performed on a set of symbols whose number is equal to the order of the group. In general such a representation is possible with a smaller number of symbols. Let H be a subgroup of G, and let the operations of G be divided, in respect of H, into the sets

Substitution-groups.

$$H, S_2H, S_3H, \ldots, S_mH.$$

If S is any operation of G, the sets

$$SH, SS_2H, SS_3H, \ldots, SS_mH,$$

differ from the previous sets only in the sequence in which they occur. In fact, if SS_p belong to the set S_qH, then since H is a group, the set SS_pH is identical with the set S_qH. Hence, to each operation S of the group will correspond a substitution performed on the symbols of the m sets, and to the product of two operations corresponds the product of the two analogous substitutions. The set of substitutions, therefore, forms a group isomorphic with the given group. Moreover, the isomorphism is simple unless for one or more operations, other than identity, the sets all remain unaltered. This can only be the case for S, when every operation conjugate to S belongs to H. In this case H would contain a self-conjugate subgroup. Hence, if H is a subgroup of G of index m, which contains no self-conjugate subgroup of G, then G can be represented as a group of substitutions performed on m symbols.

The fact that every group of finite order can be represented, generally in several ways, as a group of substitutions, gives special importance to such groups. The number of symbols involved in such a representation is called the *degree* of the group. In accordance with the general definitions already given, a substitution-group is called transitive or intransitive according as it does or does not contain substitutions changing any one of the symbols into any other. It is called imprimitive or primitive according as the symbols can or cannot be arranged in sets, such that every substitution of the group changes the symbols of any one set either among themselves or into the symbols of another set. When a group is imprimitive the number of symbols in each set must clearly be the same.

The total number of substitutions that can be performed on n symbols is $n\,!$, and these necessarily constitute a group. It is known as the *symmetric* group of degree n, the only rational functions of the symbols which are unaltered by all possible substitutions being the symmetric functions. When any substitution is carried out on the product of the $n(n-1)/2$, differences of the n symbols, it must either remain unaltered or its sign must be changed. Those substitutions which leave the product unaltered constitute a group of order $n\,!/2$, which is called the *alternating* group of degree n; it is a self-conjugate subgroup of the symmetric group. Except when $n=4$ the alternating group is a simple group; and except for $n=6$ the symmetric group is a complete group. A substitution group of degree n, which is not contained in the alternating group, must necessarily have a self-conjugate subgroup of index 2, consisting of those of its substitutions which belong to the alternating group. The determination of all possible subgroups of the symmetric group has been carried out for some of the smaller values of n. Of greater interest and importance is the determination of the transitive and in particular of the primitive subgroups. The latter determination has been made for all values of n up to 15.

Another form in which every group of finite order can be represented is that known as a linear homogeneous group. If in the equations

Linear homogeneous groups

$$x'_r = a_{r1}x_1 + a_{r2}x_2 + \ldots + a_{rm}x_m,$$
$$(r=1, 2, \ldots, m),$$

which define a linear homogeneous substitution, the coefficients are integers, and if the equations are replaced by congruences to a finite modulus n, the system of congruences will give a definite operation, provided that the determinant of the coefficients is relatively prime to n. The product of two such operations is another operation of the same kind; and the total number of distinct operations is finite, since there is only a limited number of choices for the coefficients. The totality of these operations, therefore, constitutes a group of finite order; and such a group is known as a *linear homogeneous* group. If n is a prime the order of the group is

$$(n^m-1)(n^m-n)\ldots(n^m-n^{m-1}).$$

The totality of the operations of the linear homogeneous group for which the determinant of the coefficients is congruent to unity forms a subgroup. Other subgroups arise by considering those operations which leave a function of the variables unchanged (mod. n). All such subgroups are known as linear homogeneous groups.

When the ratios only of the variables are considered, there arises a *linear fractional* group, with which the corresponding linear homogeneous group is isomorphic. Thus, if p is a prime the totality of the congruences

$$\left.\begin{array}{l} z' \equiv \dfrac{az+b}{cz+d}, \\ ad-bc \neq 0, \end{array}\right\} \text{(mod. } p)$$

constitutes a group of order $p(p^2-1)$. This class of groups for various values of p is almost the only one which has been as yet exhaustively analysed. For all values of p except 3 it contains a simple self-conjugate subgroup of index 2.

The operations of a substitution-group, as defined above, are linear substitutions of a very special type, where each symbol is replaced by another single symbol. The difference of any two symbols is also replaced by the difference of some other two. Now every difference of a pair of the symbols

Groups of linear substitutions.

$$x_1, x_2, \ldots, x_n$$

can be expressed linearly in terms of

$$x_1-x_n, x_2-x_n, \ldots, x_{n-1}-x_n.$$

Hence the substitution-group of degree n can be represented as a group of linear substitutions in the more general sense, performed on a set of $n-1$ symbols. A group of linear substitutions on m symbols is called *irreducible* when it is impossible to form m' ($<m$) linear functions of the symbols which are transformed among themselves by every operation of the group. The representation of a given group as a group of linear substitutions in as small a number of symbols as possible, and the determination whether the group so formed is irreducible or not, constitutes one of the main problems of the theory. A simple group when so represented is necessarily irreducible. On the other hand, no Abelian group, other than a cyclical one, can be represented in irreducible form. The only groups of finite order which can be represented as substitution-groups with a single symbol are clearly the cyclical groups. The determination has been made of all types which can be so represented with two and with three symbols. The difficulties presented by the cases of four symbols are very considerable and have not yet been overcome. That among the latter a group of order 25920 occurs indicates the great number of possibilities.

The chief application of the theory of groups of finite order is to the theory of algebraic equations. The analogy of equations of the second, third, and fourth degrees would give rise to the expectation that a root of an equation of any finite degree

Applications.

could be expressed in terms of the coefficients by a finite number of the operations of addition, subtraction, multiplication, division, and the extraction of roots; in other words, that the equation could be solved by radicals. This, however, as proved by Abel and Galois, is not the case: an equation of a higher degree than the fourth in general defines an algebraic irrationality which cannot be expressed by means of radicals, and the cases in which such an equation can be solved by radicals must be regarded as exceptional. The theory of groups gives the means of determining whether an equation comes under this exceptional case, and of solving the equation when it does. When it does not, the theory provides the means of reducing the problem presented by the equation to a normal form. From this point of view the theory of equations of the fifth degree has been exhaustively treated, and the problems presented by certain equations of the sixth and seventh degrees have actually been reduced to normal form.

Galois showed that, corresponding to every irreducible equation of the nth degree, there exists a transitive substitution-group of degree n, such that every function of the roots which is unaltered by all the substitutions of the group can be expressed rationally in terms of the coefficients, while conversely every function of the roots which is expressible rationally in terms of the coefficients is unaltered by the substitutions of the group. This group is called the group of the equation. In general, if the equation is given arbitrarily, the group will be the symmetric group. The necessary and sufficient conditions that the equation may be soluble by radicals is that its group should be a soluble group. When the coefficients in an equation are rational integers, the determination of its group may be made by a finite number of processes each of which involves only rational arithmetical operations. These processes consist in forming resolvents of the equation corresponding to each distinct type of subgroup of the symmetric group whose degree is that of the equation. Each of the resolvents so formed is then examined to find whether it has rational roots. The group corresponding to any resolvent which has a rational root contains the group of the equation; and the least of the groups so found is the group of the equation. Thus, for an equation of the fifth degree the various transitive subgroups of the symmetric group of degree five have to be considered. These are (i.) the alternating group; (ii.) a soluble group of order 20; (iii.) a group of order 10, self-conjugate in the preceding; (iv.) a cyclical group of order 5, self-conjugate in both the preceding. If x_0, x_1, x_2, x_3, x_4 are the roots of the equation, the corresponding resolvents may be taken to be those which have for roots (i.) the square root of the discriminant; (ii.) the function $(x_0x_1+x_1x_2+x_2x_3+x_3x_4+x_4x_0)(x_0x_2+x_2x_4+x_4x_1+x_1x_3+x_3x_0)$; (iii.) the function $x_0x_1+x_1x_2+x_2x_3+x_3x_4+x_4x_0$; and (iv.) the function $x_0^2x_1+x_1^2x_2+x_2^2x_3+x_3^2x_4+x_4^2x_0$. Since the groups for which (iii.) and (iv.) are invariant are contained in that for which (ii.) is invariant, and since these are the only soluble groups of the set, the equation will be soluble by radicals only when the function (ii.) can be expressed rationally in terms of the co-efficients. If

$$(x_0x_1+x_1x_2+x_2x_3+x_3x_4+x_4x_0)(x_0x_2+x_2x_4+x_4x_1+x_1x_3+x_3x_0)$$

is known, then clearly

$$x_0x_1+x_1x_2+x_2x_3+x_3x_4+x_4x_0$$

can be determined by the solution of a quadratic equation. Moreover, the sum and product

$$(x_0+\epsilon x_1+\epsilon^2x_2+\epsilon^3x_3+\epsilon^4x_4)^5$$

and

$$(x_0+\epsilon^4x_1+\epsilon^3x_2+\epsilon^2x_3+\epsilon x_4)^5$$

can be expressed rationally in terms of $x_0x_1+x_1x_2+x_2x_3+x_3x_4+x_4x_0$, ϵ, and the symmetric functions; ϵ being a fifth root of unity. Hence $(x_0+\epsilon x_1+\epsilon^2x_2+\epsilon^3x_3+\epsilon^4x_4)^5$ can be determined by the solution of a quadratic equation. The roots of the original equation are then finally determined by the extraction of a fifth root. To show how the problem presented by an equation of the fifth degree, when not soluble by radicals, can be reduced to a normal form, would go far beyond the limits of the present article. This question forms the subject of Prof. Klein's admirable *Vorlesungen über das Ikosaeder*. Another application of groups of finite order is to the theory of linear differential equations whose integrals are algebraic functions. It has been already seen, in the discussion of discontinuous groups in general, that the groups of such equations must be groups of finite order. To every group of finite order which can be represented as an irreducible group of linear substitutions on n variables will correspond a class of irreducible linear differential equations of the nth order whose integrals are algebraic. The complete determination of the class of linear differential equations of the second order with all their integrals algebraic, whose group has the greatest possible order, viz., 120, has been carried out by Prof. Klein.

AUTHORITIES.—**Continuous groups**: LIE and ENGEL. *Theorie der Transformationsgruppen*, Leipzig, vol. i., 1888; vol. ii., 1890; vol. iii., 1893.—LIE and SCHEFFERS. *Vorlesungen über gewöhnliche Differentialgleichungen mit bekannten infinitesimalen Transformationem.* Leipzig, 1891.—*Idem.* *Vorlesungen über continuierliche Gruppen.* Leipzig, 1893.—*Idem.* *Geometrie der Berührungstransformationen.* Leipzig, 1896.—KLEIN and SCHILLING. *Höhere Geometrie*, vol. ii. (lithographed), Göttingen, 1893 (for both continuous and discontinuous groups). **Discontinuous groups**: KLEIN and FRICKE. *Vorlesungen über die Theorie der elliptischen Modulfunctionen*, vol. i., Leipzig, 1890 (for a full discussion of the modular group).—*Idem.* *Vorlesungen über die Theorie der automorphen Functionen*, vol. i., Leipzig, 1897 (for the general theory of discontinuous groups).—SCHOENFLIES. *Krystallsysteme und Krystallstructur*, Leipzig, 1891 (for discontinuous groups of motions). **Groups of finite order**: GALOIS. *Œuvres mathématiques.* Paris, 1897 (reprint).—JORDAN. *Traité des substitutions et des équations algébriques.* Paris, 1870.—NETTO. *Substitutionentheorie und ihre Anwendung auf die Algebra.* Leipzig, 1882; English translation by Cole, Ann Arbor, U.S.A., 1892.—KLEIN. *Vorlesungen über das Ikosaeder.* Leipzig, 1884; English translation by Morrice, London, 1888.—H. VOGT. *Leçons sur la résolution algébrique des équations.* Paris, 1895.—WEBER. *Lehrbuch der Algebra*, Braunschweig, vol. i., 1895; vol. ii., 1896; a second edition appeared in 1898.—BURNSIDE. *Theory of Groups of Finite Order.* Cambridge, 1897.—BIANCHI. *Teoria dei gruppi di sostituzioni e delle equazioni algebriche.* Pisa, 1899. A summary with many references will be found in the *Encyclopädie der mathematischen Wissenschaften*, Leipzig, vol. i., 1898, 1899. *Memoirs*, &c.—Of the very great number of memoirs on group-theory which have appeared during the period 1875–1900, a few only can be here referred to. **Continuous groups**: PICARD. "Sur les équations différentielles linéaires et les groupes algébriques des transformations," *Annales de Toulouse.* 1887.—VESSIOT. "Sur l'intégration des équations différentielles linéaires," *Annales de l'École Normale*, 1892.—CARTAN. *Sur la structure des groupes de transformations finis et continus.* (Thèse.) Paris, 1894.—MOLIEN. "Ueber Systeme höherer complexen Zahlen," *Mathematische Annalen*, 1893.—LIE. "Untersuchungen uber unendliche continuierliche Gruppen," *Leipziger Abhandlungen*, 1895. **Discontinuous groups**: POINCARÉ. "Théorie des groupes fuchsiens," *Acta Mathematica*, 1882; "Mémoire sur les groups Kleinéens," *ibid.*, 1883; "Sur les groupes des équations linéaires," *ibid.*, 1884.—KLEIN. "Neue Beiträge zur Riemann'schen Functionentheorie," *Mathematische Annalen*, 1882.—PICARD. "Sur les fonctions de deux variables indépendantes analogues aux fonctions modulaires," *Acta Math.*, 1883. **Groups of finite order**: JORDAN. "Sur la détermination des groupes d'ordre fini contenus dans le groupe linéaire," *Atti della Reale Accademia di Napoli*, 1880.—GIERSTER. "Die Untergruppen der Galois'schen Gruppe der Modulargleichungen," *Math. Ann.* 1881.—DYCK. "Gruppentheoretische Studien," *Math. Ann.* 1882, 1883.—VALENTINER. *De endelige Transformations-Gruppers Theori.* Kjobenhavn, 1889.—HÖLDER. "Bildung zusammengesetzter Gruppen," *Math. Ann.*, 1895.—FROBENIUS. "Ueber Gruppencharaktere," *Berliner Sitzungsberichte*, 1896; "Ueber die Primfactoren der Gruppendeterminante," *ibid.*, 1896.—MOORE.

"An Universal Invariant for Finite Groups of Linear Substitutions," *Math. Ann.*, 1898.—MILLER. "Report on Recent Progress in the Theory of Groups of Finite Order," *Bulletin of the American Mathematical Society*, 1898.—DICKSON. "Report on Recent Progress in the Theory of Linear Groups," *ibid.*, 1899. (W. BU.)

Grove, Sir George (1820–1900), English writer on music, was born at Clapham, 13th August 1820. At the close of his school days he was articled to a civil engineer, and worked for two years in a factory near Glasgow. In 1841 and 1845 he was employed in the West Indies, erecting lighthouses in Jamaica and Bermuda. In 1849 he became secretary to the Society of Arts, and in 1852 to the Crystal Palace. In this capacity his natural love of music and enthusiasm for the art found a splendid opening, and he threw all the weight of his influence into the task of promoting the best music of all schools in connexion with the weekly and daily concerts at Sydenham, which had such a long and honourable career under the direction of Mr Manns. Without Sir George Grove that eminent conductor would hardly have succeeded in doing what he did to encourage young composers and to educate the British public in music. Grove's analyses of the Beethoven symphonies, and the other works presented at the concerts, set the pattern of what such things should be; and it was as a result of these, and of the fact that he was editor of *Macmillan's Magazine* from 1868 to 1883, that the scheme of his famous *Dictionary of Music and Musicians*, published from 1878 to 1889, was conceived and executed. His own articles on Beethoven, Mendelssohn, and Schubert are monuments of a special kind of learning, and the fact that the rest of the book is a little thrown out of balance owing to their gigantic length is hardly to be regretted. Long before this he had contributed to the *Dictionary of the Bible*, and had promoted the foundation of the Palestine Exploration Fund. On a famous journey to Vienna, undertaken in the company of his lifelong friend, Sir Arthur Sullivan, the important discovery of a large number of compositions by Schubert was made, including the music to *Rosamunde*. When the Royal College of Music was founded in 1882 he was appointed its first director, receiving the honour of knighthood. He fulfilled the duties in such a way as to bring the new institution into line with the most useful European conservatoriums. On the completion of the new buildings in 1894 he resigned the directorship, but retained an active interest in the institution to the end of his life. He died at Sydenham, 28th May 1900. (J. A. F. M.)

Grove, Sir William Robert (1811–1896), English judge and man of science, was born on 11th July 1811 at Swansea, in South Wales. After being educated by private tutors, he went up to Brasenose College, Oxford, where he took an ordinary degree in 1832. Three years later he was called to the bar at Lincoln's Inn. His health, however, did not allow him to devote himself strenuously to practice, and he occupied his leisure with scientific studies. About 1839 he constructed the well-known platinum-zinc voltaic cell that bears his name, and with the aid of a number of these exhibited the electric arc light in the London Institution, Finsbury Circus. The result was that in 1840 the managers appointed him to the professorship of experimental philosophy, an office which he held for seven years. His researches dealt very largely with electro-chemistry and with the voltaic cell, of which he invented several varieties. One of these, the Grove gas-battery, is of especial interest both intrinsically and as the forerunner of the secondary batteries now in use for the "storage" of electricity. He discovered that a current is produced by a couple of platinum plates standing in acidulated water and immersed, the one in hydrogen, the other in oxygen; hence a galvanometer connected to the electrodes of an apparatus for the electrolysis of water which has been in operation for a short time indicates the existence of a current passing in the reverse direction to that which has effected the decomposition, and thus there is a return of part of the electrical energy which has been expended. At one of his lectures at the Institution Grove anticipated the electric lighting of to-day by illuminating the theatre with incandescent electric lamps, the filaments being of platinum and the current supplied by a battery of his nitric acid cells. In 1846 he published his famous book on *The Correlation of Physical Forces*, the leading ideas of which he had already put forward in his lectures: its fundamental conception was that each of the forces of nature—light, heat, electricity, &c.—is definitely and equivalently convertible into any other, and that where experiment does not give the full equivalent, it is because the initial force has been dissipated, not lost, by conversion into other unrecognized forces. In the same year he received a Royal medal from the Royal Society for his Bakerian lecture on "Certain phenomena of voltaic ignition and the decomposition of water into its constituent gases." In 1866 he presided over the British Association at its Nottingham meeting, and delivered an address on the continuity of natural phenomena. But while he was thus engaged in scientific research, his legal work was not neglected, and his practice increased so greatly that in 1853 he became a Q.C. One of the best-known cases in which he appeared as an advocate was that of William Palmer, the Rugeley poisoner, whom he defended. In 1871 he was made a judge of the Common Pleas in succession to Sir Robert Collier, and remained on the bench till 1887. He died in London on 1st August 1896. A selection of his scientific papers will be found appended to the sixth edition of *The Correlation of Physical Forces*, published in 1874.

Groznyi, fortress and district town of Russia, North Caucasia, province of Terek, on the Sunzha river, 58 miles north-east of Vladikavkaz, on the railway to Petrovsk. There are naphtha works close by. Population (1897), 15,599.

Grünberg, a town of Prussia, province of Silesia, 34 miles by rail north-west from Glogau on the line to Frankfort-on-the-Oder. It has manufactures of straw hats, leather, and tobacco. There is a technical (textiles) school. Population (1885), 14,395; (1900), 20,987.

Gruyère, a district in the Swiss canton of Freiburg, famous for its cheese. Properly the name belongs to the whole of the upper valley of the Saane above Bulle, but it is often applied only to the Freiburg portion of this region, from Montbovon to Bulle, its capital. This region now forms the Gruyère prefecture of the canton of Freiburg, and contained in 1900, 22,936 inhabitants, mainly Romanist and French-speaking. In 1900 the town of Bulle had 3317 inhabitants, while that of Gruyères (spelt usually with the final "s" to distinguish it from the district) had 1383. A railway is projected from Bulle up the valley, and another from Montbovon to the Lake of Geneva. The county of Gruyère was seized in 1555 by Berne and Freiburg, the creditors of the last count. The Bernese portion of the upper Saane valley (capital, Château d'Oex), known as the "Pays d'en Haut," passed in 1798 to the Canton Léman (called Vaud after 1803). In 1893, 50,000 cwts. of cheese were exported from the Gruyère district (see also DAIRY FARMING).

Guadalajara, a province of Central Spain, with an area of 4869 English square miles, divided into nine

administrative districts and 398 parishes. Its population decreased from 204,984 in 1887 to 199,290 in 1897. Outside agriculture there are no industries of any importance. This province is crossed by the Madrid–Saragossa railway, which has eleven stations and 70 miles of line in the province. There are 175 miles of first-class roads. The province contains 22 productive and 179 unproductive registered mines. The former employ 350 hands. The salt mines have an output of 9382 tons. In 1898 there were 2670 horses, 29,171 mules, 16,643 asses, 8055 cattle, 440,209 sheep, 51,059 goats, 17,330 pigs: 212,500 acres were devoted to wheat; 330,130 acres to other cereals, chiefly oats, rye, barley, maize; 59,000 acres to vines; and 45,000 acres to olives.

Guadalajara, capital of the above province. A few modern buildings have been erected by the local corporations, such as the prison, provincial hospital, foundling hospital, institute for superior education, training schools for teachers of both sexes, and several primary schools. The once famous cloth manufacture has much decayed. New manufactures of soap, woollens, leather, and bricks have been instituted. Population (1897), 11,075.

Guadalajara, a city of Mexico, and capital of the state of Jalisco. Population (1895), 83,934. It is the principal seat of the cotton and wool manufacturing industries of the country. The public buildings—the cathedral, mint, Degollado theatre, and state Capitol—are splendid specimens of Mexican architecture. The Paseo is a beautiful drive on both sides of the Rio San Juan de Dios. There are numerous parks, and a botanical garden; the hospicio or home for the poor is a notable building. The town has tramways, electric lighting, &c.

Guadeloupe, a French colony in the Lesser Antilles, between Montserrat on the north and Dominica on the south. It has an area of 619 square miles, and consists of two islands, Grande Terre (255 square miles) and Basse Terre (364 square miles), separated by the Rivière Salée ("Salt River"), 4 miles long. The year is divided into the rainy season (July to November), the cool season (December to March), and the dry season (April to June). Round Guadeloupe are grouped its dependencies, namely, La Désirade, 6 miles east, with an area of 10 square miles; Marie Galante, 16 miles south-east, with an area of 55 square miles, traversed by the river St Louis; Les Saintes, 7 miles south, one of the strategic points of the Antilles; St Barthélemy, 95 miles north-west, with an area of 8 square miles (retroceded to France by Sweden in 1877); St Martin, 125 miles north-west, belonging to the extent of two-thirds to France, the remainder being Dutch. The population of Guadeloupe and its dependencies in 1887 was 182,000; but in 1898 it had fallen to 167,000, in consequence of the crisis in sugar production. In 1898 the men numbered 50,000, the women 53,500, and children 48,000. The immigrants, chiefly from India, numbered 15,500. The towns in the islands are: Basse Terre, the seat of government, with 7762 inhabitants; Trois Rivières (5016), Vieux Habitants (3954), Pointe à Pitre (a magnificent port in Grande Terre, with 17,242 inhabitants), Laurentin (4355), Le Gossier (4611), Morne à l'Eau (8442), Le Moule (10,378), Petit Bourg (5110), Petit Canal (6748), Port Louis (4393), Saint Anne (9497), Saint Francis (5265), and others. Grand Bourg, the capital of Marie Galante, has 6901 inhabitants. The administrative authority is vested in a governor, who is assisted by a privy council, and has under his orders a director of the interior, a procurator-general, and a paymaster. There is also an elective general council. The colony is divided into three arrondissements, and comprises thirty-four communes with elective municipalities. Political elections are very eagerly contested, the mulatto or negro element striving more and more to seize the power which has fallen from the hands of the old ruined colonists. The apostolic administrator resides at Basse Terre, where there is an appeal court, on which three civil tribunals are dependent (Basse Terre, Pointe à Pitre, and Marie Galante), besides eleven justices of the peace. The vagrancy problem in the colony is not the least serious which has to be dealt with. There is a *lycée* at Pointe à Pitre with 255 pupils, and a diocesan college at Basse Terre. One hundred and one Government primary schools, with (in 1900) 248 teachers and 10,920 pupils, some conducted by the Roman Catholic orders, are scattered throughout the colony. The budget for 1900 balanced at £198,750, and with the Government grant the expenditure on the colony was brought up to about £260,000. In addition the communes expend about £100,000. Altogether the local administration demands 50 per cent. of the total value of the productions. The garrison consists of only 250 men. About 125,000 acres, or a little more than a fourth part of the area of the colony, is cultivated, against 85,000 acres in 1873. Sugar-cane is still the leading crop, and the other crops are cereals, coffee, cacao, cotton, manioc, yams, and potatoes. The yield of sugar in 1875 amounted to 48,000 tons, in 1888 to 65,000; then, in consequence of the fall in the price, a decadence began, which very seriously affected the prosperity of the colony, and in 1898 the crop only reached 36,000 tons. The importation of coolies from Asia and the concentration of the works in great factories were unable to retard the crisis. The profit from the sugar industry is scarcely 5 per cent. Its centres are St Anne, Pointe à Pitre, and Le Moule. Coffee has not escaped the general depression, and the export in 1898 (670 tons) was only about half of that in 1878. The tendency, however, is to recover, and in 1899 the export was 780 tons. The export of cacao in 1899 was 410 tons. Worthy of mention also is the banana crop (200 tons). Tobacco culture, after a slight recovery, has again fallen away, as has the cultivation of vanilla. Forests cover 100,000 acres on the hills, but being difficult of access they are not worked. In 1898 the colony possessed 22,000 oxen, 11,000 sheep, 33,000 pigs, 8500 horses, and 11,000 asses and mules. Except sulphur and salt (9,900,000 bushels), no mineral substance is worked in Guadeloupe, but the thermal springs of the colony are regarded as valuable. Besides factories for sugar and distilleries for rum, there are establishments for pickled provisions and for chocolate manufacture. The commerce rose to £2,420,000 in 1878; in 1898 it had fallen to £1,450,000, of which £744,000 was for imports and £706,000 for exports. France's share in the former sum was £355,000, in the latter £700,000. The largest items in the list of imports were, in order, farinaceous foods, animal products (hides, &c.), intoxicants, fish, and textiles. After France the United States, Great Britain, and India are the countries most interested in the import trade. The principal items in the exports—all but minute sums, it will be remembered, to France and her colonies—were: sugar, £458,000; coffee, £86,000; cacao, £45,800; rum, £39,500. The totals of the imports and exports in 1899 were almost the same as in 1898: imports, £738,000; exports, £730,000. In 1899, 438 vessels of 221,303 tons (metric) entered and 419 of 187,911 tons cleared. Regular steam service is maintained between the colony and France and Great Britain.

Les Colonies Françaises. Paris, 1889.—LA SELVE. *Guadéloupe et Dependances.* Paris, 1899.—LEVASSEUR. *La France,* tome ii. Paris, 1893. LEE.—*French Colonies.* Foreign Office Report, 1900.—*L'Année Coloniale.* Paris, 1900. (P. L.)

Guam (Guahan or Guajan), the largest island of the Ladrones or Mariannes, a group of islands in the North Pacific, situated in 13° 26′ N. lat. and 144° 39′ E. long., 1823 miles east by south of Hong Kong, 1342 nautical miles south by east of Yokohoma, and 4470 miles west-south-west of San Francisco. It is a United States naval station and port of call, being 1342 miles east of the Philippines and 3337 west by south of the Sandwich Islands (Honolulu). The island is the most southerly of the group, is surrounded by a dozen islets, measures 32 miles from north to south by 9 east to west, and has an area of 224 square miles. In the north it reaches an altitude of 1000 feet in Santa Rosa, and a low ridge runs parallel to the west coast in the southern half of the island. It is wooded in both the north and west. The coast is generally rocky, except in the south-east, where it is coral-built and low. The climate is excellent, with two distinct seasons, and the rainfall is distributed throughout the year. Destructive typhoons sometimes visit the island, and earthquakes occasionally. The principal products are maize, sugar, potatoes, yams, bananas, oranges, and a few cocoanuts and pineapples. The value of the island lies in its fine harbour of San Luis d'Apra or Caldera, on the west coast, measuring 3½ miles across, with a depth of from 4 to 27 fathoms, and divided into an inner and an outer harbour by a peninsula and an island. Besides this there are several other coves and bays round the coast. The inhabitants are of the Chamorro stock (Indonesian), strongly intermixed with Philippine Tagals and Spaniards; and their speech is a dialect of Malay, corrupted by Tagal and Spanish. They number in all (1887), 8353; (1900), 9000, of whom 6185 live in the chief town Agaña, 10 miles north-east of San Luis d'Apra. The island is administered by a naval governor. It was discovered by Magellan in 1521, occupied by Spain in 1688, and ceded to the United States by the Treaty of Paris on 10th December 1898.

Guanabacoa, a town in Cuba, about 6 miles east of Havana, of which it is practically a suburb. Population (1899), 13,965.

Guanajay, a town in Cuba, 22 miles south-west of Havana. It is situated in the midst of a fertile country, about 12 miles from the north shore of Pinar del Rio province. It has a handsome plaza and some imposing houses. Population (1899), 6483.

Guanajuato, a state of Mexico, bounded on the N. by the state of San Luis Potosí, on the E. by that of Queretaro, on the S. by Michoacan, and on the W. by Jalisco. Area, 11,374 square miles. Population (1879), 834,845; (1900), 1,065,317. It is one of the most favoured regions of Mexico, its mining resources, fertility of soil, and railway communications bringing it great prosperity. The climate is temperate, the mean temperature being about 70° F. The principal agricultural products are cereals and leguminous plants of all kinds, tobacco, &c. Hogs, sheep, and goats are the principal animals raised. In 1897 the mineral production amounted to 149,507,042 kilograms, worth $9,026,348. The total trade is about $67,000,000 a year. The Mexican Central Railway traverses the state in three directions. The industries comprise 350 woollen mills, 72 flour mills, distilleries, foundries, tanneries, &c. The state is divided into five departments and thirty-one *partidos*. The capital, Guanajuato, situated 250 miles by rail from Mexico City, has good public buildings, a mint, state college, several churches, two theatres, hospitals, a pantheon, and the castle of Granaditas; population, 39,404. The principal towns of the state are Celaya (21,245), Irapuato (18,593), Silao (15,437), Salamanca (13,121), Allende (12,740), Valle de Santiago (12,671), Salvatierra (11,008), Pozos (9505), Cortazar (8623), La Luz (8318), Penjamo (7558), Santa Cruz (7440), San Francisco del Rincón (7111), Acambaro (6958), Gonzalez (6097), Dolores Hidalgo (5949), Yuriria (5789), Moroleon (5716), Comonfort (5260).

Guantanamo, the easternmost town of the south coast of Cuba. It is the shipping port and centre of a coffee-, sugar-, and lime-growing district. Population (1899), 7137.

Guarantee (sometimes spelt "Guarantie" or "Guaranty").—This word and the word "warrant" are probably both derived from the Teutonic word *wahren*, which signifies to defend or make safe and binding. "Guarantee" is, however, a term more comprehensive and of higher import than either "warrant" or "security," and designates either some international treaty whereby claims, rights, or possessions are secured, or more commonly a mere private transaction, by means of which one person, to obtain some trust, confidence, or credit for another, engages to be answerable for him.

In English law, a guarantee is a contract to answer for the payment of some debt, or the performance of some duty, by a third person who is *primarily* liable to such payment or performance. It is a *collateral* contract, which does not extinguish the original liability or obligation to which it is accessory, but on the contrary is itself rendered null and void should the latter fail, as without a principal there can be no accessory. The liabilities of a surety are in law dependent upon those of the principal debtor, and when the latter cease the former do so likewise (*per* Collins, L.J., in *Stacey* v. *Hill*, 1901, 1 K.B., at p. 666). If, therefore, persons wrongly suppose that a third person is liable to one of them, and a guarantee is given on that erroneous supposition, it is invalid *ab initio*, by virtue of the *lex contractûs*, because its foundation (which was that another was taken to be liable) has failed (*per* Wills, J., in *Mountstephen* v. *Lakeman*, L.R. 7 Q.B., p. 202).

The giver of a guarantee is called "the surety," or "the guarantor"; the person to whom it is given "the creditor," or "the guarantee"; while the person whose payment or performance is secured thereby is termed "the principal debtor," or simply "the principal." In America, but not apparently elsewhere, there is a recognized distinction between "a surety" and "a guarantor"; the former being usually bound with the principal, at the same time and on the same consideration, while the contract of the latter is his own separate undertaking, in which the principal does not join, and in respect of which he is not to be held liable, until due diligence has been exerted to compel the principal debtor to make good his default. There is no privity of contract between the surety and the principal debtor, for the surety contracts with the creditor, and they do not constitute in law one person, and are not jointly liable to the creditor (*per* Baron Parke in *Bain* v. *Cooper*, 1 Dowl. R. (N.S.) 11, 14).

No special phraseology is necessary to the formation of a guarantee; and what really distinguishes such a contract from one of insurance is not any essential difference between the two forms of words *insurance* and *guarantee*, but the substance of the contract entered into by the parties in each particular case (*per* Romer, L.J., in *Seaton* v. *Heath*—*Seaton* v. *Burnand*, 1899, 1 Q.B. 782, 792, C.A.; and see *Dane* v. *Mortgage Insurance Corporation*, 1894, 1 Q.B. 54 C.A.) In this connexion it may be mentioned that the different kinds of suretyships have been classified as follows:—(1) Those in which there is an agreement to constitute, for a particular purpose, the relation of principal and surety, to which agreement the

creditor thereby secured is a party; (2) those in which there is a similar agreement between the principal and surety only, to which the creditor is a stranger; and (3) those in which, without any such contract of suretyship, there is a primary and a secondary liability of two persons for one and the same debt, the debt being, as between the two, that of one of those persons only, and not equally of both, so that the other, if he should be compelled to pay it, would be entitled to reimbursement from the person by whom (as between the two) it ought to have been paid (*per* Earl of Selborne, L.C., in *Duncan Fox and Co.* v. *North and South Wales Bank*, 6 App. Cas., at p. 11).

The common-law requisites of a guarantee in no way differ from those essential to the formation of any other contract. That is to say, they comprise the mutual assent of two or more parties, competency to contract, and, unless the guarantee be under seal, valuable consideration. An offer to guarantee is not binding until it has been accepted, being revocable till then by the party making it. Unless, however, as sometimes happens, the offer contemplates an express acceptance, one may be implied, and it may be a question for a jury whether an offer of guarantee has in fact been accepted. Where the surety's assent to a guarantee has been procured by fraud of the person to whom it is given, there is no binding contract. Such fraud may consist of suppression or concealment or misrepresentation. There is some conflict of authorities as to what facts must be spontaneously disclosed to the surety by the creditor, but it may be taken that the rule on the subject is less stringent than that governing assurances upon marine, life, and other risks (*The North British Insurance Co.* v. *Lloyd*, 10 Exch. 523), though formerly this was denied (*Owen* v. *Homan*, 3 Mac. and G. 378, 397). Moreover, even where the contract relied upon is in the form of a policy guaranteeing the solvency of a surety for another's debt, and is therefore governed by the doctrine of *uberrima fides*, only such facts as are really material to the risk undertaken need be spontaneously disclosed (*Seaton* v. *Burnand—Burnand* v. *Seaton*, 1900, A.C. 135). As regards the competency of the parties to enter into a contract of guarantee, this may be affected by insanity or intoxication of the surety, if known to the creditor, or by disability of any kind. The ordinary disabilities are those of infants and married women—now greatly mitigated as regards the latter by the Married Women's Property Acts, 1870 to 1893, which enable a married woman to contract, as a *feme sole*, to the extent of her separate property. Every guarantee not under seal must have a consideration to support it, though the least spark of one suffices (*per* Wilmot, J., in *Pillan* v. *Van Mierop and Hopkins*, 3 Burr. at p. 1666; *Barrell* v. *Trussell*, 4 Taunt. 117), which, as in other cases, may consist either in some right, interest, profit, or benefit accruing to the one party, or some forbearance, detriment, loss, or responsibility given, suffered, or undertaken by the other. In some guarantees the consideration is entire—as where, in consideration of a lease being granted, the surety becomes answerable for the performance of the covenants; in other cases it is fragmentary, *i.e.*, supplied from time to time—as where a guarantee is given to secure the balance of a running account at a banker's, or a balance of a running account for goods supplied (*per* Lush, L.J., in *Lloyd's* v. *Harper*, 16 Ch. Div., at p. 319). In the former case, the moment the lease is granted there is nothing more for the lessor to do, and such a guarantee as that of necessity runs on throughout the duration of the lease, and is irrevocable. In the latter case, however, unless the guarantee stipulates to the contrary, the surety may at any time terminate his liability under the guarantee as to *future* advances, &c. The consideration for a guarantee must not be *past* or *executed*, but on the other hand it need not comprise a direct benefit or advantage to either the surety or the creditor, but may solely consist of anything done, or any promise made, for the benefit of the principal debtor. It is more frequently *executory* than *concurrent*, taking the form either of forbearance to sue the principal debtor, or of a future advance of money or supply of goods to him. Total failure of the consideration stipulated for by the party giving a guarantee will prevent its being enforced, as will also the existence of an illegal consideration.

The statutory requisites of a guarantee are, in England, prescribed by (1) the Statute of Frauds, which, with reference to guarantees, provides that "no action shall be brought whereby to charge the defendant upon any special promise to answer for the debt, default, or miscarriages of another person, unless the agreement upon which such action shall be brought, or some memorandum or note thereof, shall be in writing and signed by the party to be charged therewith, or some other person thereunto by him lawfully authorized," and (2) Lord Tenterden's Act (9 Geo. IV. c. 14), which by § 6 enacts that "no action shall be brought whereby to charge any person upon or by reason of any representation or assurance made or given concerning or relating to the character, conduct, credit, ability, trade, or dealings of any other person, to the intent or purpose that such other person may obtain credit, money, or goods upon" (*i.e.*, "upon credit," see *per* Parke, B., in *Lyde* v. *Barnard*, 1 M. and W., at p. 104), "unless such representation or assurance be made in writing signed by the party to be charged therewith." This latter enactment, which applies to incorporated companies as well as to individual persons (*Hirst* v. *West Riding Union Banking Co.*, 1901, 2 K.B. 560 C.A.), was rendered necessary by an evasion of the 4th section of the Statute of Frauds, accomplished by treating the special promise to answer for another's debt, default, or miscarriage, when *not* in writing, as required by that section, as a false and fraudulent representation concerning another's credit, solvency, or honesty, in respect of which damages, as for a tort, were held to be recoverable (*Pasley* v. *Freeman*, 3 T.R. 51). In Scotland, where, it should be stated, a guarantee is called a "cautionary obligation," similar enactments to those just specified are contained in § 6 of the Mercantile Law Amendment Act (Scotland), 1856, while in the Irish Statute of Frauds (7 Will. III. c. 12) there is a provision identical with that found in the English Statute of Frauds. In India a guarantee may be either oral or written (Indian Contract Act, § 126).

The Statute of Frauds does not invalidate a verbal guarantee, but renders it unenforceable by action. It may, therefore, be available in support of a defence to an action, and money paid under it cannot be recovered. An indemnity is not a guarantee within the statute, unless it contemplates the primary liability of a third person. It need not, therefore, be in writing when it is a mere promise to become liable for a debt, whenever the person to whom the promise is made should become liable (*Wildes* v. *Dudlow*, L.R. 19 Eq. 198; *Guild* v. *Conrad*, 1894, 2 Q.B. 885 C.A.). Neither does the statute apply to the promise of a *del credere* agent, which binds him, in consideration of the higher commission he receives, to make no sales on behalf of his principal except to persons who are absolutely solvent, and renders him liable for any loss that may result from the non-fulfilment of his promise. A promise to *give* a guarantee is, however, within the statute, though not one to *procure* a guarantee.

The general principles which determine what are guarantees within the Statute of Frauds, as deduced from a multitude of decided cases, are briefly as follows:—(1) the primary liability of a third person must exist or be

contemplated as the foundation of the contract (*Birkmyr* v. *Darnell*, 1 Sm. L.C., 10th ed., p. 287; *Mountstephen* v. *Lakeman*, L.R. 7 Q.B. 196; L.R. 7 H.L. 17); (2) the promise must be made to the creditor; (3) there must be an absence of all liability on the part of the surety independently of his express promise of guarantee; (4) the main object of the transaction between the parties to the guarantee must be the fulfilment of a third party's obligation; and (5) the contract entered into must not amount to a sale by the creditor to the promiser of a security for a debt or of the debt itself (see De Colyar's *Law of Guarantees and of Principal and Surety*, 3rd ed., pp. 65–161, where these principles are discussed in detail by the light of decided cases there cited).

As regards the kind of note or memorandum of the guarantee that will satisfy the Statute of Frauds, it is now provided by § 3 of the Mercantile Law Amendment Act, 1856, that "no special promise to be made, by any person after the passing of this Act, to answer for the debt, default, or miscarriage of another person, being in writing and signed by the party to be charged therewith, or some other person by him thereunto lawfully authorized, shall be deemed invalid to support an action, suit, or other proceeding, to charge the person by whom such promise shall have been made, by reason only that the consideration for such promise does not appear in writing, or by necessary inference from a written document." Prior to this enactment, which is not retrospective in its operation, it was held in many cases that as the Statute of Frauds requires "the agreement" to be in writing, all parts thereof were required so to be, including the consideration moving to, as well as the promise by, the party to be charged (*Wain* v. *Walters*, 5 East, 10; *Saunders* v. *Wakefield*, 4 B. and Ald. 595). These decisions, however, proved to be burdensome to the mercantile community, especially in Scotland and the north of England, and ultimately led to the alteration of the law, so far as guarantees are concerned, by means of the enactment already specified. Any writing embodying the terms of the agreement between the parties, and signed by the party to be charged, is sufficient; and the idea of agreement need not be present to the mind of the person signing (*per* Lindley, L.J., in *In re* Hoyle—*Hoyle* v. *Hoyle*, 1893, 1 Ch., at p. 98). It is, however, necessary that the names of the contracting parties should appear somewhere in writing; that the party to be charged, or his agent, should sign the memorandum or note of agreement, or else should sign another paper referring thereto; and that, when the note or memorandum is made, a complete agreement shall exist. Moreover, the memorandum must have been made before action brought, though it need not be contemporaneous with the agreement itself. As regards the stamping of the memorandum or note of agreement, a guarantee cannot be given in evidence unless properly stamped (Stamp Act, 1891). A guarantee for the payment of goods, however, requires no stamp, being within the exception contained in the first schedule of the Act. Nor is it necessary to stamp a written representation or assurance as to character within 9 Geo. IV. c. 14, *supra*. If under seal, a guarantee requires a ten-shilling stamp; otherwise a sixpenny stamp suffices; and, on certain prescribed terms, the stamps can be affixed any time after execution (Stamp Act, 1891, § 15, amended by § 18 of the Finance Act, 1895).

Extent of surety's liability.

The liability incurred by a surety under his guarantee depends upon its terms, and is not necessarily coextensive with that of the principal debtor. The surety cannot, however, be made liable except for a loss sustained by reason of the default guaranteed against. It was formerly considered to be the duty of the party taking a guarantee to see that it was couched in language enabling the party giving it to understand clearly to what extent he was binding himself (*Nicholson* v. *Paget*, 1 C. and M. 48). This view, however, can no longer be sustained, it being now recognized that a guarantee, like any other contract, must, in cases of ambiguity, be construed against the party bound thereby, and in favour of the party receiving it (*Mayer* v. *Isaac*, 6 M. and W. 605; *Wood* v. *Priestner*, L.R. 2 Exch. 66). The surety is not to be charged beyond the limits prescribed by his contract, which must be construed so as to give effect to what may fairly be inferred to have been the intention of the parties, from what they themselves have expressed in writing. In cases of doubtful import, recourse to parol evidence is permissible, to explain, but not to contradict, the written evidence of the guarantee. As a general rule, the surety is not liable if the principal debt cannot be enforced, because, as already explained, the obligation of the surety is merely accessory to that of the principal debtor. It has never been actually decided in England whether this rule holds good in cases where the principal debtor is an infant, and on that account is not liable to the creditor. Probably in such a case the surety might be held liable by estoppel (see *Kimball* v. *Newell*, 7 Hill (N.Y.) 116). When directors guarantee the performance by their company of a contract which is *ultra vires*, and therefore not binding on the latter, the directors' suretyship liability is, nevertheless, enforceable against them (*Yorkshire Railway Waggon Co.* v. *Maclure*, 21 Ch. D. 309 C.A.).

It is not always easy to determine for how long a time liability under a guarantee endures. Sometimes a guarantee is limited to a single transaction, and is obviously intended to be security against one specific default only. On the other hand, it as often happens that it is not exhausted by one transaction on the faith of it, but extends to a series of transactions, and remains a standing security until it is revoked, either by the act of the parties or else by the death of the surety. It is then termed a continuing guarantee. No fixed rules of interpretation determine whether a guarantee is a continuing one or not, but each case must be judged on its individual merits; and frequently, in order to achieve a correct construction, it becomes necessary to examine the surrounding circumstances, which often reveal what was the subject-matter which the parties contemplated when the guarantee was given, and likewise what was the scope and object of the transaction between them. Most continuing guarantees are either ordinary mercantile securities, in respect of advances made or goods supplied to the principal debtor, or else bonds for the good behaviour of persons in public or private offices or employments. With regard to the latter class of continuing guarantees, the surety's liability is, generally speaking, revoked by any change in the constitution of the persons to or for whom the guarantee is given. On this subject it is now provided by section 18 of the Partnership Act, 1890, which applies to Scotland as well as England, that "a continuing guarantee or cautionary obligation given either to a firm or to a third person in respect of the transactions of a firm, is, in the absence of agreement to the contrary, revoked as to future transactions by any change in the constitution of the firm to which, or of the firm in respect of the transactions of which the guaranty or obligation was given." This section, like the enactment it replaces, namely, section 4 of the Mercantile Law Amendment Act, 1856, is mainly declaratory of the common law, as embodied in decided cases, which indicate that the changes in the persons to or for whom a guarantee is given may consist either of an increase in their number, of a diminution thereof caused by death or retirement from business, or of the incorpora-

tion or consolidation of the persons to whom the guarantee is given. In this connexion it may be stated that the Government Offices (Security) Act, 1875, which has been amended by the Statute Law Revision Act, 1883, contains certain provisions with regard to the acceptance by the heads of public departments of guarantees given by companies for the due performance of the duties of an office or employment in the public service, and enables the Commissioners of His Majesty's Treasury to vary the character of any security, for good behaviour by public servants, given after the passing of the Act.

Before the surety can be rendered liable on his guarantee, the principal debtor must have made default. When, however, this has occurred, the creditor, in the absence of express agreement to the contrary, may sue the surety, without even informing him of such default having taken place, or requiring him to pay, and before proceeding against the principal debtor or resorting to securities for the debt received from the latter. In those countries where the municipal law is based on the Roman civil law, sureties usually possess the right, originally conferred by the Roman law, of compelling the creditor to sue the principal debtor before having recourse to the sureties. This right, according to a great American jurist (Chancellor Kent in *Hayes* v. *Ward*, 4 Johns. New York, Ch. Cas. p. 132), "accords with a common sense of justice and the natural equity of mankind." In England, however, this right has never been fully recognized; but, even in England, before any demand for payment has been made by the creditor on the surety, the latter can, as soon as the principal debtor has made default, compel the creditor, on giving him an indemnity against costs and expenses, to sue the principal debtor, if the latter be solvent and able to pay (*per* A. L. Smith, L.J., in *Rouse* v. *Bradford Banking Company*, 1894, 2 Ch. p. 75; *per* Lord Eldon in *Wright* v. *Simpson*, 6 Ves. at p. 733)

The usual mode of enforcing liability under a guarantee is by action in the High Court or in the County Court. It is also permissible for the creditor to obtain redress by means of a set-off or counter-claim, in an action brought against him by the surety. On the other hand, the surety may now, in any court in which the action or the guarantee is pending, avail himself of any set-off which may exist between the principal debtor and the creditor. Moreover, if one of several sureties for the same debt is sued by the creditor or his guarantee, he can, by means of a proceeding termed a third-party notice, claim contribution from his co-surety towards the common liability. Independent proof of the surety's liability under his guarantee must always be given at the trial; as the creditor cannot rely either on admissions made by the principal debtor, or on a judgment or award obtained against him (*Ex parte* Young *In re* Kitchin, 17 Ch. Div. 668). Should the surety become bankrupt either before or after default has been made by the principal debtor, the creditor will have to prove against his estate. This right of proof is now regulated by the 37th section of the Bankruptcy Act, 1883, which is most comprehensive in its terms.

Rights of sureties.

A person liable as a surety for another under a guarantee possesses various rights against him, against the person to whom the guarantee is given, and also against those who may have become co-sureties in respect of the same debt, default, or miscarriage. As regards the surety's rights against the principal debtor, the latter may, after he has made default, be compelled by the surety to exonerate him from liability by payment of the guaranteed debt (*per* Sir W. Grant, M.R., in *Antrobus* v. *Davidson*, 3 Meriv. 569, 579; *per* Lindley, L.J., in *Johnston* v. *Salvage Association*, 19 Q.B.D. 460, 461; and see *Wolmershausen* v. *Gullick*, 1893, 2 Ch. 514). The moment, moreover, the surety has himself paid any portion of the guaranteed debt, he is entitled, if the suretyship was undertaken at the principal debtor's actual or constructive request, but not otherwise, to rank as a creditor for the amount so paid, and to compel repayment thereof. In the event of the principal debtor's bankruptcy, the surety can prove against his estate, not only in respect of payments made before such bankruptcy, but also, it seems, in respect of the contingent liability to pay under the guarantee. As regards the rights of the surety against the creditor, they are exercisable even by one who in the first instance was a principal debtor, but has since become a surety, by arrangement with his creditor, duly notified to the creditor, though not even sanctioned by him. This was decided by the House of Lords in the case of *Rouse* v. *The Bradford Banking Co.* (1894, A.C. 586), removing a doubt created by the previous case of *Swire* v. *Redman* (1 Q.B.D. 536), which must now be treated as overruled. The surety's principal right against the creditor entitles him, after payment of the guaranteed debt, to the benefit of all securities, whether known to him (the surety) or not, which the creditor held against the principal debtor; and where, by default or *laches* of the creditor, such securities have been lost, or rendered otherwise unavailable, the surety is discharged *pro tanto*. This right, which is *not* in abeyance till the surety is called on to pay (*Dixon* v. *Steel*, 1901, 2 Ch. 602), extends to all securities, whether satisfied or not, given before or after the contract of suretyship was entered into. On this subject the Mercantile Law Amendment Act, 1856, § 5, provides that "every person, who being surety for the debt or duty of another, or being liable with another for any debt or duty, shall pay such debt or perform such duty, shall be entitled to have assigned to him, or to a trustee for him, every judgment, specialty, or other security, which shall be held by the creditor in respect of such debt or duty, whether such judgment, specialty, or other security shall or shall not be deemed at law to have been satisfied by the payment of the debt or performance of the duty, and such person shall be entitled to stand in the place of the creditor, and to use all the remedies, and, if need be, and upon a proper indemnity, to use the name of the creditor, in any action or other proceeding at law or in equity, in order to obtain from the principal debtor, or any co-surety, co-contractor, or co-debtor, as the case may be, indemnification for the advances made and loss sustained by the person who shall have so paid such debt or performed such duty; and such payment or performance so made by such surety shall not be pleadable in bar of any such action or other proceeding by him, provided always that no co-surety, co-contractor, or co-debtor shall be entitled to recover from any other co-surety, co-contractor, or co-debtor, by the means aforesaid, more than the just proportion to which, as between those parties themselves, such last-mentioned person shall be justly liable." This enactment is so far retrospective that it applies to a contract made before the Act, where the breach thereof, and the payment by the surety, have taken place subsequently. On the principal debtor becoming a bankrupt, the surety who has paid the guaranteed debt has a right to all dividends received by the creditor from the bankrupt in respect thereof, and to stand in the creditor's place as to future dividends. This right is, however, often waived by the guarantee stipulating that, until the creditor has received full payment of all sums due to him from the principal debtor, the surety shall not participate in any dividends distributed from the bankrupt's estate amongst his creditors.

As regards the rights of the surety against a co-surety, he is entitled to contribution from him in respect of their common liability. This particular right is not the result of

any contract, but is derived from a general equity, on the ground of equality of burden and benefit, and exists whether the sureties be bound jointly, or jointly and severally, and by the same, or different, instruments. There is, however, no right of contribution where each surety is severally bound for a given portion only of the guaranteed debt; nor in the case of a surety for a surety; nor where a person becomes a surety jointly with another, and at the latter's request. Contribution may be enforced, either before payment, or as soon as the surety has paid more than his share of the common debt (*Wolmershausen* v. *Gullick*, 1893, 2 Ch. 514); and the amount recoverable is now always regulated by the number of solvent sureties, though formerly this rule only prevailed in equity. The right of contribution is not the only right possessed by co-sureties against each other, but they are also entitled to the benefit of all securities which have been taken by any one of them as an indemnity against the liability incurred for the principal debtor.

The discharge of a surety from liability under his guarantee may be accomplished in various ways, he being regarded as a "favoured debtor" (*per* Turner, L.J., in *Wheatley* v. *Bastow*, 7 De G. M. and G. 279, 280; *per* Earl of Selborne, L.C., in *In re* Sherry—*London and County Banking Co.* v. *Terry*, 25 Ch. D., at p. 703). Thus, fraud subsequent to the execution of the guarantee (as where, for example, the creditor connives at the principal debtor's default) will certainly discharge the surety. Again, a material alteration made in the instrument of guarantee after its execution may also have this effect. The most prolific ground of discharge, however, is usually traceable to causes originating in the creditor's *laches* or conduct, the governing principle being that if the creditor violates any rights which the surety possessed when he entered into the suretyship, even though the damage be nominal only, the guarantee cannot be enforced. On this subject it suffices to state that the surety's discharge may be accomplished (1) by a variation of the terms of the contract between the creditor and the principal debtor, or of that subsisting between the creditor and the surety; (2) by the creditor taking a new security from the principal debtor in lieu of the original one; (3) by the creditor discharging the principal debtor from liability; (4) by the creditor binding himself to give time to the principal debtor for payment of the guaranteed debt; or (5) by loss of securities received by the creditor in respect of the guaranteed debt. A revocation of the contract of suretyship by act of the parties, or in certain cases by the death of the surety, may also operate to discharge the surety. The death of a surety does not *per se* determine the guarantee, but, save where from its nature the guarantee is irrevocable by the surety himself, it can be revoked by express notice after his death, or, it would appear, by the creditor becoming affected with constructive notice thereof; except where, under the testator's will, the executor has the option of continuing the guarantee, in which case the executor should, it seems, specifically withdraw the guarantee in order to determine it. Where one of a number of joint and several sureties dies, the future liability of the survivors under the guarantee continues, at all events until it has been determined by express notice. Moreover, when three persons joined in a guarantee to a bank, and their liability thereunder was not expressed to be several, it was held that the death of one surety did not determine the liability of the survivors. In such a case, however, the estate of the deceased surety would be relieved from liability.

The Statutes of Limitation bar the right of action on guarantees under seal after twenty years, and on other guarantees after six years, from the date when the creditor might have sued the surety.

AUTHORITIES.—DE COLYAR. *Law of Guarantees and of Principal and Surety*, 3rd edition, 1897; American edition, by J. A. Morgan, 1875.—THROOP. *Validity of Verbal Agreements.*—FELL. *Guarantees*, 2nd edition.—THEOBALD. *Law of Principal and Surety.*—BRANDT. *Law of Suretyships and Guarantee.*

(H. A. DE C.)

Guarda, a district of Portugal, on the watershed between the Tagus and the Douro, with an area of 2086 square miles, and a population of 263,292 in 1900. Wine is the principal product, especially in the communes of Foscôa, Mêda, Gouveia, and Ceia. Corn, *i.e.*, wheat, millet, barley, and rye, is also extensively cultivated. Woollens are made at Gouveia, Manteigas, and Guarda. The live stock, consisting principally of sheep, are estimated to amount (in value) to 3·4 per cent. of the entire kingdom. The capital, GUARDA, an episcopal see, stands on a plateau at the north end of the Serra da Estrella, 81 miles south-east of Oporto. It has a sanatorium for consumptives. Population, 5990.

Guatemala, a country of Central America, lying between 13° 42′ and 17° 49′ N. lat., and 88° 10′ and 92° 30′ W. long. The frontier towards Mexico was determined by conventions of 27th September 1882, 17th October 1883, 1st April 1895, and 8th May 1899. Starting from the Pacific, it ascends the river Suchiate, then follows an irregular line towards the north-east, till it reaches the parallel of 17° 49′ N. lat., along which it runs to the frontier of British Honduras. This frontier, by the convention of 9th July 1893, coincides with the meridian of 89° 20′ W. long. till it meets the river Sarstun, which it follows eastwards to the Gulf of Honduras. The climate is healthy, except on the coast lands, where malarial fever is prevalent. The rainy season in the interior lasts from May to October, but on the coast sometimes continues till December. The coldest month is January, and the warmest is May. The average temperatures for these months at places of different altitudes are given by Dr Sapper as follows:—

Locality.	Altitude (Feet).	Fahrenheit Degrees.	
		January.	May.
Puerto Barrios	6	74	81
Salamá	3020	68	77
Campur	3050	64	73
Chimax	4280	61	68
Guatemala	4870	60	67
Quezaltenango	7710	50	62

Area and Population.—The area is calculated at 48,300 square miles, and the population in 1900 was put at 1,574,340.

According to the returns of the census taken 26th February 1893, the population was 1,364,678 (females, 687,206; males, 677,472), of whom 882,733 were Indians: about 60 per cent. of the population are Indians, the rest are Ladinos, people of mixed blood, negroes, mulattoes, zambos, and half-caste Indians, the number of pure whites being very small. The foreign population (1893) numbered 11,331, including 1303 Americans (mostly Jews from the west), 532 Spaniards, 453 Italians, 399 Germans, 349 English, 272 French. By occupation, 327,594 persons were labourers, 46,054 bakers, 21,930 weavers, 13,034 merchants, 9653 seamstresses, 7759 servants and female cooks. The rural population numbered 827,058; inhabitants of cities and towns, 526,666; and those of special settlements, 10,954.

The principal towns, with their populations in 1893, are: Guatemala, 72,000; Quezaltenango, 16,000[1]; Antigua, 9000; Atitlán, 9000; San Cristóbal, 9000; Momostenango, 8000; Tacaná, 7000; Cobán, 6000; Nebaj, 6000; Totonicapam, 5000; Escuintla, 5000.

[1] This town was entirely destroyed at the end of April 1902 by an earthquake, but preparations for its rebuilding were promptly begun.

tion or consolidation of the persons to whom the guarantee is given. In this connexion it may be stated that the Government Offices (Security) Act, 1875, which has been amended by the Statute Law Revision Act, 1883, contains certain provisions with regard to the acceptance by the heads of public departments of guarantees given by companies for the due performance of the duties of an office or employment in the public service, and enables the Commissioners of His Majesty's Treasury to vary the character of any security, for good behaviour by public servants, given after the passing of the Act.

Before the surety can be rendered liable on his guarantee, the principal debtor must have made default. When, however, this has occurred, the creditor, in the absence of express agreement to the contrary, may sue the surety, without even informing him of such default having taken place, or requiring him to pay, and before proceeding against the principal debtor or resorting to securities for the debt received from the latter. In those countries where the municipal law is based on the Roman civil law, sureties usually possess the right, originally conferred by the Roman law, of compelling the creditor to sue the principal debtor before having recourse to the sureties. This right, according to a great American jurist (Chancellor Kent in *Hayes* v. *Ward*, 4 Johns. New York, Ch. Cas. p. 132), "accords with a common sense of justice and the natural equity of mankind." In England, however, this right has never been fully recognized; but, even in England, before any demand for payment has been made by the creditor on the surety, the latter can, as soon as the principal debtor has made default, compel the creditor, on giving him an indemnity against costs and expenses, to sue the principal debtor, if the latter be solvent and able to pay (*per* A. L. Smith, L.J., in *Rouse* v. *Bradford Banking Company*, 1894, 2 Ch. p. 75; *per* Lord Eldon in *Wright* v. *Simpson*, 6 Ves. at p. 733)

The usual mode of enforcing liability under a guarantee is by action in the High Court or in the County Court. It is also permissible for the creditor to obtain redress by means of a set-off or counter-claim, in an action brought against him by the surety. On the other hand, the surety may now, in any court in which the action or the guarantee is pending, avail himself of any set-off which may exist between the principal debtor and the creditor. Moreover, if one of several sureties for the same debt is sued by the creditor or his guarantee, he can, by means of a proceeding termed a third-party notice, claim contribution from his co-surety towards the common liability. Independent proof of the surety's liability under his guarantee must always be given at the trial; as the creditor cannot rely either on admissions made by the principal debtor, or on a judgment or award obtained against him (*Ex parte* Young *In re* Kitchin, 17 Ch. Div. 668). Should the surety become bankrupt either before or after default has been made by the principal debtor, the creditor will have to prove against his estate. This right of proof is now regulated by the 37th section of the Bankruptcy Act, 1883, which is most comprehensive in its terms.

Rights of sureties.

A person liable as a surety for another under a guarantee possesses various rights against him, against the person to whom the guarantee is given, and also against those who may have become co-sureties in respect of the same debt, default, or miscarriage. As regards the surety's rights against the principal debtor, the latter may, after he has made default, be compelled by the surety to exonerate him from liability by payment of the guaranteed debt (*per* Sir W. Grant, M.R., in *Antrobus* v. *Davidson*, 3 Meriv. 569, 579; *per* Lindley, L.J., in *Johnston* v. *Salvage Association*, 19 Q.B.D. 460, 461; and see *Wolmershausen* v. *Gullick*, 1893, 2 Ch. 514). The moment, moreover, the surety has himself paid any portion of the guaranteed debt, he is entitled, if the suretyship was undertaken at the principal debtor's actual or constructive request, but not otherwise, to rank as a creditor for the amount so paid, and to compel repayment thereof. In the event of the principal debtor's bankruptcy, the surety can prove against his estate, not only in respect of payments made before such bankruptcy, but also, it seems, in respect of the contingent liability to pay under the guarantee. As regards the rights of the surety against the creditor, they are exercisable even by one who in the first instance was a principal debtor, but has since become a surety, by arrangement with his creditor, duly notified to the creditor, though not even sanctioned by him. This was decided by the House of Lords in the case of *Rouse* v. *The Bradford Banking Co.* (1894, A.C. 586), removing a doubt created by the previous case of *Swire* v. *Redman* (1 Q.B.D. 536), which must now be treated as overruled. The surety's principal right against the creditor entitles him, after payment of the guaranteed debt, to the benefit of all securities, whether known to him (the surety) or not, which the creditor held against the principal debtor; and where, by default or *laches* of the creditor, such securities have been lost, or rendered otherwise unavailable, the surety is discharged *pro tanto*. This right, which is *not* in abeyance till the surety is called on to pay (*Dixon* v. *Steel*, 1901, 2 Ch. 602), extends to all securities, whether satisfied or not, given before or after the contract of suretyship was entered into. On this subject the Mercantile Law Amendment Act, 1856, § 5, provides that "every person, who being surety for the debt or duty of another, or being liable with another for any debt or duty, shall pay such debt or perform such duty, shall be entitled to have assigned to him, or to a trustee for him, every judgment, specialty, or other security, which shall be held by the creditor in respect of such debt or duty, whether such judgment, specialty, or other security shall or shall not be deemed at law to have been satisfied by the payment of the debt or performance of the duty, and such person shall be entitled to stand in the place of the creditor, and to use all the remedies, and, if need be, and upon a proper indemnity, to use the name of the creditor, in any action or other proceeding at law or in equity, in order to obtain from the principal debtor, or any co-surety, co-contractor, or co-debtor, as the case may be, indemnification for the advances made and loss sustained by the person who shall have so paid such debt or performed such duty; and such payment or performance so made by such surety shall not be pleadable in bar of any such action or other proceeding by him, provided always that no co-surety, co-contractor, or co-debtor shall be entitled to recover from any other co-surety, co-contractor, or co-debtor, by the means aforesaid, more than the just proportion to which, as between those parties themselves, such last-mentioned person shall be justly liable." This enactment is so far retrospective that it applies to a contract made before the Act, where the breach thereof, and the payment by the surety, have taken place subsequently. On the principal debtor becoming a bankrupt, the surety who has paid the guaranteed debt has a right to all dividends received by the creditor from the bankrupt in respect thereof, and to stand in the creditor's place as to future dividends. This right is, however, often waived by the guarantee stipulating that, until the creditor has received full payment of all sums due to him from the principal debtor, the surety shall not participate in any dividends distributed from the bankrupt's estate amongst his creditors.

As regards the rights of the surety against a co-surety, he is entitled to contribution from him in respect of their common liability. This particular right is not the result of

any contract, but is derived from a general equity, on the ground of equality of burden and benefit, and exists whether the sureties be bound jointly, or jointly and severally, and by the same, or different, instruments. There is, however, no right of contribution where each surety is severally bound for a given portion only of the guaranteed debt; nor in the case of a surety for a surety; nor where a person becomes a surety jointly with another, and at the latter's request. Contribution may be enforced, either before payment, or as soon as the surety has paid more than his share of the common debt (*Wolmershausen* v. *Gullick*, 1893, 2 Ch. 514); and the amount recoverable is now always regulated by the number of solvent sureties, though formerly this rule only prevailed in equity. The right of contribution is not the only right possessed by co-sureties against each other, but they are also entitled to the benefit of all securities which have been taken by any one of them as an indemnity against the liability incurred for the principal debtor.

The discharge of a surety from liability under his guarantee may be accomplished in various ways, he being regarded as a "favoured debtor" (*per* Turner, L.J., in *Wheatley* v. *Bastow*, 7 De G. M. and G. 279, 280; *per* Earl of Selborne, L.C., in *In re* Sherry—*London and County Banking Co.* v. *Terry*, 25 Ch. D., at p. 703). Thus, fraud subsequent to the execution of the guarantee (as where, for example, the creditor connives at the principal debtor's default) will certainly discharge the surety. Again, a material alteration made in the instrument of guarantee after its execution may also have this effect. The most prolific ground of discharge, however, is usually traceable to causes originating in the creditor's *laches* or conduct, the governing principle being that if the creditor violates any rights which the surety possessed when he entered into the suretyship, even though the damage be nominal only, the guarantee cannot be enforced. On this subject it suffices to state that the surety's discharge may be accomplished (1) by a variation of the terms of the contract between the creditor and the principal debtor, or of that subsisting between the creditor and the surety; (2) by the creditor taking a new security from the principal debtor in lieu of the original one; (3) by the creditor discharging the principal debtor from liability; (4) by the creditor binding himself to give time to the principal debtor for payment of the guaranteed debt; or (5) by loss of securities received by the creditor in respect of the guaranteed debt. A revocation of the contract of suretyship by act of the parties, or in certain cases by the death of the surety, may also operate to discharge the surety. The death of a surety does not *per se* determine the guarantee, but, save where from its nature the guarantee is irrevocable by the surety himself, it can be revoked by express notice after his death, or, it would appear, by the creditor becoming affected with constructive notice thereof; except where, under the testator's will, the executor has the option of continuing the guarantee, in which case the executor should, it seems, specifically withdraw the guarantee in order to determine it. Where one of a number of joint and several sureties dies, the future liability of the survivors under the guarantee continues, at all events until it has been determined by express notice. Moreover, when three persons joined in a guarantee to a bank, and their liability thereunder was not expressed to be several, it was held that the death of one surety did not determine the liability of the survivors. In such a case, however, the estate of the deceased surety would be relieved from liability.

The Statutes of Limitation bar the right of action on guarantees under seal after twenty years, and on other guarantees after six years, from the date when the creditor might have sued the surety.

AUTHORITIES.—DE COLYAR. *Law of Guarantees and of Principal and Surety*, 3rd edition, 1897; American edition, by J. A. Morgan, 1875.—THROOP. *Validity of Verbal Agreements.*—FELL. *Guarantees*, 2nd edition.—THEOBALD. *Law of Principal and Surety.*—BRANDT. *Law of Suretyships and Guarantee.*

(H. A. DE C.)

Guarda, a district of Portugal, on the watershed between the Tagus and the Douro, with an area of 2086 square miles, and a population of 263,292 in 1900. Wine is the principal product, especially in the communes of Foscõa, Mêda, Gouveia, and Ceia. Corn, *i.e.*, wheat, millet, barley, and rye, is also extensively cultivated. Woollens are made at Gouveia, Manteigas, and Guarda. The live stock, consisting principally of sheep, are estimated to amount (in value) to 3·4 per cent. of the entire kingdom. The capital, GUARDA, an episcopal see, stands on a plateau at the north end of the Serra da Estrella, 81 miles south-east of Oporto. It has a sanatorium for consumptives. Population, 5990.

Guatemala, a country of Central America, lying between 13° 42′ and 17° 49′ N. lat., and 88° 10′ and 92° 30′ W. long. The frontier towards Mexico was determined by conventions of 27th September 1882, 17th October 1883, 1st April 1895, and 8th May 1899. Starting from the Pacific, it ascends the river Suchiate, then follows an irregular line towards the north-east, till it reaches the parallel of 17° 49′ N. lat., along which it runs to the frontier of British Honduras. This frontier, by the convention of 9th July 1893, coincides with the meridian of 89° 20′ W. long. till it meets the river Sarstun, which it follows eastwards to the Gulf of Honduras. The climate is healthy, except on the coast lands, where malarial fever is prevalent. The rainy season in the interior lasts from May to October, but on the coast sometimes continues till December. The coldest month is January, and the warmest is May. The average temperatures for these months at places of different altitudes are given by Dr Sapper as follows:—

Locality.	Altitude (Feet).	Fahrenheit Degrees.	
		January.	May.
Puerto Barrios	6	74	81
Salamá	3020	68	77
Campur	3050	64	73
Chimax	4280	61	68
Guatemala	4870	60	67
Quezaltenango	7710	50	62

Area and Population.—The area is calculated at 48,300 square miles, and the population in 1900 was put at 1,574,340.

According to the returns of the census taken 26th February 1893, the population was 1,364,678 (females, 687,206; males, 677,472), of whom 882,733 were Indians: about 60 per cent. of the population are Indians, the rest are Ladinos, people of mixed blood, negroes, mulattoes, zambos, and half-caste Indians, the number of pure whites being very small. The foreign population (1893) numbered 11,331, including 1303 Americans (mostly Jews from the west), 532 Spaniards, 453 Italians, 399 Germans, 349 English, 272 French. By occupation, 327,594 persons were labourers, 46,054 bakers, 21,930 weavers, 13,034 merchants, 9653 seamstresses, 7759 servants and female cooks. The rural population numbered 827,058; inhabitants of cities and towns, 526,666; and those of special settlements, 10,954.

The principal towns, with their populations in 1893, are: Guatemala, 72,000; Quezaltenango, 16,000[1]; Antigua, 9000; Atitlán, 9000; San Cristóbal, 9000; Momostenango, 8000; Tacaná, 7000; Cobán, 6000; Nebaj, 6000; Totonicapam, 5000; Escuintla, 5000.

[1] This town was entirely destroyed at the end of April 1902 by an earthquake, but preparations for its rebuilding were promptly begun.

Government.—According to the constitution of 1879, the legislative power is vested in a national assembly of 69 deputies (1 for every 20,000 inhabitants) chosen for 4 years by direct popular vote in 38 electoral districts. The president of the Republic is elected in a similar manner, but for 6 years, and he is not eligible for the following term. He is assisted by 6 ministers, heads of Government departments, and by a council of state of 9 members, 4 of whom are appointed by himself and 5 by the national assembly. The two vice-presidents of the Republic are elected by the national assembly.

Local Government.—Each of the 22 departments is administered by an official called a *Jefe Politico*, or political chief, appointed by the president of the Republic, and each is subdivided into municipal districts, of which there are altogether 331. These districts are administered by one or more *alcaldes* or mayors, assisted by municipal councils, both *alcaldes* and councils being chosen by the people.

Justice.—The judicial power is vested in a supreme court, consisting of a chief-justice and four associate justices, elected by the people; six appeal courts, each with three judges, also elected by the people; and twenty-nine courts of first instance, each consisting of one judge appointed by the president, and two by the chief-justice of the supreme court.

Religion and Instruction.—The prevailing form of religion is the Roman Catholic, but the state recognizes no distinction of creed. The establishment of conventual or monastic institutions is prohibited. Of the population in 1893, 90 per cent. could neither read nor write, 2 per cent. could only read, and 8 per cent. could read and write. Primary instruction is compulsory, and, in Government schools, is provided at the cost of the state. In 1895 there were 1266 Government schools, with a total attendance of 64,015 (39,411 boys and 24,604 girls). But there are, besides, about 50 private (occasionally aided) schools of similar character, owners of plantations on which there are more than 10 children being obliged to provide school accommodation. Higher instruction is given in two national institutes at the capital, one for men with 500 pupils, and one for women with 300. At Quezaltenango there are two similar institutes, and at Chiquimula there are other two. To each of the six there is a normal school attached, and within the Republic there are 4 other normal schools. For professional instruction (law, medicine, engineering) there are 4 schools, supported by private funds, but aided occasionally by the Government. Other educational establishments are a school of art, a national conservatory of music, a commercial college, 4 trades' schools with more than 600 pupils, and a national library. For the year 1901 the expenditure of the state on instruction was put at 1,513,900 pesos.

Defence.—For the white and mixed population military service is compulsory; from the eighteenth to the twenty-fifth year of age, in the active army, and from the twenty-sixth to the fiftieth, in the reserve. The effective force of the active army is put at 56,900, of the reserve at 29,400.

Finance.—Of the revenue of Guatemala about 36 per cent. is derived from liquor and tobacco taxes; 28 per cent. from import and export duties; 9 per cent. from property, road, military, slaughter, and salt taxes; 1·7 per cent. from the gunpowder monopoly; and the remainder from various taxes, stamps, Government lands, and postal and telegraph services. The spending departments are chiefly those of war, government, and internal development. The gold value of the currency peso fluctuates between limits so wide that conversion into sterling (especially for a series of years), with any pretension to accuracy, is impracticable. In 1899 the rate of exchange moved between 710 per cent. and 206 per cent. premium on gold. Between 1892 and 1899 the gross revenues collected were as follows in currency pesos:—

Year.	Pesos.	Year.	Pesos.
1892	8,660,490	1896	15,150,740
1893	10,442,750	1897	12,479,740
1894	11,851,030	1898	9,738,661
1895	14,491,670	1899	8,566,910

The cash receipts and expenditure of the Treasury for 1896–99 were:—

Year.	Receipts.	Expenditure.
	Pesos.	Pesos.
1896	18,351,900	17,437,450
1897	22,073,590	21,433,190
1898	9,183,340	9,964,830
1899	5,946,120	5,937,281

For the year 1900–1 the revenue was estimated at 9,620,000 pesos, and the expenditure at 9,611,200 pesos.

At the end of 1899 the outstanding debt of the Republic was as follows:—

Consolidated external debt	£1,542,112
Muller and Thomsen loan	39,275
German syndicate loan (1897) . . .	101,500
German syndicate loan (1898) . . .	24,850
Other gold debts	109,745
Silver debt (internal loans, note issue, &c.), 25,763,776 pesos = ...	1,167,000
Total	2,984,482

The amount of the consolidated external debt includes arrears of interest. An agreement made in 1895 for the service of this debt was speedily broken by the Government, and another, made in 1898, fared little better, the funds assigned as security for its service being applied to the reduction of the more recent debts due to the German syndicates. At the end of 1899 the assets of the Republic, including national lands, railways, &c., were put at 32,535,300 silver pesos (£2,400,000).

Production.—The most important products of Guatemala are coffee and sugar, and the richest districts for the cultivation of these crops are on the Pacific slope of the range of volcanic mountains running parallel to the coast. On the Atlantic side of the mountains there are also coffee plantations, but in this region progress has been slower. Both in the west and east the most flourishing are the German plantations, which have a total area of more than 1000 square miles, and yield about one-third of the total coffee produce of Guatemala. In both regions the uncultivated land is overgrown with dense tropical forest, the area of which has perceptibly diminished only in the west. The extension of coffee cultivation is shown by the increase of the crop at intervals of five years since 1881, as follows:—

Year.	Lbs.	Year.	Lbs.
1881	26,037,200	1897	82,475,585
1886	52,975,100	1898	82,603,283
1891	52,449,500	1899	84,194,460
1896	68,773,633		

Sugar, which was largely exported from 1882 to 1890, is now again grown in considerable quantities. In 1898 the area under sugar-cane was 40,768 acres, and the yield amounted to 11,356,900 lb of white sugar, 141,620 bags of brown sugar, 13,494,425 lb of molasses, and 3,482,900 lb of inferior sugar. Cocoa-trees are planted in the lowlands to the number of 1,251,830, on an area of 7504 acres, the yield amounting in 1899 to 187,200 lb. There were 11,872 acres under bananas, yielding 910,500 bunches. Tobacco covered 1680 acres, yielding 935,000 lb. Cereals and other agricultural produce grown in small quantities include wheat, potatoes, rice, maize (860,167 bushels on 221,648 acres in 1898), beans (29,310 bushels on 15,456 acres). Rubber-trees are planted in the lowlands, and the production increases. In 1899 the export amounted to 513,800 lb. The cattle industry is prosperous, and hides and skins are exported. In 1898 the live stock within the Republic consisted of 196,768 cattle, 50,343 horses, 77,593 sheep, and 29,784 swine. Gold washing is carried on by natives in a primitive manner on the banks of the Motagua river in the departments of Izabal and Baja Verapaz. Salt mines abound in the departments of Alta Verapaz and Santa Rosa. Silver, iron, copper, lead, cinnabar, coal, and mica are found in different localities on the eastern side of the Republic. Mining, however, has not been undertaken on a large scale, and it is still doubtful whether the minerals known to exist in the country could be obtained in paying quantities. There are no manufactures of any importance. Coarse cotton and woollen stuffs are woven, and hats, shoes, agricultural implements, and other articles are made, but not in sufficient quantities to supply local demands.

Commerce.—The imports into Guatemala consist mainly of cotton goods and yarn, flour, sacks, and iron implements. The exports are coffee, sugar, and a few other products. The imports during the five years 1891–95 were of the average annual value (5 gold pesos = £1) of £1,442,000; in the year 1896, £1,828,670; in 1897, £1,373,600; in 1898, £970,160. The exports in the years 1891–95 amounted to the average annual value of (at 13·5 silver pesos = £1) £1,431,700; in 1896, £1,710,000; in 1897, £1,464,800; in 1898, £1,139,000; in 1899, £1,674,000. In 1899 the values of the principal exports were: coffee, £1,478,100; sugar, £50,070; bananas, £23,610; rubber, £51,380; hides and skins, £53,550; cocoa, £193. Of the imports, about 90 per cent. in value come from the four countries named in the following table, which shows the value imported from each of them in 1898 and 1899. It should be remembered that German trade is much assisted by the numerous German planters within the Republic:—

Countries.	1898	1899.
United States .	£309,829	£227,369
Great Britain .	129,689	157,429
Germany . . .	187,568	133,051
France . . .	43,467	35,728

Of the exports, the United States in 1899 took about 18 per cent. of the coffee, all the bananas, and 50 per cent. of the rubber; Great Britain took 22 per cent. of the coffee and 15 per cent. of the rubber; Germany took 55 per cent. of the coffee and 33 per cent. of the rubber.

Shipping and Communications.—The Republic is in regular steam communication on the Atlantic side with New Orleans, New York, and Hamburg, by vessels which visit the ports of Barrios and Livingston. On the western side the ports of San José, Champerico, and Ocós are visited by the Pacific mail steamers, by the vessels of a Hamburg company, and by those of the South American (Chilian) and the Pacific Steam Navigation Companies. In 1898 altogether 825 vessels entered and 845 cleared at the ports of the Republic. The principal towns are connected by waggon roads, towards the construction and maintenance of which each male inhabitant is required to pay two pesos or give four days' work a year. There are coach routes between the capital and Quezaltenango and Antigua, but over a great portion of the country transport is still on mule-back. The railways in operation are the Southern (or Central), 75 miles, from the capital to San José, belonging to an American company; the Western, 41 miles, from Champerico to Retalhuleu and San Filipé, belonging to a Guatemalan company, but largely under German management; and the Northern, 133 miles, from Port Barrios to El Rancho, a Government line, which is intended to be continued to Guatemala city (60 miles), so that, with the Southern railway, there may be an interoceanic system. For local traffic there are several lines; one from Iztapa, near San José, to Naranjo, and another from Ocós to the western coffee plantations. On the Atlantic slope transport is effected mainly by river tow-boats from Livingston along the Dulce Gulf and other lakes, and the Polochie river as far as Panzos. The narrow-gauge railway that serves the German plantations in the Verapaz region is largely owned by Germans.

Post and Telegraph.—Guatemala joined the Postal Union in 1881, but the international postal service has suffered from the financial rottenness of the Government, which was in debt to the Panama Railway Company and to a New Orleans steamboat company for conveyance of mail packets. The international postal movement in 1899 comprised the despatch of 328,112 and the receipt of 401,598 letters and packets. The total movement in 1898 consisted of the receipt of 2,769,543 and the despatch of 2,771,035 pieces of mail. In 1899 the telegraph lines had a length of 3126 miles, with 148 offices, through which 786,046 messages were sent. In and around the capital and Quezaltenango telephone services have been provided by private companies.

Money and Credit.—Within the Republic there are six banks of issue, to which the Government is deeply indebted. There is practically neither gold nor silver in circulation, and the value of the bank-notes is so fluctuating that trade is seriously hampered. In order to ease its own position and give general relief at a time of financial crisis the Government, on 29th October 1898, empowered a committee of the banks to increase the note circulation by the issue of 6,000,000 pesos of paper money in 1-, 5-, and 25-peso notes. This arrangement did not include a supply of fractional money necessary for retail transactions, and during the last six months of 1899 the only notes of smaller denomination than a peso were the *cedulas*, issued by municipalities, and current only within their several limits. In the course of 1899 fractional silver coins, ·500, ·600, and ·835 fine, were put in circulation to the nominal value of 346,373 pesos, but these, vanishing as soon as issued, made no appreciable difference. In August 1899 the Government made a further contract by which the banks that were parties to it were each authorized to issue, in addition to their earlier issues, small notes to the amount of 100,000 pesos. Since then other issues of small notes have been authorized to take the place of notes of larger denomination; and a later measure provided for the coining of 3,000,000 pesos of fractional nickel money, which will be legal tender only for payment of amounts strictly limited. The silver peso, the monetary unit, weighs 25 grammes ·900 fine. The metric system of weights and measures has been adopted.

History.—The recent history of Guatemala is mainly a record of political, military, and financial trouble. President Rufino Barrios, elected in 1873, governed the country after the manner of a dictator; and though he encouraged education, promoted railway and other enterprises, and succeeded in settling difficulties as to the Mexican boundary, the general result of his policy was baneful. Conspiracies against him were rife, and in 1884 he narrowly escaped assassination. His ambition was to be the restorer of the federal union of the Central American States, and when his efforts towards this end by peaceful means failed, he had recourse to the sword. Counting on the support of Honduras and Salvador, he proclaimed himself, in February 1885, the supreme military chief of Central America, and claimed the command of all the forces within the five states. President Zaldívar, of Salvador, had been his friend, but after the issue of the decree of union he entered into a defensive alliance with Costa Rica and Nicaragua. In March Barrios invaded Salvador, and on 2nd April a battle was fought, in which the Guatemalan president was killed. He was succeeded as president by General Barillas. No further effort was made to force on the union, and on 16th April the war was formally ended. Peace, however, only provided opportunity for domestic conspiracy, with assassination and revolution in view. In 1892, General Reina Barrios was elected president, and in 1897 he was re-elected; but on 8th February 1898 he was assassinated. Senor Morales, vice-president, succeeded him; but in the same year Don Manuel Estrada Cabrera was elected president for the term ending 1905. With the exception of brief intervals of quarrelling with neighbouring states, Guatemalan activity has been chiefly devoted to political disturbance and insurrection.

AUTHORITIES.—C. JUAN ANINO. *La Republica de Guatemala.* Guatemala, 1894.—T. BRIGHAM. *Guatemala. The Land of the Quetzal.* London, 1887.—J. M. CACERES. *Geografia de Centro-America.* Paris, 1882.—G. LEMALE. *Guia geografica de los centros de poblacion de la republica de Guatemala.* Guatemala, 1882.—F. A. DE FUENTES Y GUZMAN. *Historia de Guatemala o Recordacion Florida.* Madrid, 1882.—A. C. and A. P. MAUDSLAY. *A Glimpse at Guatemala, and Some Notes on the Ancient Monuments of Central America.* London, 1899.—GUSTAVO NIEDERLEIN. *The Republic of Guatemala.* Philadelphia, 1898.—RAMON A. SALAZAR. *Historia del Disenvolvimiento Intelectual de Guatemala,* vol. i. Guatemala, 1897.—OTTO STOLL. *Reisen und Schilderungen aus den Jahren 1878–1883.* Leipzig, 1886.—J. MENDEZ. *Guia del Inmigrante en la Republica de Guatemala.* Guatemala, 1895.—CARL SAPPER. "Grundzüge der physikalischen Geographie von Guatemala" (*Ergänzungsheft,* No. 115, *Petermann's Mitteilungen*). Gotha, 1894.—*Anuario de Estadistica de la Republica de Guatemala.* Guatemala.—*Memoria de la Secretaria de Instruccion Publica.* Guatemala, 1899.—*Handbook of Guatemala.* Revised. Bureau of the American Republics. Washington, 1897.—*United States Consular Reports.* Washington.—*British Foreign Office Diplomatic and Consular Reports.* London. (W. W. R.; C. E. A.)

Guatemala, or more exactly GUATEMALA LA NUEVA, capital of the Republic, situated in the middle of a broad plain. It lies about 5000 feet above sea-level, and is surrounded on all sides by mountains and volcanoes. It is 75 miles N. of San José, on the Pacific, with which it is connected by railway, and 190 miles S.E. of Puerto Barrios, on the Gulf of Honduras, with which also there is railway communication. In preparation for the exhibition of 1897 much was done to improve the town. The boulevards, which extend to a distance of 3 miles from the city, have undergone extensive repairs, and form a fine carriage drive; a park, La Reforma, has been laid out, and the presidential palace and other public buildings have been erected. The city has suffered somewhat from a fall in the price of coffee, the depression of silver, and other causes, but with the completion of the railway to Puerto Barrios a rapid increase of prosperity is anticipated. The foreign trade is mainly in the hands of Germans. The population in 1893 was 71,525, five-sixths being of European origin.

Guayama, a small town of Porto Rico, the capital of a province of the same name, situated about 10 miles from the south coast. The natural port is Arroyo. It is connected by fine highways with San Juan and Ponce. Population (1899), 5334.

Guayaquil, a city and port of Ecuador, and capital of the province of Guayas. Population (1890), 44,772, of whom 4378 were foreigners; (1900), about 51,000. There is a weekly service of steamers, British and Chilian, north and south, and nineteen-twentieths of the commerce of Ecuador now passes through the port. The following table shows the number of foreign vessels entered and cleared at the port during the years 1896–98:—

	1896.		1897.		1898.	
	Ships.	Tonnage.	Ships.	Tonnage.	Ships.	Tonnage.
Entered .	201	267,931	192	265,208	206	298,805
Cleared .	197	264,240	192	265,208	200	290,855

The value of the exports—chiefly cocoa, coffee, sugar, hides, and fruits—in 1896 was £1,088,919; in 1897, £1,217,628; in 1898, £1,678,170; in 1900, £1,245,531. A railway line runs from Duran on the east bank of the Guayas, opposite Guayaquil, to Chimbo, 60 miles from Duran, and its extension to Quito is now being pushed. After its devastation by fire in 1896 the greater part of the business portion of the city was rebuilt in better style, but on 30th November 1899 a fire broke out in the centre of the city, which in a few hours destroyed some of the most important public buildings, including the theatre, the San José Church, the San Vincente College, and the main offices of the Custom House. A large brewery has been established, and there are cotton and woollen mills, sugar refineries, soap works, chocolate factories, &c. The city is connected with the telegraph cable, and has several tramway lines, electric lighting and telephone service.

Guayra, La, or La Guaira, a town and port of Venezuela, in the province of Caracas, from which it is distant 23 miles by rail; an important port for foreign trade. In 1898, 325 steamships entered the port, 84 of which were British, 39 American, and 70 French. The total shipments of the most valuable exports for the same year were: coffee, 30,256,911 ℔; cacao, 11,466,078 ℔; skins, 89,729 ℔; hides, 2,091,112 ℔; and sabadilla, 171,769 ℔; and in 1899 the weight of coffee shipped was 18,944,000 ℔; of cacao, 11,399,000 ℔; and of hides, 2,155,000 ℔. The total amount of the import duties collected in 1898 was £623,191. One of the most important engineering works in Venezuela is the La Guayra breakwater, built by an English company, over 2000 feet long and 40 feet deep at the extreme point.

Gubbio, a town and bishop's see of the province of Perugia, Umbria, Italy, on the Florence–Ancona line, 68 miles west by south from Ancona by rail. Amongst the public buildings may be mentioned the town hall, containing a museum of pictures, wood-carving of the 15th and 16th centuries, MSS., &c., and the famous Eugubine tables. The manufacture of rose-tinted lustred ware is still pursued with success. Silk-throwing and the making of cement are also carried on. Population (1881), 6290; (1899), 5500.

Guelderland, or Gelderland, formerly a duchy, now a province of the Netherlands. It consists of three very distinct regions. The first, formerly the *Graafschap Zutphen*, lies east of the river Yssel, with diluvial sand and gravel, sloping from east to west (131 to 26 feet), and with its rivers accordingly flowing in the same direction to join the Yssel. The extreme east is occupied by older Tertiary loam, upon which and on the river banks are the most fertile spots, woods, cultivated land, pastures for the cattle bred in the district, towns and villages, with a population of Saxon origin. Farther from the rivers lie heaths, small fens, and sand. The second region, or the *Veluwe* ("bad land"), lies west of the Yssel, is varied by hills (164 to 328 feet), and has a soil of sand and gravel, with clay only along the banks of the Yssel and its feeders. Between the Veluwe hills and the Utrecht ridge the Geldersch valley, formed by the diluvial Rhine, is ill-drained by the Grift into the Zuider Zee. All over the Veluwe are heaths, scantily cultivated (rye and buckwheat), cattle of inferior quality, and sheep, and a sparse population. It is only on grounds sloping to the rivers Yssel and Rhine that large forests have attracted a denser population of mixed origin. The third region, or the *Betuwe* ("good land"), lies south of the Yssel and Rhine, has a level clay soil, varied by isolated hills and a sandy stretch in the direction of Nimeguen. A denser population, mainly of Frankish origin, is occupied in the cultivation of wheat, beetroot, and orchards, the breeding of excellent cattle, shipping, and industrial pursuits. Guelderland is the largest province in the kingdom, having an area of 1906 square miles. Population (1873), 437,778; (1900), 566,649.

Guelph, a city (1879) of Ontario, Canada, 45 miles W. by S. of Toronto, on the river Speed and the Grand Trunk and Canadian Pacific railways. It contains, in addition to the county and municipal buildings, the Ontario Agricultural College. The exports in 1899–1900 were valued at $734,345, imports at $869,280. Population (1881), 9890; (1900), 11,087.

Guernsey. See Channel Islands.

Guerrero, a state of Mexico, bounded on the N. by the states of Mexico and Morelos, on the N.E. by that of Puebla, on the E. and S.E. by Oaxaca, and on the S.W. by the Pacific. Area, 25,003 square miles. Population in 1879, 295,590; and in 1900, 474,594. The state lacks communication facilities, and its territory is mountainous. The principal agricultural products are cereals, coffee, cacao, vanilla, tobacco, textile fibres, &c. These products are valued at about $2,000,000 a year. Gold, silver, mercury, lead, iron, coal, sulphur, &c., are found in the state, but lack of communication retards their working. The capital is Chilpancingo (6312); amongst other towns are Chilapa (8256), Iguala (6631), Tixtla (6588), Acapulco (5770).

Guiana, an extensive region in the north-east of South America, divided between Great Britain, France, Holland, Brazil, and Venezuela. British, French, and Dutch Guiana have certain common physical characteristics. In all three countries different regions must be distinguished: the northern plain, consisting of alluvium deposited by the sea and rivers, 18 to 50 miles in breadth; the gneiss and diabase, forming the beds of the rivers; and the slate formation on the surface, covered in the south by granite. Difference of structure, modified by atmospheric conditions, causes corresponding differences in the surface relief and in vegetation, forming three natural divisions. (1) The flat coast region, with reed-bordered marshes, ridges of shells and sand indicating the former shore lines, and, near the rivers, sand and blue clay or humus. Here plantations have been formed on drained and dyked lands. (2) The higher and drier savannahs, in the east much nearer to the coast than in the west, covered with sand, and overgrown with grass, shrubs, and thin forests. (3) The undulating country rising into forest-covered hills and mountains, as the Tumuc-Humac and Acarai mountains on the southern frontier; the Nassau, Brokopondo, and Mindrineti mountains, respectively near the Maroni and the Surinam and between the latter river and the Saramacca. The character of the

river channels, the rainfall, and tides affect the navigability of the waterways. Generally speaking, in the large rivers flowing south to north vessels of 16 feet draught can ascend with the tide three or four hours' sail from the sea, and vessels drawing 6½ to 9½ feet can ascend still higher in the dry season. The middle stretches up to the rapids or cataracts are navigable for canvas boats.

I. British Guiana, the only British possession in South America, lying between 9° and 1° N. lat. and between 57° and 62° W. long. Its area is over 110,000 square miles, of which only about 130 square miles are under cultivation. Its coast-line from east to west measures 300 miles, while from north to south there is a lineal depth of more than 550 miles. It is bounded on the N. by the Atlantic Ocean, on the E. by Dutch Guiana, on the W. by Venezuela, and on the S. by Brazil. The boundary line between British Guiana and Venezuela was for many years till 1899 the subject of dispute. The Dutch, while British Guiana was in their possession, claimed the whole watershed of the Essequibo river, while the Venezuelans asserted that the Spanish province of Guayana extended up to the Essequibo. In 1886 the British Government declared that it would thenceforward exercise jurisdiction up to and within the boundary (known as the Schomburgk line) suggested by Sir Robert Schomburgk after his survey of 1842–43. In 1897, in consequence of intervention on the part of the United States, arbitration was agreed upon, and two years later the tribunal gave, in Paris, its decision in favour of a line not greatly differing from the Schomburgk line, though it awarded to Venezuela Point Barima and the immediately adjacent land, and the district between the Wenamu and the upper reaches of the Cuyuni. The delimitation of the boundary between British Guiana and Brazil was in 1902 referred to the arbitration of the King of Italy. The physical nature of British Guiana offers, roughly speaking, four different types: first, the seaboard, which, though not swampy, is low, flat, and alluvial; secondly, the basin of the Essequibo river, which traverses the colony from south to due north; thirdly, the savannah, or elevated tableland, averaging 1200 to 1500 feet in height, well watered and treeless; and fourthly, the mountainous portion of the colony, a sandstone group of mountains reaching their highest ascertained summit in Roraima, a remarkable tableland of rock, measuring roughly 4 miles by 8, and rising to a height of 8600 feet above sea-level. The colony is divided into three districts, which take their names from the three principal rivers debouching into the Atlantic—namely, the Demerara, Essequibo, and Berbice, which are navigable for 90, 35, and 150 miles respectively. Other rivers, varying in size and volume from mighty streams to small creeks, intersect the interior. The capital is Georgetown, at the mouth of the Demerara river, with a population of 53,000. New Amsterdam, on the Berbice river, has a population of 8900. Each possesses a mayor and town council, with power to raise local revenues. There are twenty-three villages, with a population of 32,573, the affairs of which are controlled by village councillors. As the climate is not favourable to prolonged physical exertion, and as three days' wage will, as a rule, supply the agricultural labourer's wants for a week, the provision of a trustworthy labour supply for sugar estates is of great importance. For sixty years the labour necessary to carry on the staple industry has been imported under a system of indenture. China helped greatly between 1853 and 1859, and the West Indies and Madeira also contributed, but India has been the only permanent recruiting-ground. A scheme adopted in 1896–97, whereby allotments of lands are made to coolies wishing to remain at the end of their indentures, in lieu of passage back to India, has worked advantageously. The census of 1891 gave a total population of 278,328. In 1899 the population was estimated as follows:—

Europeans, other than Portuguese	4,500
Portuguese	12,200
East Indians	108,000
Chinese	3,800
Africans (born)	3,300
Creoles	116,000
Aboriginal Indians	7,500
Mixed races	31,200
	286,500

English is spoken throughout the colony, but the aboriginal Indians—the Warraus, Arawaks, Wapianas, and Caribs—have their own tribal languages, which are divided into many dialects. Many of these Indians are still wholly uncivilized, although both Roman Catholic and Protestant missionaries have for many generations been working amongst them. The climate is hot, especially from July to October, but not unhealthy. The temperature ranges from 78° to 88°. The rainfall ranges from 75 to 130 inches per annum; earthquakes and violent thunderstorms are of rare occurrence, and the colony is not within the region of hurricanes. Sugar, the cultivation of which is confined to the fringe of the coast lands and to the lower banks of the main rivers, for many years the principal product of British Guiana, has survived, in the face of bounties and other adverse conditions, better than in any other West Indian colony. Attention has, however, latterly been paid to other products, especially to rice, cacao, and kola. Though the lower parts of the upper reaches of the rivers are not very fertile, there are between the true coast lands and the ranges of sand dunes which occur in Berbice, Demerara, and Essequibo, at varying distances from the mouths of the rivers, great tracts of land of marked fertility formed by the deposition of the sea-borne mud of the Amazon, which will produce almost any tropical vegetable and fruit. The timber industry is limited to those regions which lie near the lower stretches of the principal rivers, overland transport of heavy logs being difficult and costly, while on the upper reaches of the rivers are many cataracts and falls. Unalienated Crown lands extend to about 80,000 square miles, largely covered by virgin forest and in need of drainage. This land can be purchased at very cheap rates. Without beneficial occupation, however, the land reverts to the Crown. Licenses to cut timber, to collect ballata gum, indiarubber, &c., and for quarrying, are granted. The gold-producing districts (mainly placer workings) are situated in the forest portion of the colony, *i.e.*, Berbice and Corentyn; Demerara and Essequibo rivers, Mazaruni and Puruni rivers; Cuyuni river and Groote Creek, Essequibo river; and Barima, Barama, and Waini rivers. The revival of the industry dates from 1884. Diamonds to the value of £11,210 were exported in 1901, almost all from the Mazaruni district.

During 1900–1, 94,745 tons of sugar (valued at £1,082,400) were exported, besides 4,023,828 gallons of rum (value, £287,400), and gold £377,400, the other exports being molasses, timber, ballata gum, shingles, cattle, and hides. In 1878 the value of the imports was £2,150,714; that of 1900–1 was £1,311,800. In 1878 the value of the exports was £2,507,571; that of 1900–1 was £1,577,400. The average value of the imports in the five years ending 1901 was £1,288,000, as compared with an average of £1,838,400 in the five years 1881–85 inclusive; the averages of the exports for the corresponding periods being £1,815,400 and £2,515,400 respectively. The following shows the direction of the import trade in 1900–1:—United Kingdom, 48·4 per cent.; British possessions, 13·7; Foreign countries, including the United States (£759,100 in 1899–1900), 31·7. In 1878 the revenue was £405,092; in 1898–99 it was £525,865. In 1878 the

expenditure was £417,995; in 1898–99 it was £525,387. The public debt in 1877 was £323,563; in 1899 it was £975,791. During 1897–98 the tonnage of vessels entering was 304,428 (steam, 242,571; sailing, 61,857), and cleared 316,770 (steam, 253,960; sailing, 62,810). After the United Kingdom, Holland sends the most vessels; then Norway and France. Queen's College, Georgetown, a Government institution, provides secondary education for about 100 boys (mainly English or Creole, but including a fair number of Portuguese, Chinese, East Indian, and others). Secondary teaching for girls is provided at private establishments—Roman Catholic and Wesleyan. The matriculation and other examinations of the University of London and the Cambridge Local Examinations are held in the colony. A scholarship is awarded annually of £200 per annum for three years, or, for medical students, £150 for five years. In 1898–99 there were 210 state-aided elementary schools under the management of ministers of religion, with 28,689 children on the books, and an average daily attendance of 15,959. Except those belonging to estates, these schools are denominational as follows:—Anglican, 72; Church of Scotland, 36; Congregational, 30; Wesleyan, 29; Roman Catholic, 27; Estate, 13; Moravian, 2; Lutheran, 1. Four Government primary scholarships are given yearly. The bishopric of British Guiana forms part of the West Indian Province of the Church of England.

There are no imperial troops now stationed in the colony. The police, semi-military in character, numbers 806 officers and men, with a rural constabulary numbering 1169. The militia numbers 426, with a reserve of 196. There are 5 public hospitals and lunatic and leper asylums; 69 post-offices (39 being telegraph stations), and 1157 miles of telegraph lines. There are two lines of railway: from Georgetown to Mahaica (20 miles); from Demerara river to Essequibo river (18½ miles). The total length of roads in the colony is 264 miles (of which 163 were constructed by Government, and 101 by the proprietors of sugar estates).

The political constitution of the colony is, from a theoretical point of view, a mixture of a Crown colony, a dependency, and an autonomous colony—due to the fact that when Great Britain acquired the colony from the Dutch in 1814 she adopted the Dutch-Roman law bequeathed by Holland, which is still in force in civil cases, modified by Orders in Council and local ordinances; the criminal law being based on that of England. The Government consists of the governor and the court of policy, which comprises 15 members, 7 *ex-officio* nominated, and 8 elected. The court acts as a legislative council except for purposes of taxation, which is settled by the "combined court," consisting of the court of policy and 6 elected financial representatives. There is also an executive council, consisting of the governor, 5 official and 3 unofficial members nominated by the Crown, which discharges administrative functions, which until 1891 belonged to the court of policy.

(F. CU.)

II. DUTCH GUIANA, or SURINAM, has an area of about 57,900 square miles. The interest taken by the Netherlands in the colony greatly increased during the last twenty years of the 19th century, as shown by the establishment of the Surinam Association, of the Steam Navigation Company's service to Paramaribo, and by the formation of a botanical garden for experimental cultures at that town, as also by geological and other scientific expeditions, and the exhibition at Haarlem, 1898. The most important crops and those supplying the chief exports are cocoa, yielding, in 1899, 9,733,900 lb, coffee 893,100 lb, and sugar, all cultivated on the larger plantations, with rice, maize, and bananas on the smaller or coast lands. The area under sugar in 1899 was 4243 acres, under cocoa 33,536 acres, other cultures 3669 acres; total, 41,448 acres. Most of the larger plantations are situated on the lower courses of the Surinam, Commewyne, Nickerie, and Cottica, and on the coast lands, rarely in the upper parts. The goldfields lie in the older rocks (especially the slate) of the upper Surinam, Saramacca, and Maroni, and near these rivers mining concessions had been granted of 968,155 acres in 1899. The production of gold in 1899 amounted to 893,197 grammes, valued at £101,970. Cattle-rearing is a very inconsiderable industry, the total live stock of the colony in 1899 being represented by about 6760 cattle and horses, 600 asses and mules, 181 sheep, 1726 goats, and 2627 swine.

During late years meteorological observations have been carried on at five stations (Paramaribo, Burnside (Coronie), Sommelsdijk, Nieuw-Nickerie, and Groningen). The mean range of temperature for the day, month, and year shows little variation, being respectively 77·54°–88·38° F., 76·1°–78·62° F., and 70·52°–90·14° F. The north-east trade winds prevail throughout the year, but the rainfall varies considerably; for December and January the mean is respectively 8·58 and 9·57 inches, for May and June 11·26 and 10·31 inches, but for February and March 7·2 and 6·81 inches, and for September 2·48 and 2·0 inches. The seasons comprise a long and a short dry season, and a period of heavy and of slight rainfall. The inhabitants of Surinam differ with the soil and the products. The Indians (Caribs, Arawaks, Warrous) live on the savannahs, or on the upper Nickerie, Coppename, and Maroni, far from the plantations, cultivating their fields of manioc or cassava, and for the rest living by fishing and hunting. They number 1000 to 2000. The bush negroes (Marrons) dwell between 3° and 4° N., near the isles and cataracts. They are estimated at 8000, and are employed in the transport of men and goods to the goldfields, the navigation of the rivers, in trade with the Indians, and in the transport of wood to Paramaribo and the plantations. The inhabitants of Paramaribo and the plantations comprise a variety of races, represented by 400 Chinese, 600 Javanese, 10,000 coolies from India and the West Indies, 30,000 to 40,000 negroes, and 2000 of the white race; Jews number about 1200, and there is a floating Dutch population of 600. The total (1899) is about 67,150, of whom nearly one-half are in Paramaribo and one-half in the districts. In 1852 there were 6000 persons in the town and 32,000 in the districts; thus, while the population has increased but little during fifty years, the movement from the districts to the town has increased. During the same period the number of immigrants was 29,570. Agriculture is the chief means of subsistence. Of 30,000 persons whose occupation was given in the statistics, close upon 21,000 were engaged in agriculture or on the plantations, 2400 in gold-mining, and only 1000 in trade. The exports increased in value from £200,800 in 1875 to £459,800 in 1899, and the export of gold between 1882 and 1899 from £65,350 to £99,600. The imports increased from £260,450 in 1875 to £510,180 in 1899. The growth of the commerce and the countries with which it is chiefly carried on are shown in the following table:—

Year.	Vessels.			Tonnage.			Value in thousands of £.		
	Netherlands.	United States.	Other Countries.	Netherlands.	United States.	Other Countries.	Netherlands.	United States.	Other Countries.
				Imports.					
1883	30	21	198	5,944	5800	39,410	173	84	173
1899	27	14	190	27,752	7641	100,209	267	111	132
				Exports.					
1883	15	21	214	3,180	5462	42,328	69	104	165
1899	27	8	197	27,137	3578	106,935	147	267	45

According to statistics compiled by ex-governor Asch van Wyck, the population in 1898 comprised 29,000 Moravian Brethren, 9000 Protestants, 16,750 Roman Catholics, 1250 Jews, 2700 Mahommedans, and 9700 Hindus. As regards instruction, Paramaribo had in 1899 six government primary schools with 53 teachers and 1612 pupils, besides eighteen private schools with 75 teachers and 3876 pupils. In the districts there were thirteen government schools with 14 teachers and 693 pupils, and sixteen private schools with 21 teachers and 959 pupils.

AUTHORITIES.—KAPPLER. *Surinam.* Stuttgart, 1887.—BONAPARTE, PRINCE ROLAND. *Les habitants de Surinam.* Paris, 1884.—MARTIN. "Bericht über eine Reise ins Gebiet des Oberen-Surinam," *Bijdragen v. h. Inst. voor Taal Land en Volkenkunde*, vol. i. p. 1. The Hague.—WESTEROUEN VAN MEETEREN. *La Guyane Neerlandaise.* Leiden, 1884.—TEN KATE. "Een en ander over Suriname," *Gids*, 1888.—VERSCHUUR. "Voyages aux trois Guyanes," *Tour du Monde*, 1893, pp. 1, 49, 65.—LOTH. *Beknopte Aardrijkskundige beschrijving van Suriname.* Amsterdam, 1898, and *Tijdschr. Aardr. Gen.*, 1878, 79, 93.—ASCH VAN WYCK. "La Colonie de Surinam," *Les Pays Bas*, 1898. *Catalogus der Nederl. W. I. ten Toonstelling te Haarlem, 1899: Guide à travers la Section des Indes Neerlandaises*, p. 323. Amsterdam, 1899.

(C. M. K.)

III. FRENCH GUIANA.—This colony is situated between Dutch Guiana and Brazil. A delimitation of the territory belonging to France and the Netherlands was arrived at in 1891, by decision of the Emperor of Russia. In December 1900 the Swiss Government fixed as the boundary between French Guiana and Brazil the river Oyapok and the watershed on the Tumuc Humac mountains, thus awarding to France about 3000 of the 100,000

square miles which she claimed. French Guiana, according to the most recent official estimate, has an area of 50,030 square miles; but a strange divergence of opinion exists upon this point, and competent authorities variously place it, without the zone whose possession was till recently disputed with Brazil, at 47,000 square miles and 58,000 square miles. M. Coudreau ventured across the immense inland tropical forest in 1887–91, but it is still little known. The population has little altered in numbers, being estimated at about 30,000 in 1898. Of this total 12,350 lived at Cayenne, 10,100 were in the communes, 5700 formed the penal population, 1500 were native Indians (Galibi, Emerillon, Oyampi), and 500 near Maroni were negroes. Apart from Cayenne, which was rebuilt after the great fire of 1888, the centres of population are unimportant: Sinnamary with 1500 inhabitants, Mana with 1750, Roura with 1200, and Approuague with 1150. In 1892 French Guiana was finally divided into fourteen communes, exclusive of the Maroni district. Belonging to the colony are also the three Safety Islands (Royale, Joseph, and Du Diable—the last notable as the island where Dreyfus was imprisoned), the Enfant Perdu Island, and the five Remire Islands. The colony is administered by a governor, assisted by a director of the interior, a chief of the judicial service, a director of the penitentiary administration, and by a privy council. In 1879 an elective general council of sixteen members was constituted. There are a tribunal of first instance and a higher tribunal at Cayenne, besides four justices of peace, one of whom has extensive jurisdiction in other places. White convicts are now sent to the settlements; in 1885 French Guiana was appointed as a place of banishment for confirmed criminals and for convicts sentenced to more than eight years' hard labour. Of the £207,000 demanded for the colony in the colonial budget for 1901, £195,000 represented the estimated expenditure on the penal settlement, so that the cost of the colony was only about £12,000. The local budget for 1901 balanced at £99,000. Instruction is given in the college of Cayenne and in six primary schools. At the head of the clergy is an apostolic prefect. The armed force consists of two companies of marine infantry, half a battery of artillery, and a detachment of gendarmerie, and comprises about 380 men. A very small portion of the territory is devoted to agriculture, although France has paid some attention to the development of this branch of activity. In 1880 a colonial garden was created near Cayenne; since 1894 an experimental garden has been laid out at Baduel. About 8200 acres are cultivated, of which 5400 acres are under cereals and rice, the remainder being under coffee, cacao, cane, and other cultures. The low lands between Cayenne and Oyapok are capable of bearing colonial produce, and the savannahs from the Oyapok to the Arajovary might support large herds; cereals, root-crops, and vegetables might easily be grown on the high grounds, and the working of the timber in the forests of the interior should be profitable. As regards gold-mining, placers of very great wealth have been discovered on the Awa, on the Dutch frontier, and at Carsevenne in the territory which formed the subject of the Franco-Brazilian dispute. The production amounted to £160,000 in 1889, £280,000 in 1892, and to nearly £320,000 in 1899. But wages are high and transport is costly. Silver and iron have been found in various districts; kaolin is extracted in the plains of Montsinéry; and phosphates have been discovered at several places. Besides 123 workings for gold, the industries of French Guiana comprise saw-mills, distilleries, brick-works, and sugar-works. The commerce in 1885 amounted to £336,000 for imports, and to £144,000 for exports; in 1897 the values were respectively £373,350 and £286,400. The share of France and her colonies in the exports was £277,400, and in the imports £253,500. For 1899 imports were valued at £421,000, exports at £270,000. The gold export amounted to £255,000. The imports consist of wines, flour, clothes, &c. The shipping during 1899 numbered 150 vessels of 40,300 tons (metric) entered, and 149 of 39,500 tons cleared. Cayenne is almost the only port. One of the drawbacks to the development of the colony is the lack of labour. Native labour is most difficult to obtain, and attempts to utilize convict labour have not proved very successful. So far also every effort to supply the need by immigration has proved a failure. The land routes are not numerous. The most important are that from Cayenne to Iracoubo (78 miles), and that from Cayenne to Kaw along the coast to the mouth of the Approuague. Towards the interior there are only foot-paths, badly made. By water, Cayenne is in regular communication with the Safety Islands (35 miles), and the mouth of the Maroni (80 miles), with Fort de France in the island of Martinique, where travellers meet the mail packet for France, and with Boston (United States). There is a French cable between Cayenne and Brest.

See VIALA. *Les Trois Guyanes.* Montpellier, 1893.—LEVASSEUR. *La France*, tome ii. Paris, 1893. (P. L.)

Guildford, a municipal borough, market-town, and county town of Surrey, England, in the Guildford parliamentary division (since 1885) of the county, on the Wey, 30 miles south-west of London by rail. It is the seat of a suffragan bishopric. Guildford Castle has been purchased by the corporation, and the ground about it opened as a public garden (1888). Public baths, a cattle market, and an isolation hospital have been erected, and the Royal Surrey Hospital has been enlarged. Area, 607 acres. Population (1881), 11,288; (1901), 15,937.

Guimarães, a town of Portugal, district Braga, 25 miles S.E. of Braga. It has one of the largest markets in the kingdom, and manufactures cutlery, linen, leather, and preserved fruits. The vineyards cover about 9000 acres. Population (1900), 8863.

Guinea, French, a French colony in West Africa, bounded on the W. by the Atlantic, on the N. by Portuguese Guinea and Senegal, on the E. by Senegal and the Ivory Coast, and on the S. by Liberia and Sierra Leone. The shore, which extends from the Alcatraz Islands on the north to the Scarcies Islands on the south, is low, monotonous, and bordered with sand-dunes. The islands of Tomba, Laos, Matakong are at various distances from the coast. The protectorate of Futa Jallon, which commences at a distance of 80 miles from the sea, is high, and possesses well-marked features; some places have an altitude of 4000 feet, and there is scarcely any more important hydrographic centre in Africa. French Guinea is watered by the Cogon, the Rio Nunez (70 miles), the Rio Pongo, and the Mellacoree; from the Futa Jallon flow the Gambia, the Faleme, the Bafing, and the Niger. Futa Jallon was annexed after the expeditions of Moustier and Zweifel (1879), Bayol (1881), and Plat (1888). There has never been any difficulty in occupying this region. French Guinea was administered by the governor of Senegal till 1893, when the colony was declared a separate administrative unit. The present limits of the hinterland were fixed by the decree of October 1899, dividing the French Sudan (see SUDAN) among the four French West African colonies, by which French Guinea received the six circles Dinguiray, Siguiri, Kurussa, Kankan, Kissandugu, Beyla, and nearly doubled its area, which is now estimated at 92,000 square miles. The population on this area numbers about 1,250,000. The

colony is administered by a governor (since 1895 under the governor-general of French West Africa), assisted by a council composed of three official and three civil members. One of the three French colonies allowed to manage their own finances, French Guinea is practically self-supporting. In 1898 the local expenditure was only £53,805 as compared with a revenue of £70,763, and in 1899, though there was a subsidy from the home Government of £12,700, about £4500 of this was voted for military expenditure and £4000 for a road to the Niger. The inhabitants do not cultivate more than one-tenth of the surface of the country. Cotton textiles are by far the most important import; in 1898 their value amounted to £153,800 out of a total of £360,800, in 1899 to £253,000 out of a total of £617,700 (including £77,000 specie). The other principal items in 1899 were hardware £36,800, and rice £31,500. Great Britain and Sierra Leone supply practically all the textiles, and have a commanding share in the other imports. The proportionate share of France itself is small, but increasing: £59,400 in 1898, £165,000 in 1899. Rubber predominates even more among the exports than textiles among the imports, being valued in 1898 at £237,600 out of a total value of exports of £312,000, and in 1899 at £280,000 out of a total of £378,500. Though a source of great prosperity to the colony, the consequences of the supply of rubber coming to an end through abusive exportation are already beginning to be discussed. Of other exports, that of cattle from Futa Jallon is important; this has had to be curtailed for fear of exhausting the supply. Futa Jallon is also rich in gold. There is thought to be a promising future for the export of groundnuts and wax. Great Britain and Sierra Leone receive most of the exports, but France's share increased from £22,000 in 1898 to £38,500 in 1899. Means of communication are difficult. A railway will connect Konakry with Kurussa on the Niger, so as to bring the produce of the Sudan to the coast. The inland system of telegraphs was united in 1899 with that of Senegal by a line which brought the total length laid down in three years up to 560 miles. There is telegraphic communication with Europe along an English submarine cable, and steamers call at Konakry from Havre, Bordeaux, and Marseilles, and Liverpool, Antwerp, and Hamburg. The Belgian line has transferred its headquarters to Konakry from Sierra Leone, which, indeed, has in other directions lately lost much of its trade to its French neighbour. In 1898, 2369 vessels of 263,763 tons entered Konakry, and 2286 of 263,127 tons cleared. The centres of population are Konakry, the capital, on the isle of Tomba, Boké on the Rio Nunez, Dubreka, Beuti, and Timbo in Futa Jallon.

See HENRIQUE. *Les Colonies Françaises.* Paris, 1890.—TROUILLET. *Les Possessions Françaises de Guinée.* Paris, 1893.—LEE. *French Colonies.* Foreign Office Report, 1900.—*L'Année Coloniale.* Paris, 1900. (P. L.)

Guinea, Portuguese, a colonial province of Portugal, on the west coast of Africa, between 11° 40′ and 12° 40′ N. and 13° 40′ W. and the Atlantic, with an area of 4394 square miles, and an estimated population of 67,165. It is on the whole a flat region, traversed by an extensive network of rivers, of which the chief are—the Cacheo, navigable to Farim, 105 miles; the Mansoã, navigable for 44 miles; the Geba; the Corubal; the Grande de Guinala, virtually an inlet of the sea; the Combidian; and the Cacine. It includes the neighbouring archipelago of Bissagos. The rainy season lasts from May to November, and is very hot (89·6° F.) and tempestuous. Rice and millet are the principal cultivated crops. The natural products of the soil embrace *mancarra* (almonds), indiarubber, tobacco, kola nuts, indigo, cotton, coffee, and palm oil; and of the forests, mahogany, ebony, calabash, and other trees. The total trade (imports and exports) has increased from £111,100 in 1894 to £356,670 in 1899; the shipping which entered has likewise increased from 745 vessels of 47,978 tons in 1894 to 1294 vessels of 64,756 tons in 1899. The capital is Bolama, on the island of the same name in the Bissagos Archipelago, opposite the estuary of the Grande; but the principal port is Bissao, on the island of the same name. The native inhabitants belong chiefly to the Fulah, Mandingo, and Biafada races. The province is administered by a governor, assisted by a council. The estimated revenue for 1900–1901 was £23,780, and the expenditure £40,670.

See E. DE VASCONCELLOS, *As Colonias Portuguesas.* Lisbon, 1896-97. (E. DE V.)

Guines, a town in the interior of Havana province, Cuba. It is in the midst of a rich sugar district. Population (1899), 8149.

Guipuzcoa, a maritime province of Northern Spain, with an area of only 728 square miles, divided into four administrative districts and ninety parishes. The population was 181,856 in 1887, and 191,822 in 1897, being then surpassed in density only by the provinces of Barcelona and Pontevedra. Of the births 3·42 per cent. were illegitimate. The province loses large numbers through emigration. The main line of the northern railway from Madrid to France runs through the province for 90 miles, passing one of the most important custom-houses of Spain. This province has 350 miles of first-class roads, kept up at local expense only. It is very rich in mineral springs, having no fewer than two salt, twenty-two sulphurous, and thirty-five ferruginous, much frequented every summer by people from all parts of Spain. The fishing fleet is composed of 350 sailing boats and some small steamers, manned by 1900 men and boys, who secure £80,000 worth of fish annually. The coasting trade exceeds £400,000 a year, and by Irun, Passages, and the frontier roads £4,000,000 of imports and £3,000,000 of exports pass to and from France, partly in transit for the rest of Europe. Apart from the four Catalan provinces, no province has witnessed such a development of local industries as Guipuzcoa. The principal industrial centres are Irun, Renteria, Villabona, Vergara, and Azpeitia for cotton and linen stuffs; Zumarraga for osier; Eybar, Plasencia, and Elgoibar for arms and cannon, and gold incrustations; Irun for soap and carriages; San Sebastian, Irun, and Onate for paper, glass, chemicals, and saw-mills; Tolosa for paper, timber, cloths, and furniture; and the banks of the bay of Passages for the manufacture of liqueurs of every kind, and the preparation of wines for export and for consumption in the interior of Spain. This last industry occupies several thousand French and Spanish workmen. There are only nineteen productive mines, from which the main outputs in 1898 were 20,582 tons of iron and 20,659 tons of lignite; and of hydraulic cement 79,064 tons were manufactured. The mines and works connected therewith gave employment to 1300 hands. In 1898 the live stock included 1937 horses, 254 mules, 5492 asses, 60,655 cattle, 119,444 sheep, 1378 goats, 16,840 pigs. Oxen are much used as draught animals on the steep roads of the mountains. Wheat occupied 30,690 acres, and 31,000 were given to beans.

Guiraud, Ernest (1837–1892), French composer, was born at New Orleans on 26th June 1837. He studied at the Paris Conservatoire, where he won the "Grand Prix de Rome." His father had gained the

same distinction many years previously. The fact is worthy of note, as it affords the only instance of both father and son obtaining this much-coveted prize. Ernest Guiraud is the composer of the following operas :—*Sylvie* (1864), *Le Kobold* (1870), *Madame Turlupin* (1872), *Piccolino* (1876), *Galante Aventure* (1882); also the ballet *Gretna Green*, given at the Opéra in 1873. His opera *Frédégonde* was left in an unfinished condition and terminated by Saint-Saens. It was produced at the Paris Opéra in 1895. Guiraud, who was a fellow student and intimate friend of Georges Bizet, was for some years professor of composition at the Conservatoire. He was the author of an excellent treatise on Instrumentation. His music, if not particularly individual, is characteristically French, and is invariably scored with consummate art. He died in Paris, 6th May 1892.

Gujranwala, a town and district of British India, in the Rawalpindi division of the Punjab. The town is situated 40 miles N. of Lahore by rail. The population in 1881 was 22,884, in 1891 it was 26,785; the municipal income in 1897–98 was Rs.68,799. There are manufactures of brass-ware, jewellery, silk and cotton scarves. The DISTRICT comprises an area of 3017 square miles. The population in 1881 was 616,892, and in 1891 was 690,169, giving an average density of 229 persons per square mile. In 1901 the population was 756,749, showing an increase of 10 per cent. The land revenue and rates were Rs.10,95,970, the incidence of assessment being R.1–9–9 per acre; the cultivated area in 1896–97 was 675,169 acres, of which 557,452 were irrigated, including 230,685 from government canals. Part of the upland tract has been brought under cultivation by the Chenab canal. The number of police was 503; the number of schools in 1896–97 was 320, with 10,137 pupils, the proportion of boys at school to the male population of school-going age being 15·8 per cent.; the registered death-rate in 1897 was 27·89 per thousand. There are three printing-presses, issuing one vernacular newspaper, and two factories for pressing cotton. There are 116 miles of railway in all, 82 miles of navigable river, and 64 miles of metalled roads.

Gujrat, a town and district of British India, in the Rawalpindi division of the Punjab. The town stands about 5 miles from the right bank of the river Chenab, and about 70 miles N. of Lahore by rail. The population in 1891 was 18,050; the municipal income in 1897–98 was Rs.31,104. It has manufactures of inlaid work in gold and iron, brass-ware, boots, cotton goods, and shawls, and also one printing-press. The DISTRICT comprises an area of 2051 square miles. The population in 1881 was 689,115, and in 1891 was 760,875, giving an average density of 371 persons per square mile. In 1901 the population was 752,038, showing a decrease of 1 per cent., compared with an increase of 10 per cent. in the previous decade. The land revenue and rates were Rs.7,66,520, the incidence of assessment being R.1–2–9 per acre; the cultivated area in 1896–97 was 533,498 acres, of which 184,128 were irrigated, entirely from private wells; the number of police was 520; the number of schools in 1896–97 was 413, with 12,880 pupils, the proportion of boys at school to the male population of school-going age being 17·6 per cent., the highest figure in the province; the registered death-rate in 1897 was 21·89 per thousand. There are 76 miles of railway in all, 72 miles of navigable river, and 55 miles of metalled roads, but no government canal.

Gull, Sir William Withey, BART. (1816–1890), English physician, was the youngest son of John Gull, a bargeowner and wharfinger of Thorpe-le-Soken, Essex, and was born on 31st December 1816. He began life as a schoolmaster, but in 1837 Benjamin Harrison, the treasurer of Guy's Hospital, who had noticed his ability, brought him up to London from the school at Lewes where he was usher, and gave him employment at the hospital, where he also gained permission to attend the lectures. In 1838 he matriculated at the University of London, and graduated M.B. in 1841. Two years later he was made a lecturer in the medical school of the hospital, in 1851 he was chosen an assistant physician, and in 1858 he became full physician. In 1847 he was elected Fullerian professor of physiology in the Royal Institution, retaining the post for the usual three years, and in 1848 he delivered the Gulstonian Lectures, taking for his subject paralysis, the disease of which he afterwards died. At the College of Physicians he filled every office of honour but that of president. He died in London on 29th January 1890 after a series of paralytic shocks, the first of which had occurred nearly three years previously. He was created a baronet in 1872, in recognition of the skill and care he had shown in attending the Prince of Wales during his attack of typhoid in 1871. Sir William Gull's fame rested mainly on his success as a clinical practitioner; as he said himself, he was "a clinical physician or nothing." This success must be largely ascribed to his remarkable powers of observation, and to the great opportunities he enjoyed for gaining experience of disease. He was sometimes accused of being a disbeliever in drugs. That was not the case, for he prescribed drugs like other physicians when he considered them likely to be beneficial. He felt, however, that their administration was only a part of the physician's duties, and his mental honesty and outspokenness prevented him from deluding either himself or his patients with unwarranted notions of what they can do. But though he regarded medicine as primarily an art for the relief of physical suffering, he was far from disregarding the scientific side of his profession, and he made some real contributions to medical science. His papers, which were not very numerous, were printed chiefly in *Guy's Hospital Reports* and in the proceedings of learned societies: among the subjects he wrote about were cholera, rheumatic fever, tænia, paraplegia, and abscess of the brain, while he distinguished for the first time the disease now known as myxœdema, describing it as a "cretinoid condition in adult women."

Gulpáïgán, a district and city in Central Persia, situated north-west of Isfahán and south-east of Irák. Together with Khunsár it forms a small province, paying a yearly revenue of about £6000. The city of Gulpáïgán is situated 87 miles N.W. of Isfahán, at an elevation of 5875 feet, in 33° 24′ N. lat. and 50° 20′ E. long., and has a population of about 5000. The district is fertile, and produces much grain and some opium. Sometimes it is under the governor-general of the Isfahán province, at others it forms part of the province of Irák, and at times it is under a governor appointed from Tehran. It was in 1902 part of Irák.

Gumuljina, a town of European Turkey, in the vilayet of Adrianople. It is situated on the river Karaja, south of the eastern extremity of the Rhodope range of mountains and north-east of the Gulf of Lagos, and is a station on the railway between Salonica and Dedé-Agach. It has a population of about 20,000, of whom three-fourths are Turks, and the remainder Greeks, Jews, and Armenians. The district produces hard wheat, equal in quality to that of Taganrog, maize, barley, and tobacco. Sericulture and viticulture are both practised on a limited scale. The wine of Gumuljina is everywhere highly

esteemed. The most prominent feature in the commercial life of the place is its cattle fair, held annually on Greek Palm Sunday.

Gümüsh-Khaneh, the chief town of a sanjak of the same name (area, 2365 square miles; population, 114,800) in the Trebizond viláyet of Asiatic Turkey, altitude 4400 feet, situated on high ground in the valley of the Kharshut Su, about half a mile from the Trebizond–Erzerúm *chaussée*. The silver mines from which the place takes its name were noted in ancient times, and are mentioned by Marco Polo. The population of the town is 3000, chiefly Greeks.

Gun.—Firearms are said to have been first used in European warfare in the 14th century. The hand gun came into practical use in 1446, and was of very rude construction. It consisted of a simple iron or brass tube with a touch-hole at the top fixed in a straight stock of wood, the end of which passed under the right armpit when the "gonne" was about to be fired. A similar weapon was also used by the horse-soldier, with a ring at the end of the stock, by which it was suspended by a cord round the neck; a forked rest, fitted by a ring to the saddlebow, served to steady the gun. This rest, when not in use, hung down in front of the right leg. A match made of cotton or hemp spun slack, and boiled in a strong solution of saltpetre, or in the lees of wine, was an appurtenance of the hand gun. The touch-hole was first placed on the top of the barrel, but afterwards at the side, with a small pan underneath to hold the priming, and guarded by a cover moving on a pivot.

An improvement in firearms took place in the first year of the reign of Henry VII., or at the close of Edward IV., by fixing a cock on the hand gun to hold the match, which was brought down to the priming by a trigger, whence the term matchlock or *arc-à-bouche*, a bow with a mouth, subsequently corrupted to *harquebus*. The harquebus or matchlock was supposed to have been invented in Italy. This weapon is still in use among the Chinese, Tartars, Sikhs, Persians, and Turks. An improvement in the stock was also made during this period by forming it with a wide butt end to be placed against the right breast. Subsequently the stock was bent, a German invention, and the arm was called a hackbutt or hagbut, and the smaller variety a demihague. The harquebus and hackbutt were about a yard in length, including barrel and stock, and the demihague was about half the size and weight, the forerunner of the pistol. The wheel-lock, an improvement on the matchlock, was invented in Nuremberg in 1517; was first used at the siege of Parma in 1521; was brought to England in 1530, and continued in partial use there until the time of Charles II. This wheel-lock consisted of a fluted or grooved steel wheel which protruded into the priming pan, and was connected with a strong spring. The cock, also regulated by a spring, was fitted with a piece of pyrites (sulphuret of iron). In order to discharge the gun the lock was wound up by a key, the cock was let down on the priming pan, the pyrites resting on the wheel; on the trigger being pressed the wheel was released and rapidly revolved, emitting sparks, which ignited the powder in the pan. The complicated and expensive nature of this lock, with its liability to injury, no doubt prevented its general adoption.

About 1540 the Spaniards constructed a larger and heavier firearm, carrying a ball of 10 to the pound, called a musket. This weapon was introduced into England before the middle of the 16th century, and came into general use throughout Europe, having been first extensively used at the battle of Pavia in 1525. The snaphaunce was invented about this period in Germany, and from its comparative cheapness was much used in England, France, and Holland. It held a flint instead of the pyrites of the wheel or firelock, which ignited the powder in the pan by striking on a piece of furrowed steel, when released by the trigger, and emitting sparks.

As a sporting weapon the gun may be said to date from the invention of the wheel-lock in the beginning of the 16th century, though firearms were used for sporting purposes in Italy, Spain, Germany, and to some extent in France, in the 15th century. Before that period the longbow in England and the crossbow on the Continent were the usual weapons of the chase. In Great Britain little use appears to have been made of firearms for game shooting until the latter half of the 17th century, and the arms then used for the purpose were entirely of foreign make.

The French gunmakers of St Étienne claim for their town that it is the oldest centre of the firearms industry. They do not appear to have made more than the barrels of the finest sporting arms, and these even were sometimes made in Paris. The production of firearms by the artists of Paris reached its zenith about the middle of the 17th century. The Italian, German, Spanish, and Russian gunsmiths also showed great skill in the elegance and design of their firearms, the Spaniards in particular being makers of fine barrels. Pistols are understood to have been made for the first time about 1540 at Pistoia in Italy, from which town they receive their name. About 1635 the modern firelock or flint-lock was invented, which only differed from the snaphaunce by the cover of the pan forming part of the furrowed steel struck by the flint. Originally the priming was put into the pan from a flask containing a fine-grained powder called serpentine powder. Later the top of the cartridge was bitten off, and the pan filled therefrom before loading. The mechanism of the flint-lock musket rendered all this unnecessary, as, in loading, a portion of the charge passed through the vent into the pan, where it was held by the cover or hammer. The highest development of the flint-lock is found in the fowling-pieces of the end of the 18th and beginning of the 19th centuries, particularly those made by Joseph Manton, the celebrated English gunsmith and inventor. The Napoleonic wars afforded English gunmakers an opportunity, which they fully utilized, of gaining the supremacy over their foreign competitors in the gunmaking trade. English gunmakers reduced the weight, improved the shooting powers, and perfected the lock mechanism of the sporting gun, and increased the range and efficiency of the rifle. This transference of the gunmaking craft from the Continent to England was also assisted by the tyranny of the foreign gunmaking guilds. In 1637 the London gunmakers obtained their Charter of Incorporation. The important gunmaking industry of Birmingham dates from 1603, and soon rivalled that of London. Double shot-guns do not appear to have been generally used until the 19th century. The first successful double guns were built with the barrels over and under, and not side by side, and were invented about 1616 by one Guilliano Bossi of Rome. In 1784 double shot guns were described as a novelty. Joseph Manton patented the elevated rib which rested on the barrels. The general success of the double gun was eventually due to the light weight which the better material and workmanship of the best gunmakers made possible, and to the quickness and certainty of ignition of the modern cartridge.

The objections to the flint-lock were that it did not entirely preserve the priming from wet, and that the flint sparks sometimes failed to ignite the charge. In 1807

the Rev. Mr Forsyth obtained a patent for priming with a fulminating powder made of chlorate of potash, sulphur, and charcoal, which exploded by concussion. This important improvement in firearms was not recognized and adopted by the military authorities until more than thirty years later. In the meantime it was gradually developed, and the copper percussion cap invented, by various gunmakers and private individuals. Thomas Shaw of Philadelphia first used fulminate in a steel cap in 1814, which he changed to a copper cap in 1816. It was not until the introduction of the copper cap that the percussion gun could be considered in every way superior to the flint. In 1834, in the reign of William IV., Forsyth's invention was tested at Woolwich by firing 6000 rounds from six flint-lock muskets, and a similar number from six percussion muskets, in all weathers. This trial established the percussion principle. The shooting was found to be more accurate, the recoil less, the charge of powder having been reduced from 6 to 4½ drs., the rapidity of firing greater, and the number of miss-fires much reduced, being as 1 to 26 nearly in favour of the percussion system. In consequence of this successful trial the military flintlock in 1839 was altered to suit the percussion principle. This was easily accomplished by replacing the hammer and pan by a nipple with a hole through its centre to the vent or touch-hole, and by replacing the cock which held the flint by a smaller cock or hammer with a hollow to fit on the nipple when released by the trigger. On the nipple was placed the copper cap containing the detonating composition, now made of three parts of chlorate of potash, two of fulminate of mercury, and one of powdered glass.

In 1840 the Austrian army was supplied with the percussion musket, and in 1842 a new model percussion musket with a block or back-sight for 150 yards was issued to the British army, 11 ℔ 6 ozs. in weight, 4 ft. 6¾ in. in length without bayonet, 6 ft. with bayonet, and with a barrel 3 ft. 3 in. in length, firing a bullet of 14½ to the ℔ with 4½ drs. of powder. This musket was larger in bore than that of France, Belgium, Russia, and Austria, and thus had the advantage of being able to fire their balls, while the English balls could not be fired from their barrels. But the greater weight and momentum of the English ball was counteracted by the excess of windage. This percussion musket of 1842, the latest development of the renowned Brown Bess, continued in use in the British army until partially superseded in 1851 by the Minié rifle, and altogether by the Enfield rifle in 1855. (For further information as to the history and development of military, target, and sporting rifles see RIFLE.)

Modern Shot Guns.—The modern sporting breech-loaders may be said to have originated with the invention of the cartridge-case containing its own means of ignition. The breech-loading mechanism antedated the cartridge by many years, the earliest breech-loading hand guns dating back to 1537. Another distinct type of breech-loader was invented in France about the middle of the 17th century. During the 17th and 18th centuries breech-loading arms were very numerous and of considerable variety. The original cartridge, a charge of powder and bullet in a paper envelope, dates from 1586. These were used with muzzle-loaders, the base of the cartridge being ripped or bitten off by the soldier before placing in the barrel. It was only when the detonating cap came into use that the paper cartridge answered well in breech-loaders. The modern breech-loader has resulted from a gradual series of improvements, and not from any one great invention. Its essential feature is the prevention of all escape of gas at the breech when the gun is fired by means of an expansive cartridge-case containing its own means of ignition. The earlier breech-loaders were not gas-tight, because the cartridge-cases were either consumable or the load was placed in a strong non-expansive breech-plug. The earliest efficient modern cartridge-case was the pin-fire, patented by Houiller, a Paris gunsmith, in 1847, with a thin weak shell which expanded by the force of the explosion, fitted perfectly in the barrel, and thus formed an efficient gas check. Probably no invention connected with firearms has wrought such changes in the principle of gun-construction as those effected by the expansive cartridge-case. This invention has completely revolutionized the art of gunmaking, has been successfully applied to all descriptions of firearms, and has produced a new and important industry—that of cartridge manufacture.

About 1836, Lefaucheux, a Paris gunsmith, improved the old Pauly system of breech-loading, but its breech action was a crude mechanism, with single grip worked by a bottom lever. The double grip for the barrels was the subsequent invention of a Birmingham gunmaker. The central-fire cartridge, practically as now in use, was introduced into England in 1861 by Daw. It is said to have been the invention of Pottet, of Paris, improved upon by Schneider, and gave rise to considerable litigation in respect of its patent rights. Daw, who controlled the English patents, was the only exhibitor of central-fire guns and cartridges at the International Exhibition of 1862. In his system the barrels work on a hinge joint, the bottom lever withdraws the holding-down bolt; the cartridge is of the modern type, the cap being detonated by a striker passing through the standing breech to the inner face. The cartridge-case is withdrawn by a sliding extractor fitted to the breech ends of the barrels. Daw was subsequently defeated in his control of the patents by Eley Bros., owing to the patent not having been kept in force in France. The modern breech-loading gun has been gradually and steadily improved since 1860. Westley Richards adopted and improved Matthews' top-lever mechanism. About 1866 the rebounding lock was introduced, and improved in 1869. The treble wedge-fast mechanism for holding down the barrels was originated by W. W. Greener in 1865, and perfected in 1873. A very important improvement was the introduction of the hammerless gun, in which the mechanism for firing is placed entirely within the gun. This was made possible by the introduction of the central-fire cartridge. In 1862 Daw, and in 1866 Green, introduced hammerless guns in which the cocking was effected by the under lever. These guns did not attain popularity. In 1871 T. Murcott patented a hammerless gun, the first to obtain distinct success. This also was a lever-cocking gun. About the same time Needham introduced the principle of utilizing the weight of the barrels to assist in cocking. In 1875 Anson and Deeley utilized the fore-end attached to the barrels to cock the locks. From this date hammerless guns became really popular. Subsequently W. W. Greener and some other gunmakers improved the hammerless mechanism. Still greater improvements have since been introduced by Westley Richards, Purdey, and others, including cocking by means of the mainspring. In 1874 J. Needham introduced the ejector mechanism, by which each empty cartridge-case is separately and automatically thrown out of the gun when the breech is opened. The necessary force is provided by the mainspring of the lock. W. W. Greener and some other gunmakers have since introduced minor modifications and improvements of this mechanism. The latest improvement in the modern breech-loader is the single trigger mechanism introduced by some of the leading English gunmakers, by which both barrels can be fired in succession

by a single trigger. This improvement enables both barrels to be rapidly fired without altering the grip of the right hand.

Repeating or magazine shot-guns on the principle of the repeating rifle, with a magazine barrel below the single firing barrel, are also made by some American and other gunmakers (particularly by the Winchester Small Arms Company), but as yet have not come into general use, being comparatively cumbersome and not well balanced. The difficulty of a shifting balance as each cartridge is fired has also yet to be overcome. Several varieties of a combination rifle and shot-gun are also made, for a description of which see RIFLE.

The chief purposes for which modern shot-guns are required are game-shooting, trap-shooting at pigeons, and wild-fowling. The game gun may be any bore from 32 to 10 gauge. The usual standard bore is 12 gauge. The usual weight of the 12-bore double-barrelled game gun is from 6 to 7 ℔ with barrels 30 inches long. These barrels are made of laminated steel twisted and welded, and are known as Damascus barrels, or of forged wrought steel drilled, or more usually of Whitworth fluid-compressed steel. The standard charge is 3 drams of powder and $1\frac{1}{8}$ oz. of No. 6 shot. The ordinary game gun should have a killing circle of 30 inches at 30 yards with the first barrel and at 40 yards with the second. Improved materials and methods of manufacture, and what is known as "choke" boring of the barrels have enabled modern gunmakers to regulate the shooting of guns to a nicety. Choke-boring is the constriction of the diameter of the barrel near the muzzle, and was known in America in the early part of the 19th century. In 1875 Pape of Newcastle was awarded a prize for the invention of choke-boring, there being no other claimant. The methods of choke-boring have since been varied and improved by the leading English gunmakers. The pigeon gun is usually heavier than the game gun, and more choked. It generally weighs from 7 to 8 ℔. In England its weight, by club rules, is restricted to 8 ℔, and its bore to 12 gauge. The standard wild-fowling gun is a double 8-bore with 30-inch barrels weighing 15 ℔, and firing a charge of 7 drams of powder and $2\frac{3}{4}$ to 3 oz. of shot. These guns are also made in both smaller and larger varieties, including a single barrel 4-bore, which is the largest gun that can be used from the shoulder, and single barrel punt guns of $1\frac{1}{2}$-inch bore, weighing 100 ℔. (H. S.-K.)

Gung'l, Josef (1810–1889), Hungarian composer and conductor, was born, 1st December 1810, at Zsámbék, in Hungary. After starting life as a school-teacher, and learning the elements of music from Ofen, the school-choir-master, he became first oboist at Graz, and, at twenty-five, bandmaster of the 4th regiment of Austrian artillery. His first composition, a Hungarian march, written in 1836, attracted some notice, and in 1843 he was able to establish an orchestra in Berlin. With this band he travelled far, even in 1849 to America. It is worth recording that Mendelssohn's complete *Midsummer Night's Dream* music is said to have been first played by Gung'l's band. In 1853 he became bandmaster to the 23rd Infantry Regiment at Brünn, but in 1864 he lived at Munich, and in 1876 at Frankfort, after (in 1873) having conducted with great success a series of promenade concerts at Covent Garden, London. From Frankfort Gung'l went to Weimar to live with his daughter, a well-known German opera singer and local prima donna. There he died, 31st January 1889. Gung'l's dances number over 300, perhaps the most popular being the "Amoretten," "Hydropaten," "Casino," "Dreams on the Ocean" waltzes; "Im Stille Mitternacht" polka, and "Blue Violets" mazurka. His Hungarian march had the honour of being transcribed by Liszt. His music is characterized by the same easy flowing melodies and well-marked rhythm that distinguish the music of Strauss, to whom alone he can be ranked second in this kind of composition. (R. H. L.)

GUN-MAKING.

THE ninth edition of this Encyclopædia carried the history of British service guns up to the year 1878. These guns were of a short, muzzle-loading type, and consisted of a steel barrel, over which was shrunk a series of wrought-iron coils. Forged steel was chosen as the best material for the barrel, on account of the closer nature of its texture and the absence of flaws as compared with wrought iron; it was therefore far less eroded by the action of the powder gases than the more open fibre of wrought iron, in which streaks of slag, due to the imperfect forging or welding operation, are invariably present. The manufacture of large steel forgings was then practically in its infancy, and defects which occasionally appeared in the mass of an apparently sound forging—often the result of imperfect annealing—caused the material to be looked upon as somewhat treacherous, and liable to fracture, without warning, under any sudden stress, unless strengthened by surrounding it with coils of wrought iron. Experience gained from the bursting of guns, by accident or design, had shown that this latter material always showed evident signs of distress before finally fracturing. The coiled iron never flew to pieces as the steel of that period occasionally did. These guns were built up of as few coils as possible, and only in the largest guns were two layers of coils superimposed on the barrel. Thick coils were preferred to thin ones, the argument being that one thick coil cost less than several thin ones, and thus one of the principles of the Armstrong construction was rendered inoperative. At the present time the opposite extreme is favoured, and by the use of wire the full benefit is obtained of the ideal thin coil or hoop, without the disadvantage of excessive weight and cost. Wrought iron is no longer considered the best material; indeed, so far as structural purposes go, it is non-existent. The steel industry has made so much progress since 1880 that steel is looked upon as one of the most trustworthy metals in use.

The gun steel used in England and most foreign countries is prepared by the open-hearth method in a regenerative gas furnace of the Siemens-Martin type. (For a full description of the arrangement see *Ency. Brit.*, 9th edition, vol. xiii. page 294, and *Supp.* IRON AND STEEL.) The steel is run from the furnace into a large ladle, previously heated by gas, and from this it is poured into a cast-iron ingot mould of from 10 to 12 feet high and 2 feet or more in diameter. The external shape of these ingots varies in different steel works, but they are so arranged that, as the ingot slowly cools, the shrinkage of the metal shall not set up dangerous internal stresses. *Forging the barrel.* The top of the ingot is generally porous, and consequently, after cooling, it is usual for about one-third of the length of the ingot to be cut from the top and remelted; a small part of the bottom is also often discarded. The centre of the larger ingots is also inclined to be somewhat unsound, and a hole is therefore bored through them to remove this part. In the Whitworth method of fluid-compressed steel

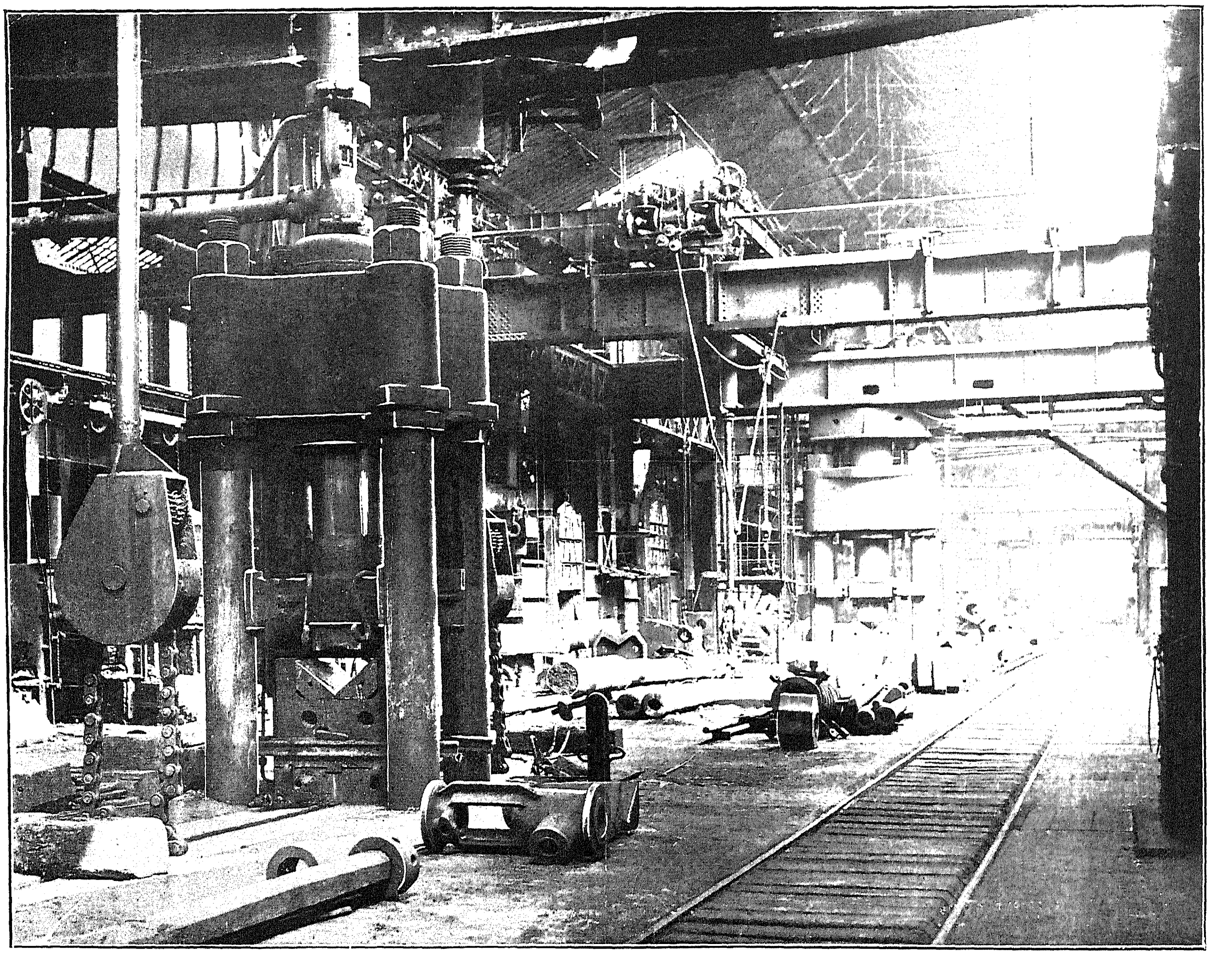
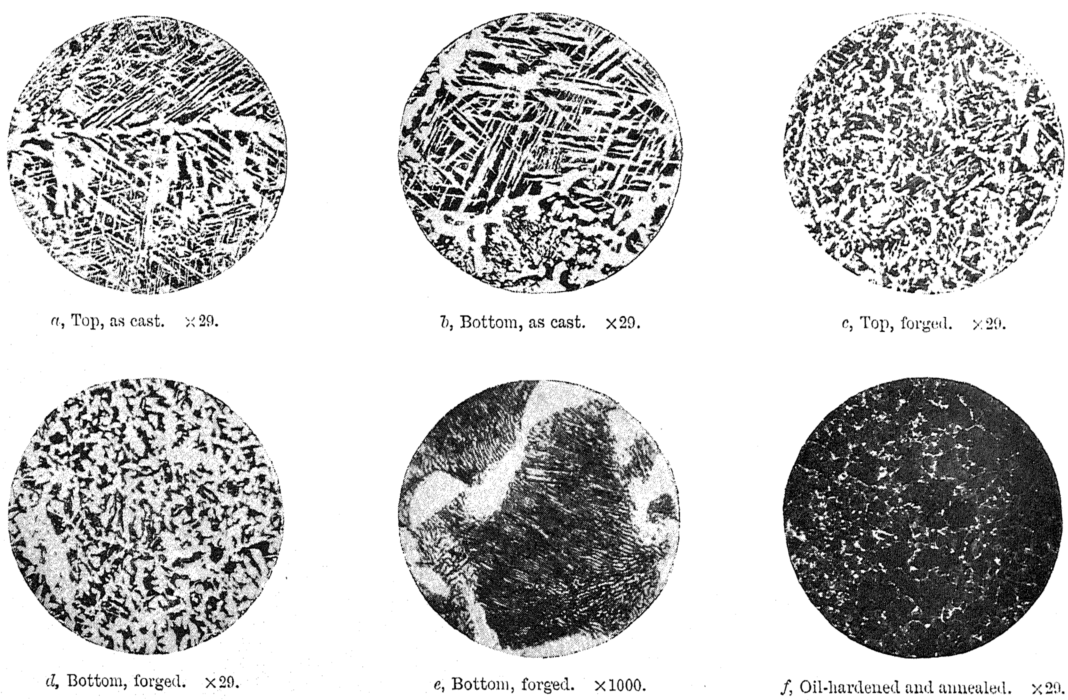


FIG. 1.—Interior of a Modern Gun-making Establishment.



a, Top, as cast. ×29. *b*, Bottom, as cast. ×29. *c*, Top, forged. ×29.

d, Bottom, forged. ×29. *e*, Bottom, forged. ×1000. *f*, Oil-hardened and annealed. ×29.

FIG. 2.—Effects of Forging on Structure of Metal.

this porosity at the top and centre of the ingot does not occur to the same extent, and a much greater portion can therefore be utilized. The sound portion of the ingot is heated in a reheating gas furnace, which is usually built in close proximity to a hydraulic forging press. This press is now almost exclusively used for forging the steel in place of the steam hammers which were formerly an important feature in all large works (Fig. 1, PLATE). The largest of these steam hammers could not deliver a blow of more than some 500 foot tons of energy; with the hydraulic press, however, the pressure amounts to, for ordinary purposes, from 1000 tons to 5000 tons, while for the manufacture of armour plates it may amount to as much as 10,000 or 12,000 tons. For 8-inch guns and those of larger calibre the bored-out ingot is forged hollow on a tubular mandrill, kept cool by water running through the centre; from two to four hours' forging work can be performed before the metal has cooled down too much. Generally, after one end of the ingot has been forged down to the proper size, it is then reheated and the other end similarly treated. The forging of the steel and the subsequent operations have a very marked influence on the structure of the metal, as will be seen from the micro-photographs of Fig. 2 (PLATE); (*a*) and (*b*) show the structure of the cast steel of the actual ingot. From these it will be noticed that the crystals are very large and prominent, but as the metal passes through the various operations they become smaller and less pronounced. Thus (*c*) and (*d*) show the metal after forging; (*e*) shows the pearlite structure with a magnification of 1000 diameters, which disappears on the steel being oil-hardened; and (*f*) shows the oil-hardened and annealed crystals. At the Bofors Works in Sweden gun barrels up to 15 centimetres calibre are often formed of an unforged cast steel tube, but this practice, although allowing of the production of an inexpensive gun, is not followed by other nations.

After the forging is completed it is annealed by reheating and cooling slowly, and a number of test pieces are cut from each end tangentially to the circumference of the bore. Half the number of these are tested to ascertain the quality of the steel in the soft state, and the remainder are hardened and annealed in the way described hereafter for the treatment of the gun forging, and tested partly for tensile test and partly for bending. It is found that the quality of the steel is greatly improved by forging, so long as this is not carried so far as to set up a laminar structure in the metal, which is thereby rendered less suitable for gun construction, being weaker across the laminæ than in the other directions. It is then termed overforged.

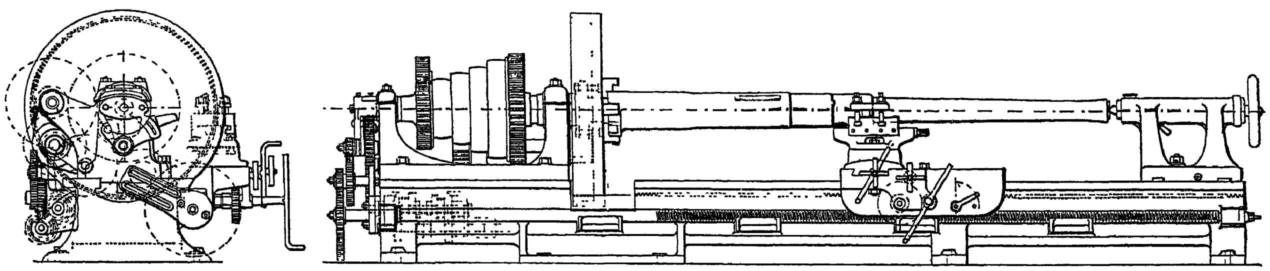


Fig. 3A.

If the tests are satisfactory the forging is rough-turned and bored, and then reheated to a temperature of 1600° F., and hardened by being plunged into a vertical tank of rape oil. This process is a somewhat critical one; great care must be observed in uniformally heating the whole of the forging in a furnace in close proximity to the oil tank into which it is plunged, and it must be completely submerged as rapidly as possible. In some cases the oil in the tank is circulated by pumping, so that uniformity of cooling is ensured, and in addition the tank is surrounded by a water jacket, which also helps to keep it at a uniform heat. The forging is subsequently again heated to from 900° F. to 1200° F., and allowed to cool slowly by being placed in warm sand, &c. This last operation is termed annealing, and is intended to dissipate any internal stress which may have been induced in the forging by any of the previous processes, especially that of oil-hardening.

After this annealing process a second set of test pieces, two for tensile and two for bending test, are cut from each end of the forging in the positions above mentioned. For guns of less than 3-inch calibre only half this number of test pieces is taken, and with hoops of less than 48 inches in length the test pieces are taken only from the end which formed the upper part of the cast ingot. In all cases of annealed steel the test piece of 2 inches length and 0·533 inch diameter must not break with less than 34 tons per square inch or more than 44 tons per square

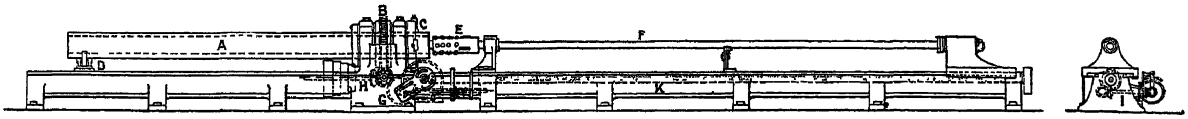


Fig. 3B.

inch; the elongation must not be less than 17 per cent., nor the elastic limit less than 21 tons per square inch. For breech screws the steel is made of a harder quality, as it has to resist a crushing stress. These are the tests required in England, but they differ in different countries; for instance, in France a harder class of steel is employed, and the tensile strength must not be less than 46 tons, nor the elastic limit less than 25 tons per square inch, neither must the elongation fall below 15 per cent.

Steel having about 3 per cent. of nickel is now being used to some extent for the smaller guns, and offers certain advantages. It does not require tempering, and in the soft state has a tensile strength equal to that of ordinary tempered gun steel, with a higher elastic limit and about the same elongation. The structure is of a very uniform and finely crystalline nature.

Assuming that the tests of the annealed forging are satisfactory, the forging, which we will suppose to be a barrel, is tested for straightness, and, if necessary, rectified; it is then bored out to nearly the finished dimension and rough- and afterwards fine-turned in a lathe, on the exterior (Fig. 3A). In the meantime the other portions of the gun are in progress, and as it is far easier to turn down the outside of a tube than to bore out its interior to the exact

measurements required to allow for shrinkage, the interior of the jacket and other hoops are bored out in a boring-machine and finished before the exterior of the barrel is fine-turned; and so for any other hoop. The process is illustrated in Fig. 3B. The barrel or hoop A to be bored is passed through the revolving headstock B and firmly held by jaws C, the other end being supported on rollers D. A head E, mounted on the end of a boring-bar F, is drawn gradually through the barrel as it revolves by the leading screw K actuated by the gear G. The boring head is provided with two or more cutting tools, and also with a number of pins of brass or pieces of hard wood to act as guides, in order to keep the boring head central after it has entered the barrel. The revolving headstock B is driven by a belt and worm-gear H.

With wire guns the procedure is somewhat different. The wire is wound on to its tube, which has been previously fine-turned; the exterior diameter of the wire is then carefully measured, and the interior of the covering tube or hoop finished to suit. The covering hoop is often not allowed any shrinkage, as it is simply intended as a protection to the wire and to give longitudinal strength; but in order to place it over the wire it must be heated, and thus some little contraction always does take place, as it is found that any hoop on cooling, after being heated, is somewhat smaller than it was originally. The heat to

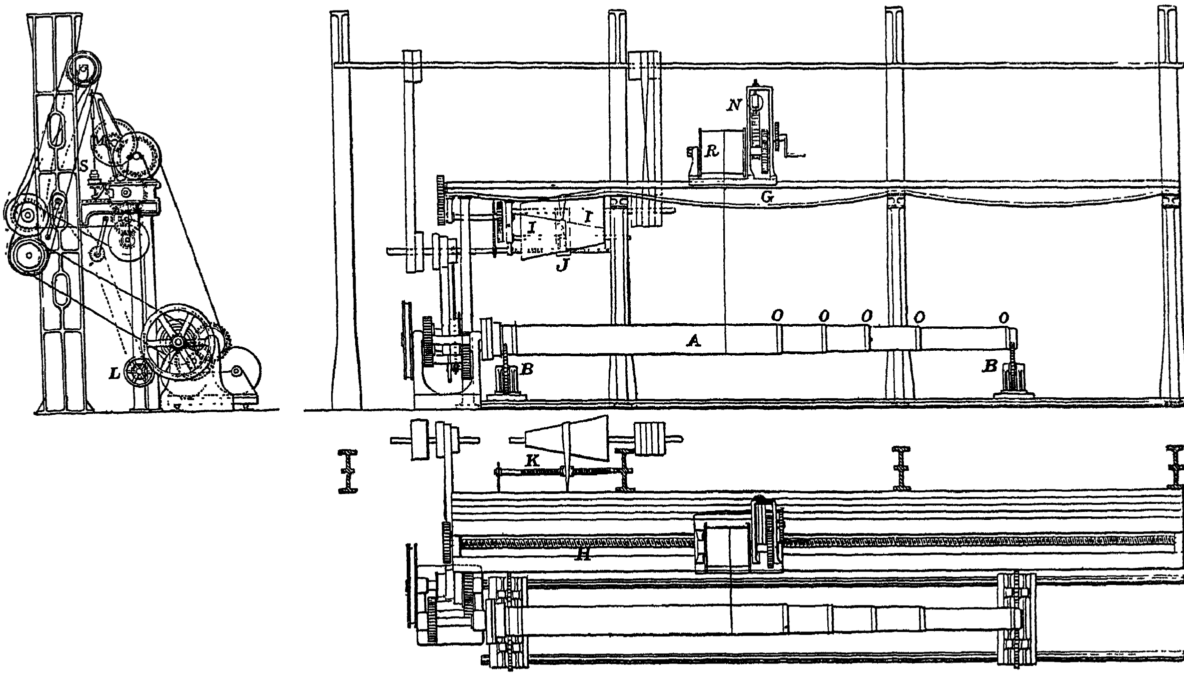


Fig. 4.

which these hoops are brought for shrinking never exceeds, or even approaches, that used in annealing, otherwise the modifying effects of the annealing process would be interfered with.

In the earliest modern type B.-L. guns the breech screw engaged directly with a screw thread cut in the barrel, which thus had to resist a large portion of, if not all, the longitudinal stress. This was, until quite recently, the system adopted in France, but it has some serious objections. The principal one is, that the barrel must be made of large external diameter to meet the longitudinal stress, and this in consequence reduces the circumferential strength of the gun. Again, the diameter of the screw is always considerably larger than the breech opening, and so an abrupt change of section takes place, which should always be avoided in structures liable to sudden shocks. The only advantage is, that the thick barrel gives stiffness against bending, but this liability is met in a better manner in all the later patterns of British guns by the long continuous outer tubes which are shrunk over the barrel or wire. In the English system the breech screw is engaged either in the breech piece, *i.e.*, the hoop which is shrunk on over the breech end of the barrel, or in a special bush screwed into the breech piece. The latter method suits the latest system of construction, in which the breech piece is put on the barrel from the muzzle, while with the earlier type it was put on from the breech end.

Hoop construction.

With the earlier constructions short hoops were used whenever possible, as, for instance, over the chase of the gun, principally because the steel in short lengths was less likely to contain flaws. But as the metallurgical processes of steelmaking developed the necessity for this disappeared, and the hoops have become gradually longer. This has, however, increased correspondingly the difficulties in boring and turning, and to a much greater extent those encountered in building up the gun. In this operation the greatest care has to be taken, or warping of the long tubes will occur during heating. The tubes are heated in a vertical cylindrical furnace, gas jets playing on both the exterior and interior of the tube. When sufficiently hot, the tube is raised out of the furnace and dropped vertically over the barrel or other portion of the gun. In cooling it shrinks longitudinally as well as circumferentially, and in order to avoid gaps it is, after being placed in position, cooled at one end to make it grip by a ring of water jets, while the other portions are kept hot by rings of burning gas flames, which are successively extinguished to allow the hoop to shorten gradually, and thus avoid internal longitudinal stress. A stream of water is also directed along the interior of the gun during the building-up process, in order to ensure the hoop cooling from the interior. After the building up has been completed, the barrel is fine-bored and ground, then chambered and rifled. The breech is then screwed either for the bush or breech screw, and the breech mechanism is fitted to the gun.

In order to obtain longitudinal strength, the outer

tubes are so arranged that each hooks on to its neighbour from muzzle to breech. Thus the chase hoop hooks on to the barrel by a step, and the succeeding hoops hook on to each other until the jacket is reached; this is secured to the breech piece by a strong collar and screwed ring. In some of the later patterns of guns there is usually only a chase hoop covering the forward portion of the gun and a jacket covering the breech portion—an arrangement which simplifies the design, but greatly increases the difficulties of manufacture.

Wire guns are now made of almost all calibres, ranging from 3-inch to 12-inch. Many authorities object to guns of less calibre than 4·7 inch being wound with wire, as they consider that on diameters so small the interior surface of each layer of wire is over-compressed, while the exterior is too much extended; but if the thickness of the wire is proportioned to the diameter of the tube on which it is wound, there is no reason why this should be the case. The wire is wound on the barrel with a certain tension, ascertained by calculation, and varying from about 50 tons per square inch for the layers first wound on the gun to about 35 or 40 for the outer layers. To fasten the wire at the beginning and end, several methods are adopted. In the Woolwich system a narrow annular ring (O O, Fig. 4), with slots cut into one of its faces, is shrunk on to the gun, and into these slots one end of the wire is inserted and secured in position by a steel-screwed plug, each layer of wire being fastened at the beginning and end in this way. At Elswick the wire is fastened by bending it into a circular-cut groove in a similar annular ring, but the wire is only fastened off in the same way after several layers have been wound. With each succeeding layer of wire the interior layers are compressed, and these in turn compress the barrel; it is therefore necessary, in order to prevent the fatigue of the material of the barrel, to make it relatively thick, or, better still, to have an outer barrel superimposed on the inner one. This latter arrangement is now used in all guns larger than 4·7 inch, but it will probably be extended to guns of even 4-inch calibre; it is not so important with smaller guns, where the barrel is always comparatively thick, and thus meets the conditions. With modern guns the interior of the outer barrel is bored taper, the larger end being towards the breech, and the exterior of the inner barrel or liner is made taper to correspond. The latter is then inserted in the outer barrel while both are cold, and forced into position by hydraulic pressure. The details of the machines for winding on the wire differ somewhat in different works, but all are arranged so that any desired tension can be given to the wire as it is being wound on to the gun.

Wire construction.

The wire is manufactured in much the same way as ordinary wire. A red-hot bar of steel, gradually rolled down between rollers to a section about double that which it is finally intended to have, is annealed and carefully pickled in an acid bath to detach any scale. It is then wound on a drum, ready for the next process, which consists in drawing it through graduated holes made in a hardened steel draw-plate, the wire being often annealed and pickled during this process. The draw-plate holes vary in size from slightly smaller than the rolled bar section to the finished size of the wire, and, as a rule, the sharp corners of the wire are only given by the last draw. It is found that considerable wear takes place in the holes of the draw-plate, and a new plate may be required for each hank of 500 or 600 yards of wire. Great importance is attached to the absence of scale from the wire when it is being drawn, and after pickling, the rolled bar and wire are treated with lime or some similar substance to facilitate the drawing. The tests for the finished wire are as follows:—It has to stand a tensile stress of from 90 to 110 tons per square inch of section, and a test for ductility, in which a short length of the wire is twisted a considerable number of turns in one direction, then unwound, and retwisted in the opposite direction without showing signs of fracture. It will be seen that the wire is extremely strong, and the moderate stress of from 25 to 30 tons per square inch, which at most it is called upon to withstand in a gun, is far less than it could endure with perfect safety.

The wire, after manufacture, is made up into hanks for storage purposes, but when required for gun construction it is thoroughly cleaned and wound on a drum R about 3 feet 6 inches in diameter, which is placed in one portion of the machine in connexion with a powerful band friction brake M. The wire is then led to the gun A placed between centres or on rollers BB, parallel to the axis of the wire drum. By rotating the gun the wire is drawn off from the drum against the resistance of the band brake, which is so designed that, by adjusting the weight S, suspended from the brake strap, any desired resistance can be given in order to produce the necessary tension in the wire as it is being wound on the gun. The stress on the wire is indicated on the dial N. The headstock, containing the drum of wire, is capable of being moved along the bed G by a leading screw H, driven by a belt through variable speed cones I; the belt is moved along the cones by forks J, traversed by screws K, which in their turn are actuated by chain belts from the hand-wheel L. The traversing speed is regulated to suit the diameter of winding by moving the belt along the speed cones. The wire is rectangular in section, 0·25 inch wide and 0·06 inch thick, and after it has been wound on to the gun it presents a very even surface, which does not generally require any further preparation. The diameter over the wire is gauged, and the jacket or other covering hoop is carefully bored equal to this, if no shrinkage is to be allowed, or the dimension is diminished in accordance with the amount of shrinkage to be arranged for. The gun is built up, after wiring, in the same manner as a gun without wire, the jacket or other hoop being heated in the vertical gas furnace, and when hot enough dropped into place over the wire, cooled by the ring of water jets at the end first required to grip, and kept hot at the other, exactly as before described.

Strictly speaking, the description of obturators should be included in that of breech mechanism; but as there are, at present, two systems of obturation in use in the British service, and as the design of the breech mechanism depends in a large measure on the system adopted, we propose to consider this part of the subject separately. The purpose of the obturator is to make the breech end of the gun gas-tight, and

Obturators.

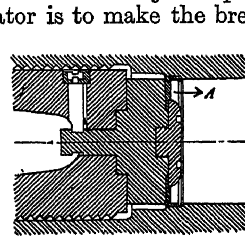


Fig. 5.

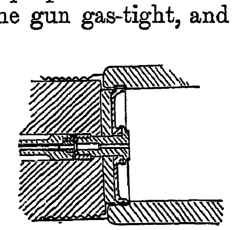


Fig. 6.

to prevent any escape of gas past the breech arrangements. In the first Armstrong B.-L. guns this object was attained by fitting to the breech block a copper ring coned on the exterior; the cone surface was screwed tightly up, by the breech screw, against a corresponding copper ring fitted at the breech opening of the gun chamber. This was a positive method, but one which could be used only when it was possible to jam the copper surfaces together by a powerful screw. In the French service B.-L. guns have been in use since about 1863, and one of the first systems of obturation was arranged on the same principle as the leather packing ring of the hydraulic press. On the face of the breech screw a steel ring, A, of a cup form, was fastened by a central screw; the outer lip of the cup fitted against a slightly coned seating formed in the breech of the gun (Fig. 5). When the gun

was fired, the gas pressure expanded the cup ring and forced it into close bearing against the breech screw and the seating in the gun, thus preventing any escape of gas. Very similar to this was the Elswick cup obturation (Fig. 6), introduced by the Elswick Ordnance Company, except that its bearing face was slightly rounded, so that on

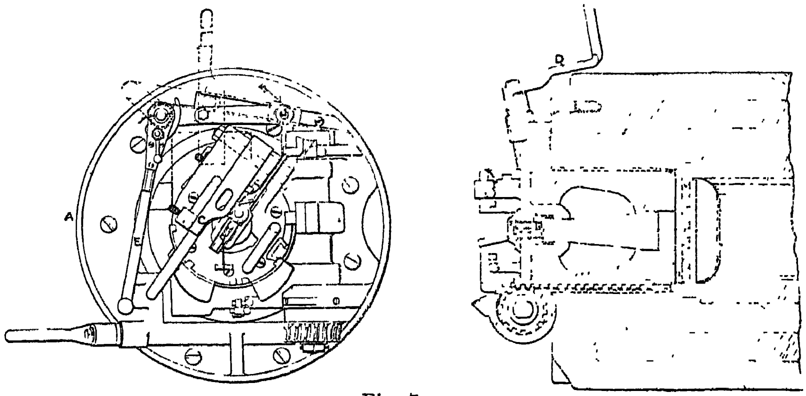


Fig. 7.

setting back against the breech screw it became flattened and expanded the lip more than with the French obturator. Besides this, the seating in the gun was formed of a copper ring, let into the gun, which could be renewed when necessary. Both these types of obturators were perfectly efficient if treated with care, and with the Elswick plan the parts liable to damage could be replaced, though a slight abrasion of the cup or seating allowed the gas to escape, and so accentuated the defect with each round fired; unless, therefore, the fault was immediately remedied, considerable damage was caused to the gun after a few rounds. The Broadwell gas ring, used in some French B.-L. guns and by Krupp for his guns, and described in the ninth edition of this Encyclopædia, depends on the same principle, and is open to the same objections. For all his latest pattern guns Krupp uses the metallic cartridge case, to be described lower down.

After this there was introduced into the French service by Colonel De Bange a new form of obturator, which has since been adopted by the British and other Governments. It consists of a pad (Fig. 8) made up of a strong annular-shaped canvas bag, containing a mixture of asbestos fibre and mutton suet; the bag with its contents is placed in a properly formed die and subjected to hydraulic pressure. The pad is placed on the front of the breech screw, and it is protected on its faces by discs of metallic tin or copper, having steel wedge rings on the outer edges; the circumference of the complete pad and discs is slightly coned, and fits into a corresponding seating formed at the breech end of the gun, the canvas of the circumference of the pad being in immediate contact with the gun. In front of the pad is placed a strong steel disc formed with a spindle, and called a mushroom head, the spindle passing through the hole in the pad and through the breech screw being secured in rear by a nut. The firing vent is generally drilled through the mushroom head and spindle, and is then termed an axial vent, to distinguish it from the radial vent bored through the body of some guns. On the gun being fired the gas exerts a great pressure on the mushroom head, which compresses the pad and forces it out on the circumference into close contact with the seating, thus forming a perfect gas seal. It is found that this apparently delicate arrangement will stand considerable ill-usage and act perfectly for an indefinite time, and as it is easily replaced, it is looked upon as one of the best forms of obturator. In some countries the Freyre obturator is in use; this has a somewhat similar axial head to the De Bange, but the asbestos pad is replaced by a single steel wedge ring into which the axial head fits. On firing the gun the head is forced into the wedge ring, and thus expands it against the seating of the gun.

We have now to consider one other means of obturation, viz., metallic cartridge cases. These act on the same principle as the cup obturation, and are extremely efficient for the purpose; moreover, they have certain advantages when used for small guns. The idea has developed from the use of such cartridges in small arms, and larger cartridges of the same type were introduced in 3-pounder and 6-pounder guns by Hotchkiss and Nordenfelt about the year 1880. Then in 1886 the Elswick Company produced a 36-pounder (soon converted to a 45-pounder) of 4·7 inches calibre, with the powder charge contained in metallic cases, and about 1888 a 6-inch 100-pounder gun, using similar cartridges. Metallic cases of a short pattern were also used in guns of 8-inch and 10-inch calibre, and although their action was quite efficient, they were heavy to manipulate, and it was considered that for guns above 6-inch calibre the De Bange obturation was the most advantageous. Krupp, however, uses cartridge cases with guns even of 12 inches calibre, but this is, in all probability, due to the difficulties attending the use of the

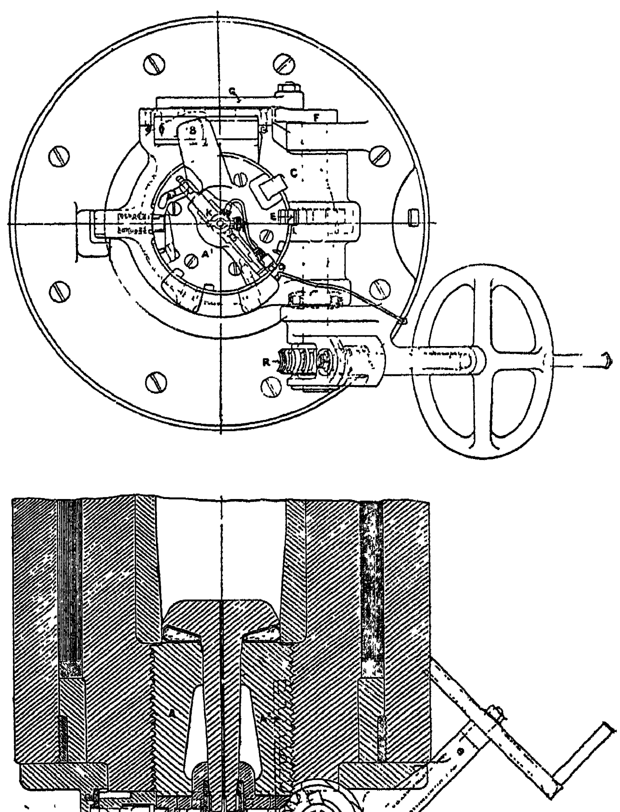


Fig. 8.

ordinary forms of obturation with the wedge breech system, especially now that the use of smokeless powder, which is exceedingly searching in its action, is almost obligatory. With smokeless powder any small defect in the ring obturators is immediately attacked, and increases with such

rapidity as quickly to render the obturator useless, even if it does not seriously damage the gun. There are, however, certain disadvantages with cartridge cases, such as their weight, the difficulty of stowage, &c., which has caused a reaction in England in favour of the De Bange system, especially for guns of 6-inch and even smaller calibres. Most other nations, however, still retain cartridge cases for guns up to 6-inch calibre. Aluminium cases have been

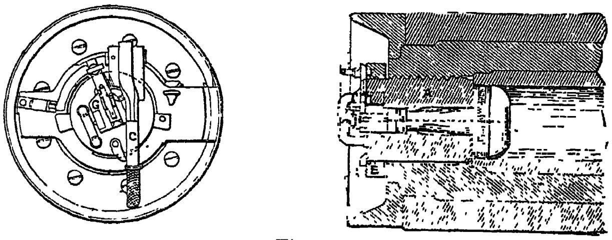


Fig. 9.

experimented with, but up to the present have not proved satisfactory.

Breech mechanism.

One of the most important parts of the gun is the breech mechanism, and a vast amount of ingenuity is expended in designing this, that it may be as simple and at the same time as effective and quick-acting as possible. In England the interrupted breech screw is used. This is a French invention, and consists of a strong screwed plug engaging with a corresponding screw thread cut on the interior of the breech opening of the gun. The screw surface of the breech plug is cut away in sections equally divided and alternating with the threaded portions. The screw surface of the breech opening of the gun is similarly cut away, so that the plug can be pushed nearly home into the breech opening without trouble; by then revolving the breech screw through a small angle, the screwed portions of the plug and breech opening engage. Thus if three sections are cut away, the angle of revolution necessary to ensure a full engagement of the screw surfaces will be 60°. A modification of the cylindrical breech screw (called the Welin screw), in which the loss of the threaded surface by the interrupted portion is reduced, has lately been introduced into the English service. In the older types of mechanism the breech was opened in from three to four different operations, which involved considerable loss of time. Thus in the earlier patterns of 10-inch B.-L. gun, to open the breech the cam lever C was folded up so that it engaged the pin J in connexion with the ratchet lever E (Fig. 7). This was then worked, and disengaged the breech screw from the threads cut in the gun; the cam lever was then folded down so as to start the breech screw, and the winch handle D rotated to withdraw the screw and swing it clear of the breech opening. During these operations the firing lock was actuated and made safe, but the fired tube had to be extracted by hand. To close the gun these various operations were reversed. To open or close the gun would certainly occupy at least half a minute with trained men. To compare with this a modern 12-inch breech mechanism is shown in Fig. 8. In order to open this breech it is only necessary to turn the hand-wheel continuously in one direction, and to close it again the motion of the hand-wheel has only to be reversed; either closing or opening the breech occupies about six seconds. Supposing the breech closed, the hand-wheel when rotated gives motion to the link G through the worm-wheel R and crank F. By this means the tooth B is moved from its extreme right position to the left, and so disengages the breech screw A from the threads in the gun; the rack A^2 on the breech screw then comes into gear with the pinion E, and draws the breech screw out of the gun into the carrier ring C which finally swings on the axis pin RF and clears the breech opening. While the opening is being performed the firing lock K is operated by the cam groove A^3, which puts the firing mechanism, either electric or percussion, to safety by withdrawing the firing needle, extracts the fired tube, and leaves the primer chamber open for a fresh primer. All these operations are performed in the reverse order on closing. With both these types of mechanism the De Bange system of obturation, with the pad only slightly coned, is used. With smaller guns the mechanism is still simpler, as less power is required for opening the breech. Thus with the 6-inch B.-L. gun, Mark IV., date about 1885 (Fig. 9), the breech is opened in three separate operations:—(*a*) the cam-lever C, which also locks the breech, is raised into the vertical position and pulled over to the left, disengaging the screw threads; (*b*) the cam lever is folded down, so that the cam acting on the rear face of the gun releases the De Bange obturator, and the screw A is then pulled by hand through the carrier ring B out of the breech; and (*c*) the carrier ring and breech screw are revolved together to the right, clear of the breech opening. In a modern 6-inch gun fitted with De Bange obturator all these operations are combined, and the mechanism worked by a horizontal hand lever, which is moved from left to right through an angle of about 200°. The hand lever A (Fig. 10) moves a link B connected to a pin C on the breech screw D, and disengages the screw from the gun; a small lateral movement is then given to the axis pin of the carrier, so as to allow the obturator pad E to swing out of its seating; when this is quite free the whole mechanism revolves on the axis pin, and thus clears the breech opening. The

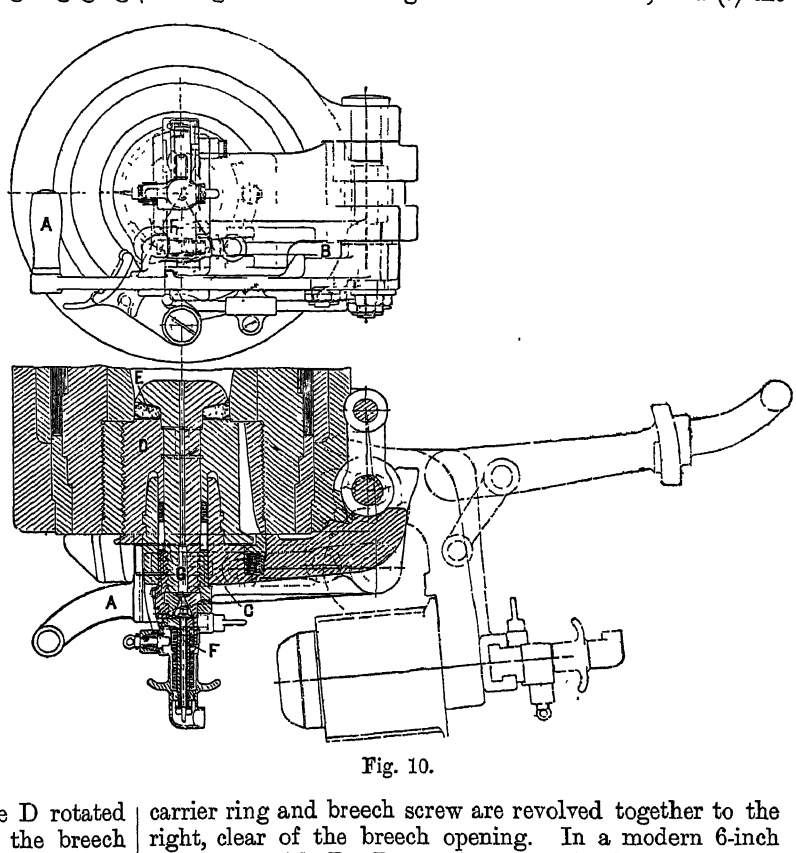


Fig. 10.

firing lock F is actuated at the same time and ejects the fired tube G, and a new tube is inserted while the gun is being loaded, so that immediately the breech is closed the charge can be fired without loss of time. In the old mechanisms the breech had to be closed first and the firing tube inserted afterwards.

The breech mechanism for guns firing metallic cartridge cases is somewhat simpler than that for the De Bange obturation, due principally to the fact of the firing primer being contained in the cartridge case, when this is intro-

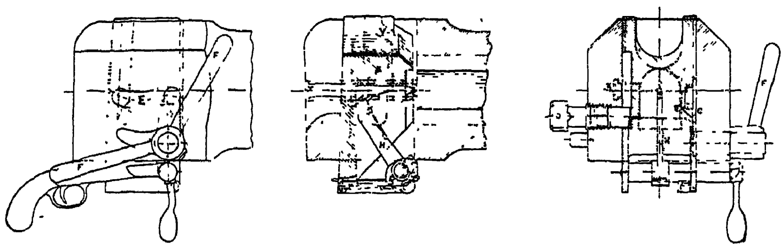


Fig. 11.

duced into the gun. In the Hotchkiss and also in the Skoda systems the mechanism is of the vertical breech block type; the actuating lever F (Fig. 11) is on the right side of the gun, and is connected to a powerful crank arm C working in a groove E cut in the breech lock. By pulling the lever towards the rear the crank arm forces down the block A and extracts the fired case by an extractor X, which in the Hotchkiss gun is actuated by a cam groove Y, also cut on the side of the block. As the mechanism is opened the hammer H is cocked ready for the next round. To close the mechanism the lever is pushed over to the front, and by releasing the trigger sear by pulling the lanyard the hammer falls and fires the cap of the cartridge case. Automatic gear can be fitted which opens the breech and extracts the fired case by means of a supplementary mechanism and strong spring actuated by the

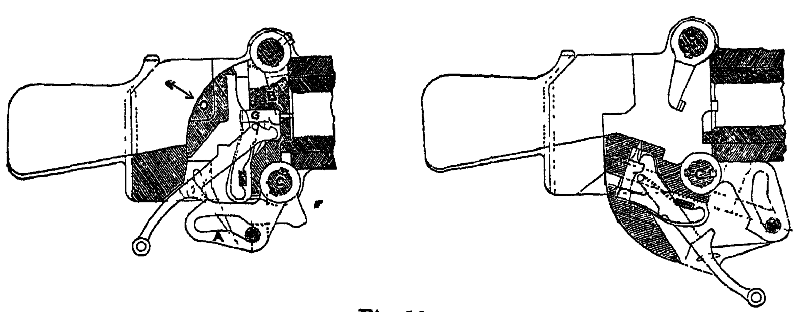


Fig. 12.

recoil of the gun; when a new cartridge is pushed into the gun the breech, which was retained by the extractor, is released, and closes automatically.

The Nordenfelt mechanism (Fig. 12) consists of a breech block B and a wedge O to secure it. A hand lever on the shaft C is pulled to the rear, and this works the action cam A, which pulls down the wedge; the breech block B is then caused to rotate, and falls back to the rear. This motion of the breech block actuates the extractor and extracts the case. While the wedge is being withdrawn the firing pin G is pulled back and cocked for the next round. The mechanism is closed by reversing the hand lever, which rotates the breech block upwards, and pushes home the cartridge case; the wedge is then forced up, and secures the breech block.

For larger guns the Elswick type of coned screw has found much favour, and has been fitted to guns of all calibres from 3-inch to 6-inch, both for the British and numerous foreign Governments. The breech screw is formed partly conical and partly cylindrical, to facilitate its entrance and its exit; this form, moreover, is taken advantage of by cutting the interruptions in the screwed surface alternately on the coned part and on the cylindrical part, so that there is a screw surface all round the circumference of the breech screw. By this means the stress is taken all round the circumference, both of the breech screw and in the gun, instead of in portions alternately, as with the ordinary cylindrical form of breech screw. This form of breech screw can also be used with De Bange obturation and the actuating mechanism similar to that already described. The breech screw F (Fig. 13) is mounted on a carrier D pivoted on the right side of the gun. On the rear face of the breech screw projects a pin A, which is connected to the horizontal hand lever E by a block B, sliding in a groove cut in the carrier and link C. When the hand lever is pulled from left to right to open the gun, the link pulls the sliding block across the rear face of the breech screw, and rotates it until the screw threads are disengaged; the sliding block then comes to a stop in the carrier, and the whole mechanism can be revolved on the axis pin G, clear of the breech opening. This then also acts on an extractor H, which extracts the fired cartridge case a short distance, so that it is easily removed by hand; it would be dangerous to the gun's crew for these heavy cartridge cases to be violently ejected. On first moving the hand lever to open the gun the firing mechanism is put to safety by slightly withdrawing the firing needle, and it is impossible to fire the gun until the lever is quite closed. To fire by percussion, the needle is drawn back by hand until it is cocked; by then pulling the lanyard attached to the trigger J, the needle is released and fires the primer.

Rifling.

The rifling of a gun is the term given to the numerous shallow grooves cut spirally along the bore; the rib left between two grooves is called the "land." The machine used for rifling modern guns is very similar to that employed for the old muzzle-loaders; but as guns have kept increasing in length, the difficulties of their manufacture have increased also, and it has only been by improving the mechanical appliances that the various obstacles have been surmounted and a steady progress made possible. The rifling machine (Fig. 14) is a special tool used in gun construction only, and is in reality a copying machine. A steel or cast-iron bar J, which forms the copy of the developed rifling curve, is first made. The copying bar—which is straight if the rifling is to be uniform, but curved if it is to be increasing—is fixed inclined at the proper angle to standards K on the machine. The cutting tool is carried at one end, C, of a strong hollow cylindrical rifling bar B, the other end of which is fixed to a saddle M. This is moved along the bed of the machine by a long screw N, and the rifling bar is consequently either pushed into the gun or withdrawn by the motion of the saddle along the machine. During this motion it is made slowly to rotate by being connected to the copying bar by suitable gearing, I; it will thus be seen that the cutting tool will cut a spiral groove along the bore of the gun in strict conformity with the copy. In most English machines the cutting tool cuts only as the rifling bar is drawn out of the gun; during the reverse motion the cutter F is withdrawn out

of action by means of a wedge arrangement D, actuated by a rod passing through the centre of the rifling bar, which also pushes forward the tool at the proper time for cutting. One, two, or three grooves may be cut at one time, the full depth being attained by slowly feeding the tool after each stroke. After each set of grooves is cut the rifling bar or the gun is rotated, so as to bring the cutters to a new position.

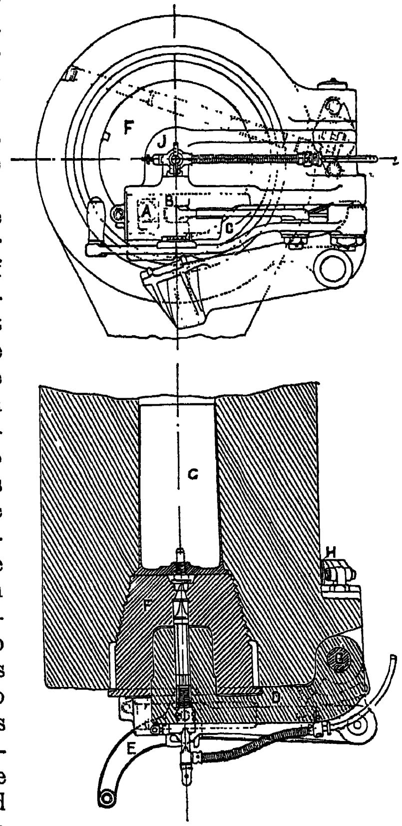


Fig. 13.

All modern guns are rifled on the poly-groove system, *i.e.*, a considerable number (from four to six per inch of diameter) of shallow grooves are cut all round the bore of the gun; the stress induced on the rifling, in forcing the projectile to rotate during its passage along the bore, is thereby distributed around the circumference. In the old muzzle-loaders a few deep and wide grooves only were cut, so that the metal studs fixed in the projectile should not be too numerous, and thus unduly weaken its walls. When the studs were superseded by the copper gas check, more numerous grooves were cut so as to distribute the rotational pressure. This was a great improvement, as the powder gas expanded the edge of the gas check, and so prevented the escape of gas over the projectile, as in the previous systems.

The first type of driving band used in modern breech-loading guns was a broad band of copper fixed to the base of the projectile, but this was expensive, and not altogether satisfactory. Mr Vavasseur then devised the plan of pressing, by hydraulic or other means, a comparatively narrow band of copper into a recessed groove cut near the base of the projectile; this proved most satisfactory, and has now been universally adopted. It will be seen that with breech-loading guns the projectile is better centred, and the copper driving band forms a definite stop for the projectile; in consequence, the capacity of the gun chamber is practically constant. In addition, the use of a copper band ensures a uniform resistance while the projectile is being forced through the gun, and it also prevents the escape of gas. These elements have a very great influence on the accuracy of the gun, and fully account for the vastly superior results obtained from breech-loading ordnance as compared with the muzzle-loading type. Many authorities believe that the best results are obtained when the projectile is fitted with two copper bands, one near the head and the other near the base. No doubt it is better centred when so arranged, but such projectiles can only be fired from guns rifled with a uniform twist, and it must also not be forgotten that the groove formed for the front band in the head of the projectile necessarily weakens the part of the shot which should be strongest.

Projectiles with a driving band at the base only can be fired from guns rifled either uniformly or with increasing twist. The pitch of the rifling or the amount of twist depends altogether on the length of the projectile; if this is short, a small amount of twist only is necessary; if long, a greater amount of twist must be arranged for in order to spin the shell more rapidly. Professor Greenhill has shown that the pitch of the rifling necessary to keep a projectile in steady motion is independent of the velocity, of the calibre, or of the length of the gun, but depends principally on the length of the shell and on its description, so that for similar projectiles one pitch would do for all guns.

The following table has been calculated from Professor Greenhill's formula :—

Length of projectile in calibres.	Minimum twist at muzzle of gun requisite to give stability of rotation expressed in 1 turn in n calibres.			
	Cast iron common shell; cavity $=\frac{8}{27}$ths vol. of shell. (Density of cast iron 7·207.)	Palliser shell; cavity $=\frac{1}{8}$th vol. of shell (Density of chilled iron 8·000.)	Solid steel bullet. (Density of steel 8·000.)	Solid lead and tin bullets of similar composition to M.-H. bullets. (Density of alloy 10·9.)
	n	n	n	n
2·0	63·87	71·08	72·21	84·29
2·1	59·84	66·59	67·66	78·98
2·2	56·31	62·67	63·67	74·32
2·3	53·19	59·19	60·14	70·20
2·4	50·41	56·10	57·00	66·53
2·5	47·91	53·32	54·17	63·24
2·6	45·65	50·81	51·62	60·26
2·7	43·61	48·53	49·30	57·55
2·8	41·74	46·45	47·19	55·09
2·9	40·02	44·54	45·25	52·72
3·0	38·45	42·79	43·47	50·74
3·1	36·99	41·16	41·82	48·82
3·2	35·64	39·66	40·30	47·04
3·3	34·39	38·27	38·84	45·38
3·4	33·22	36·97	37·56	43·84
3·5	32·13	35·75	36·33	42·40
3·6	31·11	34·62	35·17	41·05
3·7	30·15	33·55	34·09	39·79
3·8	29·25	32·55	33·07	38·61
3·9	28·40	31·61	32·11	37·48
4·0	27·60	30·72	31·21	36·43
4·1	26·85	29·88	30·36	35·43
4·2	26·13	29·08	29·55	34·49
4·3	25·45	28·33	28·78	33·59
4·4	24·81	27·61	28·05	32·74
4·5	24·20	26·93	27·36	31·94
4·6	23·65	26·32	26·74	31·21
4·7	23·06	25·66	26·08	30·44
4·8	22·53	25·08	25·48	29·74
4·9	22·03	24·51	24·91	29·07
5·0	21·56	23·98	24·36	28·44
5·1	21·08	23·46	23·84	27·83
5·2	20·64	22·97	23·34	27·24
5·3	20·22	22·50	22·86	26·68
5·4	19·81	22·05	22·40	26·14
5·5	19·42	21·61	21·96	25·63
5·6	19·04	21·19	21·53	25·13
5·7	18·68	20·79	21·12	24·66
5·8	18·33	20·40	20·73	24·20
5·9	18·00	20·03	20·35	23·75
6·0	17·67	19·67	19·98	23·33
7·0	14·99	16·68	16·95	19·78
8·0	13·02	14·48	14·72	17·18
9·0	11·50	12·80	13·00	15·18
10·0	10·31	11·47	11·65	13·60

In most modern guns the projectile varies in length from 3·5 to 4 calibres, so that the rifling is made to terminate at the muzzle with a twist of 1 turn in 30 calibres, which is found ample to ensure a steady flight to the projectile. With howitzers the projectile may be 4·5 calibres long, and the rifling has to be made of a shorter pitch to suit. The relative merits of uniform and increasing rifling depend on the description of gunpowder used in the gun; for quick-burning explosives most authorities favour the increasing twist, while for slow-burning powder it would appear that the uniform twist has the advantage. So many considerations have to be taken into account in this important question, that it would not be possible to detail them here. We give, in the following table, the pressures between the rifling and driving band of the projectile, which have been calculated from the experiments carried out by Sir Andrew Noble with some 4·7-inch guns. These results are obtained by using the formulæ shown in *Ency. Brit.*, vol. xi. p. 295 :—

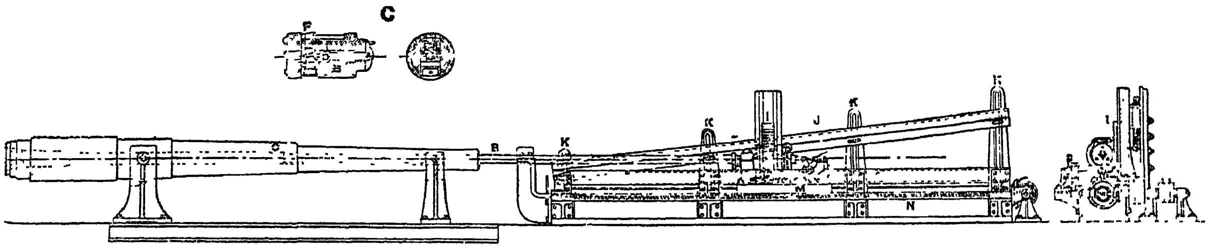


Fig. 14.

Travel of shot in bore in feet.	Total thrust, &c., on base of shot in tons.	Uniform Rifling. Total thrust in tons between driving surface of grooves and ring of projectile.	Velocity in ft. secs.	Parabolic Rifling. Total thrust between driving surface of groove and ring of projectile in tons.
0·5	254·7	19·9	548	7·9
1·0	264·0	20·7	849	9·7
1·5	245·0	19·2	1064	10·3
2·0	207·9	16·3	1224	10·5
2·5	175·7	13·7	1343	10·5
3·0	150·7	11·8	1437	10·4
4 0	115·2	9·1	1577	10·5
5·0	94·9	7·4	1680	10·8
6·0	80·6	6·3	1761	11·1
7·0	69·5	5·4	1828	11·4
8·0	60·0	4·7	1884	11·6
9·0	52·1	4·1	1931	11·8
10·0	44·8	3·5	1970	11·9
11·0	38·4	3·0	2004	12·0
12·0	32·9	2·6	2032	12·0
13·0	28·4	2·2	2056	12·1
14·0	24·3	1·9	2076	12·1
14·4	22·6	1·8	2084	12·1

In order to understand properly the principles of gun construction, it is necessary to study the theoretical considerations of the stresses set up in the metal of the gun by the pressure of the powder gases, or by the shrinkage of the tubes in built-up guns or the tension of the wire in wire-wound guns.

For this purpose take a small brick-shaped piece of the metal of the tube (see Fig. 15), and suppose its dimensions to be defined as follows :—

(i.) By two adjacent concentric cylinders of radii r and $r+\delta r$,

(ii.) By two consecutive radial planes at an angle $\delta\theta$,

(iii.) By two transverse planes at distances x and $x+\delta x$ from one end,

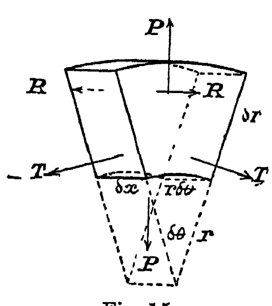


Fig. 15.

so that the width of the lower part of the element will be $r\delta\theta$, its depth δr, and thickness δx.

Let the tube be acted upon by the powder gases, which will induce in the small piece of metal—

T = a circumferential stress,

P = a radial stress,

R = a longitudinal stress,

and assume by these stresses that the piece is slightly altered in all its dimensions, so that the radius increases by u and the thickness by $d\xi$, thus—

$r\delta\theta$ becomes $\quad r\delta\theta\left(1+\frac{u}{r}\right)$,

so that the circumferential extension $=\frac{u}{r}=e$,

δr becomes $\quad \delta r\left(1+\frac{du}{dr}\right)$,

and the radial extension $\quad =\frac{du}{dr}=f$,

δx becomes $\quad \delta x\left(1+\frac{d\xi}{dx}\right)$,

and the longitudinal extension $\quad =\frac{d\xi}{dx}=g$.

Putting $A=\frac{1}{3n}+\frac{1}{9k}$, the longitudinal dilatation for unit stress,

$B=\frac{1}{6n}-\frac{1}{9k}$, the transverse contraction for unit stress for any single force acting alone (see *Ency. Brit.*, vol. vii. p. 806).

Therefore, when the three forces are acting on the element together we have

$$\left.\begin{aligned} e&=AT-B(P+R)\\ f&=AP-B(T+R)\\ g&=AR-B(P+T)\end{aligned}\right\} \quad . \quad . \quad . \quad . \quad . \quad (1)$$

or since $\quad \frac{B}{A}=\sigma$, Poisson's ratio,

and putting $\frac{1}{A}=M$, Young's modulus of elasticity, we have

$$\left.\begin{aligned} Me&=T-\sigma(P+R)\\ Mf&=P-\sigma(T+R)\\ Mg&=R-\sigma(P+T)\end{aligned}\right\} \quad . \quad . \quad . \quad . \quad . \quad (2)$$

We have also (see *Ency. Brit.*, vol. xv. p. 745)

$$T=\frac{d}{dr}(Pr) \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

From equations (2) we obtain

$$T=\frac{M}{(1+\sigma)(1-2\sigma)}\{(1-\sigma)e+\sigma(f+g)\} \quad . \quad . \quad (4)$$

$$P=\frac{M}{(1+\sigma)(1-2\sigma)}\{(1-\sigma)f+\sigma(e+g)\} \quad . \quad . \quad (5)$$

$$R=\frac{M}{(1+\sigma)(1-2\sigma)}\{(1-\sigma)g+\sigma(e+f)\} \quad . \quad . \quad (6)$$

Now making use of the relation in equation (3) and using equations (4) and (5) we obtain, by putting the proper values of e, f, and g,

$$(1-\sigma)\frac{u}{r}+\sigma\left(\frac{du}{dr}+\frac{d\xi}{dx}\right)=(1-\sigma)\left(\frac{du}{dr}+r\frac{d^2u}{dr^2}\right)$$
$$+\sigma\left(\frac{du}{dr}+r\frac{d}{dr}\frac{d\xi}{dx}+\frac{d\xi}{dx}\right),$$

or transposing and dividing by r

$$(1-\sigma)\left(\frac{d^2u}{dr^2}+\frac{1}{r}\frac{du}{dr}-\frac{u}{r^2}\right)+\sigma\frac{d}{dr}\frac{d\xi}{dx}=0 \quad . \quad . \quad . \quad (7)$$

Assuming that the longitudinal stress R is constant throughout the section,

$$\frac{dR}{dr}=0,$$

and from (6)

$$(1-\sigma)\frac{d}{dr}\frac{d\xi}{dx}+\sigma\left(\frac{d^2u}{dr^2}+\frac{1}{r}\frac{du}{dr}-\frac{u}{r^2}\right)=0 \qquad . \quad . \quad (8)$$

From (7) and (8) we see that

$$\frac{d^2u}{dr^2}+\frac{1}{r}\frac{du}{dr}-\frac{u}{r^2}=0 \qquad . \quad . \quad . \quad . \quad . \quad (9)$$

and

$$\frac{d}{dr}\frac{d\xi}{dx}=0 \qquad . \quad . \quad . \quad . \quad . \quad . \quad (10)$$

Integrating (9)

$$\frac{du}{dr}+\frac{u}{r}=2C, \text{ a constant,}$$

or $$rdu+udr=2Crdr,$$

and again integrating $$ur=Cr^2+D$$

that is $$e=\frac{u}{r}=C+\frac{D}{r^2}$$

and $$f=\frac{du}{dr}=C-\frac{D}{r^2}$$

Integrating (10)

$$g=\frac{d\xi}{dx}=a, \text{ a constant.}$$

Suppose we are dealing with a single tube of a gun of radii r_{n-1} and r_n; then the radial stress varies from P_{n-1} at the interior to P_n at the exterior of the tube. As the tensional stresses are considered positive, the pressures must be negative.

Therefore from (5)

$$P_{n-1}-P_n=D\frac{M}{1+\sigma}\left(\frac{r_n^2-r_{n-1}^2}{r_{n-1}^2r_n^2}\right)$$

$$D=\frac{1+\sigma}{M}\frac{r_{n-1}^2r_n^2}{r_n^2-r_{n-1}^2}(P_{n-1}-P_n),$$

and by putting $R=0$ or to a constant in (6) and combining the result with (5) we obtain the other constants,

$$C=\frac{1-\sigma}{M}\frac{P_{n-1}r_{n-1}^2-P_nr_n^2}{r_n^2-r_{n-1}^2}$$

$$a=-\frac{2\sigma}{M}\frac{P_{n-1}r_{n-1}^2-P_nr_n^2}{r_n^2-r_{n-1}^2}.$$

Using these values in equations (4), (5), and (6) we find for any intermediate radius r that

$$T=\frac{P_{n-1}r_{n-1}^2-P_nr_n^2}{r_n^2-r_{n-1}^2}+\frac{r_{n-1}^2r_n^2}{r^2}\frac{P_{n-1}-P_n}{r_n^2-r_{n-1}^2}$$

$$=\frac{P_{n-1}(r^{-2}+r_n^{-2})-P_n(r_{n-1}^{-2}-r^{-2})}{r_{n-1}^{-2}-r_n^{-2}} \qquad . \quad . \quad (11)$$

$$P=\frac{r_{n-1}^2r_n^2}{r^2}\frac{P_{n-1}-P_n}{r_n^2-r_{n-1}^2}-\frac{P_{n-1}r_{n-1}^2-P_nr_n^2}{r_n^2-r_{n-1}^2}$$

$$=\frac{P_{n-1}(r^{-2}-r_n^{-2})+P_n(r_{n-1}^{-2}-r^{-2})}{r_{n-1}^{-2}-r_n^{-2}} \qquad . \quad . \quad (12)$$

$$R=0 \text{ or a constant} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (13)$$

From the last equation of (2) it will be seen that

$$T+P=\frac{1}{\sigma}(R-Mg), \text{ a constant.}$$

Therefore in the same hoop, P being of negative sign,

$$T_n-P_n=T-P \quad . \quad . \quad . \quad . \quad . \quad . \quad (14)$$

Suppose the radii of the barrel to be r_0 and r_1, of the superimposed hoop r_1 and r_2, and of the n^{th} hoop r_{n-1} and r_n. Then from (12) the external pressure of the n^{th} hoop is

$$P_n=r_{n-1}^2\frac{P_{n-1}-P_n}{r_n^2-r_{n-1}^2}-\frac{P_{n-1}r_{n-1}^2-P_nr_n^2}{r_n^2-r_{n-1}^2},$$

and from (11) the internal tension of this hoop is

$$T_{n-1}=\frac{P_{n-1}r_{n-1}^2-P_nr_n^2}{r_n^2-r_{n-1}^2}+r_n^2\frac{P_{n-1}-P_n}{r_n^2-r_{n-1}^2}.$$

Adding, we find

$$T_{n-1}+P_n=(P_{n-1}-P_n)\frac{r_n^2+r_{n-1}^2}{r_n^2-r_{n-1}^2}.$$

Therefore the pressure between the n^{th} hoop and the $(n-1)^{th}$ hoop is

$$P_{n-1}=\frac{r_n^2-r_{n-1}^2}{r_n^2+r_{n-1}^2}(T_{n-1}+P_n)+P_n \qquad . \quad . \quad (15)$$

In the same way the pressure between the $(n-1)^{th}$ and $(n-2)^{th}$ hoops is

$$P_{n-2}=\frac{r_{n-1}^2-r_{n-2}^2}{r_{n-1}^2+r_{n-2}^2}(T_{n-2}+P_{n-1})+P_{n-1} \qquad . \quad . \quad (16)$$

So that when P_n and the tensions T_{n-1}, T_{n-2} . . . are known, the other pressures can be found. It is usual in gun construction to consider that the proof tension of the barrel should not exceed 15 tons per square inch, and of the outer hoops 18 tons per square inch. If the n^{th} hoop is the exterior hoop then $P_n=0$, if we neglect the atmospheric pressure.

The stress obtained by (15) is called the *Firing stress*, as it is due to the pressure P_0 of the powder gases produced by the discharge of the gun, P_0 varying for different positions along the bore (GUNNERY: § *Interior Ballistics*). In order to obtain the full benefit of the hoop system it will be seen that a certain pressure, to be obtained by shrinkage, should exist at the common surface of each pair of hoops; this is called the *initial stress* or *stress of repose*. Considering the gun a homogeneous solid block of steel, *i.e.*, by putting $n=1$ in (15) the powder pressure P_0 will produce the *powder stress;* and the following relation exists:—

$$\text{Initial stress}+\text{powder stress}=\text{firing stress} \quad . \quad . \quad (17)$$

The method of working will best be seen by a practical example. Take, for instance, a section across the chamber of a 4·7-inch Q.-F. gun, in which the diameter of the chamber is 5 inches, that of the barrel 8·2 inches, and the external diameter of the jacket 15 inches.

$$\text{Here } r_0=2{\cdot}5\ ;\ r_1=4{\cdot}1\ ;\ \text{and } r_2=7{\cdot}5$$
$$T_0=15\ ;\ T_1=18\ ;\ \text{and } P_2=0.$$

From (15) we have for the firing stress

$$P_1=\frac{(7{\cdot}5)^2-(4{\cdot}1)^2}{(7{\cdot}5)^2+(4{\cdot}1)^2}\times 18=9{\cdot}72 \text{ tons per square inch.}$$

$$P_0=\frac{(4{\cdot}1)^2-(2{\cdot}5)^2}{(4{\cdot}1)^2+(2{\cdot}5)^2}\times(15+9{\cdot}72)+9{\cdot}72=21 \text{ tons per square inch.}$$

By (14) we can obtain the tension $T_n{}^1$ of the outer fibres of the hoops, thus

$$T_2{}^1=P_2+T_1-P_1=18-9{\cdot}72=8{\cdot}28 \text{ tons,}$$
$$\text{and } T_1{}^1=P_1+T_0-P_0=9{\cdot}72+15-21=3{\cdot}72 \text{ tons.}$$

For the powder stress (11) and (12) may be used by making $n=1$ and $p_1=0$, then

$$t_0=\frac{(7{\cdot}5)^2+(2{\cdot}5)^2}{(7{\cdot}5)^2-(2{\cdot}5)^2}\times 21=26{\cdot}25 \text{ tons,}$$

$$t_2{}^1=26{\cdot}25-21=5{\cdot}25 \text{ tons,}$$

for a radius $r=4{\cdot}1$ inches

$$p=6{\cdot}32 \text{ tons and } t_1=11{\cdot}57 \text{ tons.}$$

Subtracting the powder stress from the firing stress we obtain the initial stress, which can be seen at a glance from the following table:—

		Tensions.			Pressures.		
	At Radius.	Firing Stress.	Powder Stress.	Initial Stress.	Firing Stress.	Powder Stress.	Initial Stress.
Barrel	$r_0=2{\cdot}5$	15·0	26·25	−11·25	21·0	21·0	0
	$r_1=4{\cdot}1$	3·72	11·57	−7·85	9·72	6·32	3·4
Jacket	$r_1=4{\cdot}1$	18·0	11·57	6·43	9·72	6·32	3·4
	$r_2=7{\cdot}5$	8·28	5·25	3·03	0	0	0

Figure 16, A shows the stress drawn to scale.

Denoting by u^1_{n-1} and u_{n-1} the radial displacement, from the unstrained position, of the outer and inner circumferential fibres of a tube and the superimposed hoop respectively due to shrinkage, the external radius $r_{n-1}+u_{n-1}{}^1$ of the tube will be diminished by $u_{n-1}{}^1$ and the internal radius $r_{n-1}-u_{n-1}$ of the hoop will be increased by u_{n-1}.

Since the shrinkage S is defined as the excess of the external diameter of a tube over the internal diameter of the hoop before shrinkage when both are in the cold state

$$\tfrac{1}{2}S=(r_{n-1}+u_{n-1}{}^1)-(r_{n-1}-u_{n-1})=u_{n-1}{}^1+u_{n-1}$$

As u_{n-1} denotes an extension it is considered positive in sign, and since u^1_{n-1} denotes a compression it is negative. From (2) we have

$$Me=\ M\frac{u_{n-1}}{r_{n-1}}=T_{n-1}-\sigma(P_{n-1}+R)$$

$$-Me=-M\frac{u^1_{n-1}}{r_{n-1}}=T^1_{n-1}-\sigma(P_{n-1}+R).$$

Therefore subtracting

$$M(u_{n-1}+u_{n-1}{}^1)=(T_{n-1}-T_{n-1}{}^1)r_{n-1},$$

or, denoting the shrinkage between the $(n-1)^{th}$ and n^{th} hoops by ${}_{n-1}S_n$ we find that

$${}_{n-1}S_n=(T_{n-1}-T_{n-1}{}^1)\frac{2r_{n-1}}{M} \qquad . \quad . \quad . \quad (17)$$

From (14)

$$T_{n-1} - T_{n-1}{}^1 = T_{n-1} - T_{n-2} + P_{n-2} - P_{n-1},$$

and consequently

$$_{n-1}S_n = \left\{T_{n-1} - T_{n-2} + \frac{r_{n-1}^2 - r_{n-2}^2}{r_{n-1}^2 + r_{n-2}^2}(T_{n-2} + P_{n-1})\right\}\frac{2r_{n-1}}{M} \quad . \quad (18)$$

Where M can be taken as 12,500 tons per square inch for gun steel. (See Unwin's *Testing of Materials of Construction*, p. 249.)

In wire guns, we may regard the tube on which the wire is wound, as so large, in comparison with the thickness of the wire, that the compression of the concave surface of the wire and the extension of its convex surface may be neglected without sensible error. We may also neglect any consideration of longitudinal stress in the wire coils.

It is assumed that in the firing stress the tension T, usually taken at from 25 to 30 tons per square inch, is uniform throughout the thickness of the wiring. If the wire is wound direct on the barrel and is covered by a jacket, then r_0, r_1 are the radii of the barrel, r_1, r_2 are the radii of the internal and external layer of wire, and r_2, r_3 the radii of the jacket. Then for the firing stress in the wire we have—

$$T(r_2 - r) = Pr - P_2 r_2 \quad . \quad . \quad . \quad (19)$$

or

$$T(r - r_1) = P_1 r_1 - Pr \quad . \quad . \quad . \quad (20)$$

The initial tensions of the wire are arranged so that T is uniform when the gun is fired, and we have now to determine what must be the winding tensions to produce these conditions.

Denote by θ the winding tension, by ϕ the initial tension, and by ω the pressure at any radius r. It is assumed that M is uniform for the gun steel and wire, and that θ, at any radius r, is equal to ϕ increased by the circumferential stress, due to the initial radial pressure ω, of the superincumbent layers, acting on the portion of the wire coil and barrel between the radii r_0 and r. Thus from equation (15) by putting $n=1$ and $P_0=0$, and considering the barrel and wire homogeneous

$$\theta = \phi + \omega\frac{r^2 + r_0^2}{r^2 - r_0^2} \quad . \quad . \quad . \quad . \quad (21)$$

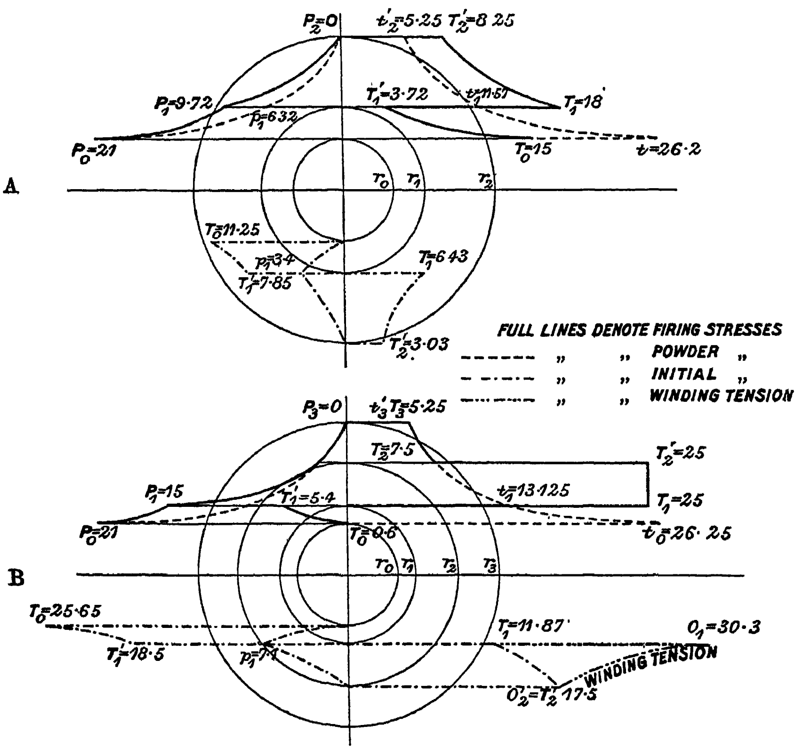


Fig. 16.

From (17), (11), and (12), P_0 being now the powder pressure—

$$\phi = T = P_0\frac{r_0^2}{r^2} \cdot \frac{r_3^2 + r^2}{r_3^2 - r_0^2} \quad . \quad . \quad . \quad (22)$$

$$\omega = P - P_0\frac{r_0^2}{r^2} \cdot \frac{r_3^2 - r^2}{r_3^2 - r_0^2} \quad . \quad . \quad . \quad (23)$$

By means of these equations and by (19) we find that the expression (21) reduces to

$$\theta = \frac{E}{r} + \frac{F}{r - r_0} + \frac{G}{r + r_0}$$

where

$$E = -(T + P_2)r_2$$
$$F = (T + P_2)r_2 - (T + P_0)r_0$$
$$G = (T + P_2)r_2 + (T + P_0)r_3.$$

To compare with the previous example, we will calculate the stresses in a 4·7 Q.-F. wire gun, consisting of a barrel, intermediate layer of wire, and jacket.

Here $r_0 = 2{\cdot}5$, $r_1 = 3{\cdot}75$, $r_2 = 5{\cdot}5$, $r_3 = 7{\cdot}5$;

the tension T_1 to $T_2{}^1$ of the wire = 25 tons per square inch, suppose.

Take $P_0 = 21$ tons per square inch and consider that the jacket fits tightly over the wire, but has no shrinkage. Then for the firing stresses we have from (12)

$$P_2 = 2{\cdot}25 \text{ tons},$$

and from (19) and (20) $T_1(r_2 - r_1) = P_1 r_1 - P_2 r_2$

$$P_1 = 14{\cdot}97, \text{ say } 15 \text{ tons};$$

from (15) we can obtain T_0 and T_2 since we know P_0, P_2, and P_2

$$T_0 = 0{\cdot}6 \text{ tons}, \ T_2 = 7{\cdot}5 \text{ tons}.$$

From (11) we find

$$T_1{}^1 = -5{\cdot}4 \text{ tons (a compression) and } T_3{}^1 = 5{\cdot}25 \text{ tons}.$$

The powder stress can be obtained in the same way as in the previous example, and so also the initial stress; therefore tabulating:—

	At Radius	Tensions. Firing Stress.	Tensions. Powder Stress.	Tensions. Initial Stress.	Pressures. Firing Stress.	Pressures. Powder Stress.	Pressures. Initial Stress
Barrel	$r_0 = 2{\cdot}5$	0·6	26·25	−25·65	21·0	21·0	0
	$r_1 = 3{\cdot}75$	−5·4	13·125	−18·525	15·0	7·875	7·125
Wire	$r_1 = 3{\cdot}75$	25·0	13·125	11·875	15·0	7·875	7·125
	$r_2 = 5{\cdot}5$	25·0	7·5	17·5	2·25	2·25	0
Jacket	$r_2 = 5{\cdot}5$	7·5	7·5	0	2·25	2·25	0
	$r_3 = 7{\cdot}5$	5·25	5·25	0	0	0	0

For the winding tension of the wire

$$E = -149{\cdot}875 \ ; \ F = 34{\cdot}875 \ ; \ G = 264{\cdot}875 \ ;$$

so that calculating θ we find that the winding tension must commence 30·3 tons per square inch and finish off at 17·5 tons per square inch. It will be noticed that the finishing-off tension is the same as the initial tension which would be expected.

Fig. 16, B shows these stresses.

Professor Greenhill has put these formulas, both for the built-up and wire-wound guns, into an extremely neat and practical geometrical form, which could be used instead of the arithmetical processes; for these see the *Text-Book of Gunnery*, *Treatise of Service Ordnance*, and *Journal of the United States Artillery*, vol. iv.

In England, as we have before mentioned, the longitudinal stress at the breech end of the gun is provided for by the breech piece; or, in guns where this is absent, by the jacket. Its amount is easily calculated on the hypothesis of uniform stress throughout the thickness of the breech piece or jacket.

If r_0 is the largest radius of the gun chamber, P_0 the maximum powder pressure, and the radii of the breech piece or jacket r_1 and r_2, then the tension in tons per square inch

$$T = \frac{2\pi P_0 r_0^2}{2\pi(r_2^2 - r_1^2)} = P_0\frac{r_0^2}{r_2^2 - r_1^2}.$$

Gunmakers usually arrange that a large factor of safety is observed in providing for this longitudinal stress; and in the larger calibres of guns both the breech piece and jacket may be available for longitudinal strength; but even in this case the jacket is best considered as an auxiliary only, as, owing to the necessary connexions between these two portions, it is possible the jacket may not be taking its full share of stress.

The screw thread of the breech screw and of the breech opening must be so proportioned as to provide for a similar strength; but in many modern B.-L. guns fitted with De Bange obturation the diameter of the seating at the breech opening can be made just large enough to admit the projectile freely. As this would generally be considerably smaller than the maximum diameter of the chamber, a less area is exposed to the gas pressure, and consequently less thread section is required.

(A. G. H.)

GUNNERY OR BALLISTICS.

BALLISTICS, the science of throwing warlike missiles or projectiles, is now divided into two parts: *Exterior Ballistics*, in which the motion of the projectile is considered after it has received its initial impulse, when the projectile is moving freely under the influence of gravity and the resistance of the air, and it is required to determine the circumstances so as to hit a certain object, with a view to its destruction or perforation; and *Interior Ballistics*, in which the pressure of the powder-gas is analysed in the bore of the gun, and the investigation is carried out of the requisite charge of powder to secure the initial velocity of the projectile; also including the calculation of the strength of the various parts of the gun required to withstand the pressure at all parts of the bore.

I. Exterior Ballistics.

In the ancient theory due to Galileo, the resistance of the air is ignored, and, as shown in ordinary treatises on Dynamics, the trajectory is now a *parabola*. But this theory is very far from being of practical value for most purposes of gunnery; so that a first requirement is an accurate experimental knowledge of the resistance of the air to the projectiles employed, at all velocities useful in artillery. The theoretical assumptions of Newton and Euler (*hypotheses magis mathematicæ quam naturales*) of a resistance varying as some simple power of the velocity, for instance, as the square or cube of the velocity (the quadratic or cubic law), lead to results of great analytical complexity, and are useful only for provisional extrapolation at high or low velocities, pending further experiment.

The foundation of our knowledge of the resistance of the air, as employed in the construction of Ballistic Tables, is the series of experiments carried out between 1867 and 1879 by the Rev. F. Bashforth, B.D. (*Report on the Experiments made with the Bashforth Chronograph*, &c., 1865–1870; *Final Report*, &c., 1878–1880; *The Bashforth Chronograph*, Cambridge, 1890). According to these experiments, the resistance of the air can be represented by no simple mathematical law over a large range of velocity. Abandoning therefore all *à priori* theoretical assumption, Bashforth set to work to measure experimentally the velocity of shot and the resistance of the air by means of equidistant electric screens furnished with vertical threads or wire, and by a chronograph which measured the instants of time at which the screens were cut by a shot flying nearly horizontally. Formulæ of the *Calculus of Finite Differences* enable us from the chronograph records to infer the velocity and retardation of the shot, and thence the resistance of the air. (For practical details refer to the article CHRONOGRAPH.)

As a first result of the experiments it was found that the resistance of similar shot was proportional, at the same velocity, to the surface, or cross section, or square of the diameter. The resistance R can thus be divided into two factors, one of which is d^2, where d denotes the diameter of the shot in inches, and the other factor is denoted by p or $f(v)$, where p is the resistance in pounds at the same velocity to a similar 1-inch projectile; thus

$$R = d^2p = d^2f(v),$$

and the value of p, or $f(v)$, for velocities ranging from 100 to 2800 feet per second (f/s) is given in the second column of the extract from the abridged Ballistic Table.

These values of p refer to a standard density of the air, of 534·22 grains per cubic foot, which is the density of dry air at sea-level in the latitude of Greenwich, at a temperature of 62° F. and a barometric height of 30 inches.

But in consequence of the humidity of the climate of England it is better to suppose the air to be (on the average) two-thirds saturated with aqueous vapour, and then the standard temperature will be reduced to 60° F., so as to secure the same standard density; the density of the air being reduced perceptibly by the presence of the aqueous vapour.

It is further assumed, as the result of experiment, that the resistance is proportional to the density of the air; so that if the standard density changes from unity to any other relative density denoted by τ, then

$$R = \tau d^2p,$$

and τ is called the *coefficient of tenuity*.

The factor τ becomes of importance in long-range high-angle fire, where the shot reaches the higher attenuated strata of the atmosphere; on the other hand, we must take $\tau =$ about 800, in calculations of shooting under water.

The resistance of the air is considerably reduced in modern projectiles by giving them a greater length and a sharper point, and by the omission of projecting studs, and a factor κ, called the *coefficient of shape*, is introduced to allow for this change.

For projectiles in which the ogival head is struck with a radius of 2 diameters, Bashforth puts $\kappa = 0{\cdot}975$; on the other hand, for flat-headed projectiles, as required at proof-butts, $\kappa = 1{\cdot}8$, say 2 on the average.

For spherical shot κ is not constant, and a separate ballistic table must be constructed; but κ may be taken as 1·7 on the average.

Lastly, to allow for the superior centring of the shot obtainable with the breech-loading system, Bashforth introduces a factor σ, called the *coefficient of steadiness*.

This steadiness may vary during the flight of the projectile, as the shot may be unsteady for some distance after leaving the muzzle, afterwards steadying down, like a spinning-top. Again, σ may increase as the gun wears out, after firing a number of rounds.

Collecting all the coefficients, τ, κ, σ, into one, we put

$$(1) \qquad R = nd^2p = nd^2f(v)$$

where

$$(2) \qquad n = \tau\kappa\sigma,$$

and n is called the *coefficient of reduction*.

By means of a well-chosen value of n, determined by a few experiments, it is possible, with the most recent designs, to utilize Bashforth's experimental results carried out with old-fashioned projectiles, pending further experiments. For instance, $n = 0{\cdot}8$ is considered a good average for the modern rifle bullet.

Starting with the experimental values of p, for a standard projectile, fired under standard conditions in air of standard density, we proceed to the construction of the Ballistic Tables; and first determine the time t in seconds required for the velocity of a shot, d inches in diameter and weighing w pounds, to fall from any initial velocity V f/s to any final velocity v f/s.

If r denotes the retardation of the shot, in f/s², due to the resistance of R pounds, then by Newton's *Second Law of Motion*, "Change of Motion is proportional to the Impressed Force."

$$(3) \qquad \frac{r}{g} = \frac{R}{w} = \frac{nd^2}{w}p,$$

since r varies as R, and $r = g$ when $R = w$.

If Δv denotes the loss of velocity in the small interval of time Δt,

$$(4) \qquad \frac{\Delta v}{\Delta t} = \text{average retardation in the interval } \Delta t$$
$$= r = \frac{R}{w}g = \frac{nd^2}{w}gp$$

where p denotes the average value in the interval; and therefore

$$(5) \qquad \Delta t = \frac{w}{nd^2}\frac{\Delta v}{gp}.$$

We put

$$(6) \qquad \frac{w}{nd^2} = C,$$

and call C the *ballistic coefficient* (driving-power) of the shot; so that

$$(7) \qquad \Delta t = C\frac{\Delta v}{gp};$$

and now if t changes to T for the standard projectile for which $C = 1$,

$$(8) \qquad \Delta t = C\Delta T,$$

where

$$(9) \qquad \Delta T = \frac{\Delta v}{gp}.$$

Since p is tabulated as $f(v)$, a function of v, the velocity v is taken as the argument of the Ballistic Table; starting with the lowest experimental value, say $v = 400$, the change in velocity Δv is taken constantly as 10, and the average value of p in each interval of velocity between 400, 410, 420, . . . is multiplied by g and divided into $\Delta v = 10$, to obtain the corresponding value of ΔT; the sum of these values of ΔT is afterwards made, by an arithmometer, and entered in the column under T.

The number T is also denoted by T(v), and now

$$(10) \qquad T(V) - T(v)$$

is the time taken by the standard projectile for the velocity to fall from V to v f/s; while

$$(11) \qquad t = C\{T(V) - T(v)\}$$

is the number of seconds occupied by a projectile whose ballistic coefficient is C, between the same limits of velocity, V and v.

Next let Δs denote the number of feet of advance in the time Δt; then

$$(12) \qquad \Delta s = v\Delta t,$$

and if s changes to S for the standard projectile,

$$(13) \qquad \Delta S = v\Delta T,$$

where v denotes the mean velocity in the interval; and ΔS can be calculated with sufficient accuracy from ΔT by taking the mean velocity in the intervals as 415, 425, 435. . . .

These differences ΔS are entered in the corresponding column of the table; and their sum, obtained by the arithmometer, is entered in the column headed S.

The number S, also denoted by S(v), is such that

$$(14) \qquad S(V) - (S)v$$

is the number of feet advanced horizontally by the standard projectile, while the velocity falls from V to v f/s; and

$$(15) \qquad s = C[S(V) - S(v)]$$

is the number of feet of advance of any other projectile whose ballistic coefficient is C, between the same limits of velocity, V and v.

To save the trouble of proportional parts required when the velocity proceeds by increments of 10, Bashforth has provided Ballistic Tables which give by interpolation the values of T and S for every unit of velocity, in the region useful in artillery. A third table, due to Mr W. D. Niven, F.R.S., Director of Naval Studies, Greenwich, called the *degree* table, determines the change of direction of motion of the shot while the velocity changes from V to v, the shot flying nearly horizontally.

To explain the theory of this table, suppose the tangent at the point of the trajectory, where the velocity is v, to make an angle i radians with the horizon.

Then, resolving normally in the trajectory, and supposing the resistance of the air to act tangentially,

$$(16) \qquad v\frac{di}{dt} = g\cos i,$$

where di denotes the infinitesimal *decrement* of i in the infinitesimal increment of time dt.

In problems of Direct Fire, where the trajectory is flat enough for $\cos i$ to be undistinguishable from unity, equation (16) becomes

$$(17) \qquad v\frac{di}{dt} = g, \text{ or } \frac{di}{dt} = \frac{g}{v};$$

so that we can put

$$(18) \qquad \frac{\Delta i}{\Delta t} = \frac{g}{v},$$

if v denotes the mean velocity during the small finite interval of time Δt, during which the direction of motion of the shot changes through Δi radians.

If the inclination or change of inclination in degrees is denoted by δ or $\Delta\delta$,

$$(19) \qquad \frac{\delta}{180} = \frac{i}{\pi},$$

so that

$$(20) \qquad \Delta\delta = \frac{180}{\pi}\Delta i = \frac{180g}{\pi}\frac{\Delta t}{v};$$

and if δ and i change to D and I for the standard projectile,

$$(21) \qquad \Delta I = g\frac{\Delta T}{v},$$

$$(22) \qquad \Delta D = \frac{180g}{\pi}\frac{\Delta T}{v}.$$

The differences ΔD are thus calculated, while the values of D are obtained by summation with the arithmometer; and they are entered in their respective columns.

For some purposes it is preferable to retain the circular measure, i radians, as being undistinguishable in Direct Fire from $\sin i$ and $\tan i$; and now the differences ΔI and the sum I are calculated and entered in their columns.

The last function A, called the *altitude function*, will be explained when High Angle Fire is considered (p. 175).

The annexed scheme of computation shows the method employed, using four-figure logarithms; and when the significant figures are reduced to three, the work can be shortened still further by the use of the Slide Rule.

When the values of p are revised in accordance with the results of new experiments, a recomputation of the Ballistic Tables in this manner will have to be carried out.

CALCULATION OF A BALLISTIC TABLE.

v		1600-1610.	1610-1620.	1620-1630.
p		11·48	11·60	11·72
$\log p$		1·0599	1·0645	1·0690
$\log \frac{\Delta v}{g}$	$\bar{1}$·4923			
$\log \Delta T$		$\bar{2}$·4324	$\bar{2}$·4278	$\bar{2}$·4233
$\frac{\Delta v}{gp} = \Delta T$		0·0271	0·0268	0·0265
T	27·5457	27·5728	27·5996	27·6261
$\log v$		3·2055	3·2082	3·2109
$\log \Delta S$		1·6379	1·6360	1·6342
$v\Delta T = \Delta S$		43·44	43·25	43·08
S	18587·05	18630·49	18673·74	18716·82
$\log \frac{180g}{\pi}$	3·2658			
$\log \frac{\Delta T}{v}$		$\bar{5}$·2269	$\bar{5}$·2196	$\bar{5}$·2124
$\log \Delta D$		$\bar{2}$·4927	$\bar{2}$·4854	$\bar{2}$·4782
$\frac{180g}{\pi}\frac{\Delta T}{v} = \Delta D$		0·0311	0·0306	0·0301
D	49·7729	49·8040	49·8346	49·8617
$\log g$	1·5077			
$\log \Delta I$		$\bar{4}$·7346	$\bar{4}$·7273	$\bar{4}$·7201
$g\frac{\Delta T}{v} = \Delta I$		0·000543	0·000534	0·000525
I	0·868675	0·869218	0·869752	0·870277
$\log I$		$\bar{1}$·9392	$\bar{1}$·9394	$\bar{1}$·9396
$\log \Delta S$		1·6379	1·6360	1·6342
$\log \Delta A$		1·5771	1·5754	1·5738
$I\Delta S = \Delta A$		37·77	37·63	37·48
A	8470·36	8508·13	8545·76	8583·24

ABRIDGED BALLISTIC TABLE.

v	p	ΔT	T	ΔS	S	ΔD	D	ΔI	I	ΔA	A
f/s											
1600	11·416	·0271	27·5457	43·47	18587·00	·0311	49·7729	·000543	·868675	37·77	8470·36
1610	11·540	·0268	27·5728	43·27	18630·47	·0306	49·8040	·000534	·869218	37·63	8508·13
1620	11·662	·0265	27·5996	43·08	18673·74	·0301	49·8346	·000525	·869752	37·48	8545·76
1630	11·784	·0262	27·6261	42·90	18716·82	·0296	49·8647	·000517	·870277	37·35	8583·24
1640	11·909	·0260	27·6523	42·72	18759·72	·0291	49·8943	·000508	·870794	37·21	8620·59
1650	12·030	·0257	27·6783	42·55	18802·44	·0287	49·9234	·000500	·871302	37·09	8657·80
1660	12·150	·0255	27·7040	42·39	18844·99	·0282	49·9521	·000492	·871802	36·96	8694·89
1670	12·268	·0252	27·7295	42·18	18887·38	·0277	49·9803	·000484	·872294	36·80	8731·85

Abridged Ballistic Table—*continued.*

v	p	ΔT	T	ΔS	S	ΔD	D	ΔI	I	ΔA	A
f/s											
1680	12·404	·0249	27·7547	41·98	18929·56	·0273	50·0080	·000476	·872778	36·65	8768·65
1690	12·536	·0247	27·7796	41·78	18971·54	·0268	50·0353	·000468	·873254	36·50	8805·30
1700	12·666	·0244	27·8043	41·60	19013·32	·0264	50·0621	·000461	·873722	36·35	8841·80
1710	12·801	·0242	27·8287	41·41	19054·92	·0260	50·0885	·000453	·874183	36·21	8878·15
1720	12·900	·0239	27·8529	41·23	19096·33	·0256	50·1145	·000446	·874636	36·07	8914·36
1730	13·059	·0237	27·8768	41·06	19137·56	·0252	50·1401	·000439	·875082	35·94	8950·43
1740	13·191	·0234	27·9005	40·90	19178·62	·0248	50·1653	·000432	·875521	35·81	8986·37
1750	13·318	·0232	27·9239	40·69	19219·52	·0244	50·1901	·000425	·875953	35·65	9022·18
1760	13·466	·0230	27·9471	40·53	19260·21	·0240	50·2145	·000419	·876378	35·53	9057·83
1770	13·591	·0227	27·9701	40·33	19300·74	·0236	50·2385	·000412	·876797	35·37	9093·36
1780	13·733	·0225	27·9928	40·19	19341·07	·0233	50·2621	·000406	·877209	35·26	9128·73
1790	13·862	·0223	28·0153	40·00	19381·26	·0229	50·2854	·000400	·877615	35·11	9163·99
1800	14·002	·0221	28·0376	39·81	19421·26	·0225	50·3083	·000393	·878015	34·96	9199·10
1810	14·149	·0219	28·0597	39·68	19461·07	·0222	50·3308	·000388	·878408	34·86	9234·06
1820	14·269	·0217	28·0816	39·51	19500·75	·0219	50·3530	·000382	·878796	34·73	9268·92
1830	14·414	·0214	28·1033	39·34	19540·26	·0216	50·3749	·000376	·879178	34·59	9303·65
1840	14·552	·0212	28·1247	39·17	19579·60	·0212	50·3965	·000370	·879554	34·46	9338·24
1850	14·696	·0210	28·1459	39·01	19618·77	·0209	50·4177	·000365	·879924	34·33	9372·70
1860	14·832	·0209	28·1669	38·90	19657·78	·0206	50·4386	·000360	·880289	34·25	9407·03
1870	14·949	·0207	28·1878	38·75	19696·68	·0203	50·4592	·000355	·880649	34·14	9441·28
1880	15·090	·0205	28·2085	38·61	19735·43	·0200	50·4795	·000350	·881004	34·02	9475·42
1890	15·224	·0203	28·2290	38·46	19774·04	·0198	50·4995	·000345	·881354	33·91	9509·44
1900	15·364	·0201	28·2493	38·32	19812·50	·0195	50·5193	·000340	·881699	33·80	9543·35
1910	15·496	·0199	28·2694	38·19	19850·82	·0192	50·5388	·000335	·882039	33·69	9577·15
1920	15·656	·0197	28·2893	38·01	19889·01	·0189	50·5580	·000330	·882374	33·55	9610·84
1930	15·809	·0196	28·3090	37·83	19927·02	·0186	50·5769	·000325	·882704	33·40	9644·39
1940	15·968	·0194	28·3286	37·66	19964·85	·0184	50·5955	·000320	·883029	33·26	9677·79
1950	16·127	·0192	28·3480	37·48	20002·51	·0181	50·6139	·000316	·883349	33·12	9711·05
1960	16·302	·0190	28·3672	37·26	20039·99	·0178	50·6320	·000311	·883665	32·94	9744·17
1970	16·484	·0187	28·3862	36·99	20077·25	·0175	50·6498	·000305	·883976	32·71	9777·11
1980	16·689	·0185	28·4049	36·73	20114·24	·0172	50·6673	·000300	·884281	32·48	9809·82
1990	16·888	·0183	28·4234	36·47	20150·97	·0169	50·6845	·000295	·884581	32·26	9842·30
2000	17·096	·0181	28·4417	36·21	20187·44	·0166	50·7014	·000290	·884876	32·05	9874·56
2010	17·305	·0178	28·4598	35·95	20223·65	·0163	50·7180	·000285	·885166	31·83	9906·61
2020	17·515	·0176	28·4776	35·65	20259·60	·0160	50·7343	·000280	·885451	31·57	9938·44
2030	17·752	·0174	28·4952	35·35	20295·25	·0158	50·7503	·000275	·885731	31·32	9970·01
2040	17·990	·0171	28·5126	35·06	20330·60	·0155	50·7661	·000270	·886006	31·07	10001·33
2050	18·229	·0169	28·5297	34·77	20365·66	·0152	50·7816	·000265	·886276	30·82	10032·40
2060	18·463	·0167	22·5466	34·49	20400·43	·0149	50·7968	·000260	·886541	30·58	10063·33
2070	18·706	·0165	28·5633	34·21	20434·92	·0147	50·8117	·000256	·886801	30·34	10093·80
2080	18·978	·0163	28·5798	33·93	20469·13	·0144	50·8264	·000251	·887057	30·10	10124·14
2090	19·227	·0160	28·5961	33·60	20503·06	·0141	50·8408	·000247	·887308	29·82	10154·24
2100	19·504	·0158	28·6121	33·34	20536·66	·0139	50·8549	·000242	·887555	29·59	10184·06
2110	19·755	·0156	28·6279	33·02	20570·00	·0136	50·8688	·000238	·887797	29·32	10213·65
2120	20·010	·0154	28·6435	32·76	20603·02	·0134	50·8824	·000234	·888035	29·10	10242·97
2130	20·294	·0152	28·6589	32·50	20635·78	·0132	50·8958	·000230	·888269	28·88	10272·07
2140	20·551	·0150	28·6741	32·25	20668·28	·0129	50·9090	·000226	·888499	28·66	10300·95
2150	20·811	·0149	28·6891	32·00	20700·53	·0127	50·9219	·000222	·888725	28·44	10329·61

In the calculation of Range Tables for *Direct Fire*, defined officially as "fire from guns with full charges at elevations not exceeding 15°," the vertical component of the resistance of the air may be ignored as insensible, and

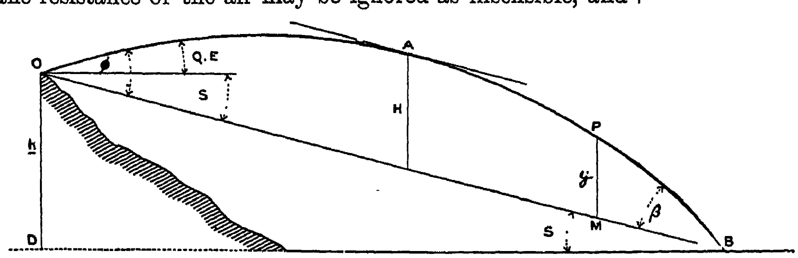


Fig. 1.

the actual velocity and its horizontal component, or component parallel to the line of sight, are undistinguishable.

The equations of motion are now, the co-ordinates x and y being measured in feet,

$$\frac{d^2x}{dt^2} = -r = -\frac{gp}{C}. \tag{23}$$

$$\frac{d^2y}{dt^2} = -g. \tag{24}$$

The first equation leads, as before, to

$$t = C\{T(V) - T(v)\}. \tag{25}$$

$$x = C\{S(V) - S(v)\}. \tag{26}$$

The integration of (24) gives

$$\frac{dy}{dt} = \text{constant} - gt = g(\tfrac{1}{2}T - t), \tag{27}$$

if T denotes the whole time of flight from O to the point B (Fig. 1), where the trajectory cuts the line of sight; so that $\frac{1}{2}$T is the time to the vertex A, where the shot is flying parallel to OB.

Integrating (27) again,

$$y = g(\tfrac{1}{2}Tt - \tfrac{1}{2}t^2) = \tfrac{1}{2}gt(T - t)\,; \tag{28}$$

and denoting T − t by t', and taking $g = 32f/s^2$,

$$y = 16tt', \tag{29}$$

Colonel Sladen's formula, employed in plotting ordinates of a trajectory.

At the vertex A, where $y = H$, we have $t = t' = \frac{1}{2}T$, so that

$$H = \tfrac{1}{8}gT^2, \tag{30}$$

which for practical purposes, taking $g = 32$, is replaced by

$$H = 4T^2, \text{ or } (2T)^2. \tag{31}$$

Thus if the time of flight of a shell is 5 seconds, the height of the vertex of the trajectory is about 100 feet; and if the fuse is set to burst the shell one-tenth of a second short of its impact at B, the height of the burst is 7·84, say 8 feet.

The line of sight Ox, considered horizontal in Range Table results, may be slightly inclined to the horizon, as in shooting up or down moderate slopes, without appreciable modification of (25) and (26), and y or PM is still drawn vertically to meet OB in M.

Given the ballistic coefficient C, the initial velocity V, and a range of R yards or X = 3R feet, the final velocity v is first calculated from (26) by

(32) $$S(v) = S(V) - \frac{X}{C},$$

and then the time of flight T by

(33) $$T = C\{T(V) - T(v)\}.$$

Denoting the angles of departure and descent, measured in degrees and from the line of sight OB, by ϕ and β, the total deviation in the range OB is (Fig. 1)

(34) $$\delta = \phi + \beta = C\{D(V) - D(v)\}.$$

To share the δ between ϕ and β, the vertex A is taken as the point of *half-time* (and therefore beyond *half-range*, because of the continual diminution of the velocity), and the velocity v_o at A is calculated from the formula

(35) $$T(v_o) = T(V) - \frac{\frac{1}{2}T}{C} = \tfrac{1}{2}\{T(V) + T(v)\};$$

and now the degree table gives

(36) $$\phi = C\{D(V) - D(v_o)\},$$

(37) $$\beta = C\{D(v_o) - D(v)\}.$$

This value of ϕ is the tangent elevation (T. E.); the quadrant elevation (Q. E.) is ϕ − S, where S is the angular depression of the line of sight OB; and if O is h feet vertical above B, the angle S in minutes at a range of R yards is given by

(38) $$\sin S = \frac{h}{3R}$$

or, for small angle, expressed in minutes,

(39) $$S = 1146\frac{h}{R}.$$

So also the angle β must be increased by S to obtain the angle at which the shot strikes a horizontal plane, the water, for instance.

The following is a specimen of the calculations required in the compilation of a Range Table for moderate ranges of Direct Fire:—a 6-inch gun has been selected, with increments of range of 500 yards, reaching up to 2000 yards; the intermediate hundreds of yards can be interpolated, and the results tabulated in the ordinary form of a Range Table (of which a short extract is given), in which vertical columns give the values of v, t, ϕ, β, &c., corresponding to every hundred yards of range. The discrepancies between the calculated and tabulated results will serve to show the influence of a slight change in the coefficient of reduction n and the muzzle velocity V.

The Abridged Ballistic Table has been employed, of which the extract given above covers the extent of velocity required; to avoid the trouble of proportional parts required for units of velocity with the Abridged Table, extended tables are given in Text-Books of Gunnery, but these are too long for insertion here.

A Slide Rule can be used for the computations, instead of four-figure logarithms, with ample accuracy for practical purposes.

Calculation of a Range Table for 6-inch Gun.

w=100 lb, d=6″, n=0·96, C=2·892, s=1500 ft.,

$\frac{s}{C}$ = ·518, V = 2150 f/s.

Range.	0	500 Yds.	1000 Yds.	1500 Yds.	2000 Yds.
$S(v)$	20700·53	20182·53	19664·53	19146·53	18628·53
v	2150	1999	1862	1732	1610
$T(v)$	28·6891	28·4399	28·1711	27·8815	27·5728
$\frac{t}{C}$		0·2492	0·5180	0·8076	1·1163
t		0·720	1·497	2·33	3·225
$D(v)$	50·9219	50·6997	50·4427	50·1451	49·8040
$\frac{\delta}{C} = \frac{\phi + \beta}{C}$		0·2222	0·4792	0·7768	1·1179
$\phi + \beta$		0·6425	1·384	2·243	3·234
$\frac{1}{2}\frac{t}{C}$		0·1246	0·2590	0·4038	0·5581
$T(v_o)$		28·5645	28·4301	28·2853	28·1310
v_o		2071	1994	1918	1843
$D(v_o)$		50·8132	50·6913	50·5542	50·4029
$\frac{\phi}{C}$		0·1087	0·2306	0·3677	0·5190
ϕ		0·3145	0·666	1·062	1·5
		0° 19′	0° 40′	1° 4′	1° 30′
β		0·3280	0·718	1·181	1·734
		0° 20′	0° 43′	1° 11′	1° 43′
[1] ϕ		0° 19′	0° 39′	1° 6′	1° 26′

[1] By Hadcock's Double-Entry Table.

Range Table for 6-inch Q.F. Guns, Marks I. to III.

Charge {weight, 13 lb 4 oz. / gravimetric density, $\frac{55·01}{0·504}$ / nature, cordite, size 30.

Projectiles {nature, Palliser shot, Shrapnel shell. / weight, 100 lb.

Muzzle velocity, 2154 f/s.
Nature of mounting, pedestal.
Jump, nil.

Remaining Velocity.	To strike an object 10 feet high range must be known within	Slope of Descent.	5 minutes' Elevation or Depression alters point of impact. Range.	5 minutes' Elevation or Depression alters point of impact. Laterally or Vertically.	ELEVATION.	RANGE.	FUSE scale for T. and P. middle No. 54 Marks I.,* II., or III.	50 per cent. of rounds should fall in Length.	50 per cent. of rounds should fall in Breadth.	50 per cent. of rounds should fall in Height.	Time of Flight.	Penetration into Wrought Iron.
f/s.	yards.	1 in	yards.	yards.	° ′	yards.		yards.	yards.	yards.	secs.	inches.
2122	1145	687	125	0·14	0 4	100	¼	...	0·4	...	0·16	13·4
2091	635	381	125	0·29	0 9	200	¾	...	0·4	..	0·31	13·2
2061	408	245	125	0·43	0 13	300	1	...	0·4	...	0·47	13·0
2032	316	190	125	0·58	0 17	400	1¼	...	0·4	..	0·62	12·8
2003	**260**	**156**	**125**	**0·72**	**0 21**	**500**	**1¾**	...	**0·5**	**0·2**	**0·78**	**12·6**
1974	211	127	125	0·87	0 26	600	2	...	0·5	0·2	0·95	12·4
1946	183	110	125	1·01	0 30	700	2¼	...	0·5	0·2	1·11	12·2
1909	163	98	125	1·16	0 34	800	2¾	...	0·5	0·2	1·28	12·0
1883	143	85	125	1·31	0 39	900	3	...	0·6	0·3	1·44	11·8
1857	**130**	**78**	**125**	**1·45**	**0 43**	**1000**	**3¼**	...	**0·6**	**0·3**	**1·61**	**11·6**
1830	118	71	125	1·60	0 47	1100	3¾	...	0·6	0·3	1·78	11·4
1803	110	66	125	1·74	0 51	1200	4	...	0·6	0·3	1·95	11·2
1776	101	61	125	1·89	0 55	1300	4½	...	0·7	0·4	2·12	11·0
1749	93	56	125	2·03	0 59	1400	4¾	...	0·7	0·4	2·30	10·8
1722	**86**	**52**	**125**	**2·18**	**1 3**	**1500**	**5**	...	**0·7**	**0·4**	**2·47**	**10·6**
1695	80	48	125	2·32	1 7	1600	5¼	25	0·8	0·5	2·65	10·5
1669	71	43	125	2·47	1 11	1700	5¾	25	0·9	0·5	2·84	10·3
1642	67	40	100	2·61	1 16	1800	6¼	25	1·0	0·5	3·03	10·1
1616	61	37	100	2·76	1 22	1900	6½	25	1·1	0·6	3·23	9·9
1591	**57**	**34**	**100**	**2·91**	**1 27**	**2000**	**7**	25	**1·2**	**0·6**	**3·41**	**9·7**

High Angle and Curved Fire.—"High Angle Fire," as defined officially, "is fire at elevations greater than 15°," and "Curved Fire is fire from howitzers at all angles of elevation not exceeding 15°." In these cases the curvature of the trajectory becomes considerable, and the methods employed in Direct Fire must be modified; the method generally employed is due to Colonel Siacci of the Italian Artillery.

Starting with the exact equations of motion in a resisting medium

$$(40) \qquad \frac{d^2x}{dt^2} = -r\cos i = -r\frac{dx}{ds},$$

$$(41) \qquad \frac{d^2y}{dt^2} = -r\sin i - g = -r\frac{dy}{ds} - g,$$

and eliminating r,

$$(42) \qquad \frac{dx}{dt}\frac{d^2y}{dt^2} - \frac{dy}{dt}\frac{d^2x}{dt^2} = -g\frac{dx}{dt};$$

and this, in conjunction with

$$(43) \qquad \tan i = \frac{dy}{dx} = \frac{dy}{dt}\Big/\frac{dx}{dt}.$$

$$(44) \qquad \sec^2 i\frac{di}{dt} = \left(\frac{dx}{dt}\frac{d^2y}{d^2t} - \frac{dy}{dt}\frac{d^2x}{dt^2}\right)\Big/\left(\frac{dx}{dt}\right)^2,$$

reduces to

$$(45) \qquad \frac{di}{dt} = -\frac{g}{v}\cos i, \text{ or } \frac{d\tan i}{dt} = -\frac{g}{v\cos i},$$

the equation obtained, as in (16), by resolving normally in the trajectory, but di now denoting the *increment* of i in the increment of time dt.

Denoting $\frac{dx}{dt}$, the horizontal component of the velocity, by q, so that

$$(46) \qquad v\cos i = q,$$

equation (40) becomes

$$(47) \qquad \frac{dq}{dt} = -r\cos i,$$

and therefore

$$(48) \qquad \frac{dq}{di} = \frac{dq}{dt}\frac{dt}{di} = \frac{rv}{g},$$

by reason of (45).

It is convenient to express p as a function of v in the notation

$$(49) \qquad p = f(v),$$

so that

$$(50) \qquad r = g\frac{f(v)}{C},$$

and now

$$(51) \qquad \frac{dq}{di} \text{ or } \frac{dv\cos i}{di} = \frac{vf(v)}{C},$$

an equation connecting $v = q\sec i$, or q and i.

Now

$$(52) \qquad \frac{dt}{dq} = -C\frac{\sec i}{gf(q\sec i)},$$

and multiplying by $\frac{dx}{dt}$ or q,

$$(53) \qquad \frac{dx}{dq} = -C\frac{q\sec i}{gf(q\sec i)},$$

and multiplying by $\frac{dy}{dx}$ or $\tan i$,

$$(54) \qquad \frac{dy}{dq} = -C\frac{q\sec i\tan i}{gf(q\sec i)};$$

also

$$(55) \qquad \frac{di}{dq} = C\frac{1}{q\sec i f(q\sec i)}$$

$$(56) \qquad \frac{d\tan i}{dq} = C\frac{\sec i}{qf(q\sec i)},$$

from which the values of t, x, y, i, and $\tan i$ are given by integration with respect to q, when $\sec i$ is given as a function of q by means of (48).

Now these integrations are quite intractable, even for very simple mathematical assumptions of the function $f(v)$, say the quadratic or cubic law, $f(v) = kv^2$, or kv^3.

But, as originally pointed out by Euler, the difficulties can be turned if we notice that in the ordinary trajectories of practice the quantities i, $\cos i$, and $\sec i$ vary so slowly that they may be replaced by their *mean* values η, $\cos\eta$, and $\sec\eta$; especially if the trajectory, when considerable, is divided up in the calculations into arcs of small curvature, the curvature of an arc being defined as the angle between the tangents or normals at the ends of the arc.

Replacing then the angle i on the right-hand side of equations (52)–(56) by some mean value η, we introduce Siacci's pseudo-velocity u defined by

$$(57) \qquad u = q\sec\eta,$$

so that u is a quasi-component parallel to the mean direction of the tangent, say the direction of the chord of the arc.

Integrating from any initial pseudo-velocity U,

$$(58) \qquad t = C\int_u^U \frac{du}{gf(u)},$$

$$(59) \qquad x = C\cos\eta\int\frac{u\,du}{gf(u)},$$

$$(60) \qquad y = C\sin\eta\int\frac{u\,du}{gf(u)};$$

and supposing the inclination i to change from ϕ to θ radians over the arc,

$$(61) \qquad \phi - \theta = C\cos\eta\int\frac{du}{uf(u)},$$

$$(62) \qquad \tan\phi - \tan\theta = C\sec\eta\int\frac{du}{uf(u)}.$$

But according to the definition of the functions T, S, I, and D of the Ballistic Table, employed for Direct Fire, with u written for v,

$$(63) \qquad \int_u^U\frac{du}{gf(u)} = \int\frac{du}{gp} = T(U) - T(u),$$

$$(64) \qquad \int\frac{u\,du}{gf(u)} = S(U) - S(u),$$

$$(65) \qquad \int\frac{du}{uf(u)} = I(U) - I(u);$$

and therefore

$$(66) \qquad t = C[T(U) - T(u)]$$

$$(67) \qquad x = C\cos\eta[S(U) - S(u)]$$

$$(68) \qquad y = C\sin\eta[S(U) - S(u)]$$

$$(69) \qquad \phi - \theta = C\cos\eta[I(U) - I(u)]$$

$$(70) \qquad \tan\phi - \tan\theta = C\sec\eta[I(U) - I(u)],$$

while, expressed in degrees,

$$(71) \qquad \phi^\circ - \theta^\circ = C\cos\eta[D(U) - D(u)].$$

These (66)–(71) are Siacci's equations, slightly modified by General Mayevski; and now in the numerical applications to High Angle Fire we can still employ the Ballistic Table for Direct Fire.

It will be noticed that η cannot be exactly the same mean angle in all these equations; but if η is the same in (67) and (68),

$$(72) \qquad \frac{y}{x} = \tan\eta,$$

so that η is the inclination of the chord of the arc of the trajectory, as in Niven's method of calculating trajectories (*Proc. R. S.*, 1877); but this method requires η to be known with accuracy, as 1% variation in η causes more than 1% variation in $\tan\eta$.

The difficulty is avoided by the use of Siacci's altitude-function A or A(u), by which y/x can be calculated without introducing $\sin\eta$ or $\tan\eta$, but in which η occurs only in the form $\cos\eta$ or $\sec\eta$, which varies very slowly for moderate values of η, so that η need not be calculated with any great regard for accuracy, the arithmetic mean $\frac{1}{2}(\phi + \theta)$ of ϕ and θ being near enough for η over any moderate arc $\phi - \theta$.

Now taking equation (70), and replacing $\tan\theta$, as a variable final tangent of an angle, by $\tan i$ or $\frac{dy}{dx}$,

$$(73) \qquad \tan\phi - \frac{dy}{dx} = C\sec\eta\Big[I(U) - I(u)\Big]$$

and integrating with respect to x over the arc considered,

$$(74) \qquad x\tan\phi - y = C\sec\eta\left[xI(U) - \int_0^x I(u)dx\right].$$

But

$$(75) \qquad \int_0^x I(u)dx = \int_U^u I(u)\frac{dx}{du}du$$
$$= C\cos\eta\int_u^U I(u)\frac{u\,du}{gf(u)}$$
$$= C\cos\eta[A(U) - A(u)]$$

in Siacci's notation; so that the altitude-function A must be calculated by summation from the finite differences,

(76) $$\Delta \mathrm{A} = \mathrm{I}(u)\frac{u\Delta u}{gp} = \mathrm{I}(u)\Delta \mathrm{S},$$

as shown already in the specimen computation of the Ballistic Table.

Dividing again by x, as given in (67),

(77) $$\tan\phi - \frac{y}{x} = \mathrm{C}\sec\eta\left[\mathrm{I}(\mathrm{U}) - \frac{\mathrm{A}(\mathrm{U}) - \mathrm{A}(u)}{\mathrm{S}(\mathrm{U}) - \mathrm{S}(u)}\right]$$

from which y/x can be calculated, and thence y.

In the application of Siacci's method to the calculation of a trajectory in High Angle Fire by successive arcs of small curvature, starting at the beginning of an arc at an angle ϕ with velocity v_ϕ, the curvature of the arc $\phi - \theta$ is first settled upon, and now

(78) $$\eta = \tfrac{1}{2}(\phi + \theta)$$

is a good first approximation for η.

Now calculate the pseudo-velocity u_ϕ from

(79) $$u_\phi = v_\phi \cos\phi \sec\eta,$$

and then, from the given values of ϕ and θ, calculate u_θ from either of the formulæ of (70) or (71),

(80) $$\mathrm{I}(u_\theta) = \mathrm{I}(u_\phi) - \frac{\tan\phi - \tan\theta}{\mathrm{C}\sec\eta}.$$

(81) $$\mathrm{D}(u_\theta) = \mathrm{D}(u_\phi) - \frac{\phi^\circ - \theta^\circ}{\mathrm{C}\cos\eta}.$$

Then with the suffix notation to denote the beginning and end of the arc $\phi - \theta$,

(82) $${}_\phi t_\theta = \mathrm{C}[\mathrm{T}(u_\phi) - \mathrm{T}(u_\theta)]$$

(83) $${}_\phi x_\theta = \mathrm{C}\cos\eta[\mathrm{S}(u_\phi) - \mathrm{S}(u_\theta)]$$

(84) $${}_\phi\left(\frac{y}{x}\right)_\theta = \tan\phi - \mathrm{C}\sec\eta\left[\mathrm{I}(u_\phi) - \frac{\Delta\mathrm{A}}{\Delta\mathrm{S}}\right],$$

Δ now denoting any finite tabular difference of the function between the initial and final (pseudo-) velocities.

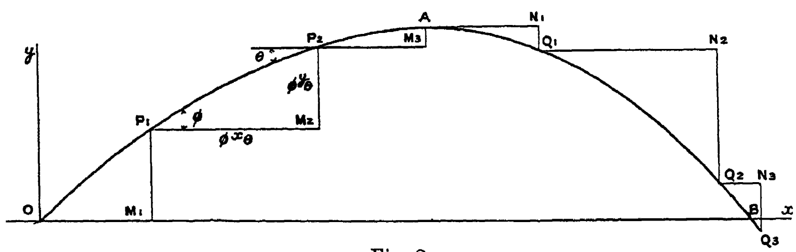


Fig. 2.

Also the velocity v_θ at the end of the arc is given by

(85) $$v_\theta = u_\theta \sec\theta \cos\eta.$$

Treating this final velocity v_θ and angle θ as the initial velocity v_ϕ and angle ϕ of the next arc, the calculation proceeds as before (Fig. 2).

In long range High Angle Fire the shot ascends to such a height that the correction for the tenuity of the air becomes important, and the curvature $\phi - \theta$ of an arc should be so chosen that ${}_\phi y_\theta$, the height ascended, should be limited to about 1000 feet, equivalent to a change of 1 inch in the barometer or 3 % in the tenuity-factor τ.

A convenient rule has been given by Captain James M. Ingalls, U.S.A., for approximating to a high angle trajectory in a single arc, which assumes that the mean density of the air may be taken as the density at two-thirds of the estimated height of the vertex; the rule is founded on the fact that in an unresisted parabolic trajectory the average height of the shot is two-thirds the height of the vertex, as illustrated in a jet of water, or in a stream of bullets from a Maxim gun.

The longest recorded range is that given in 1888 by the 9·2-inch gun to a shot weighing 380 ℔ fired with velocity 2375 f/s at elevation 40°; the range was about 12 miles, with a time for flight of about 64 seconds, shown in Fig. 2.

A calculation of this trajectory is given by Lieutenant A. H. Wolley-Dod, R.A., in the *Proceedings R.A. Institution*, 1888, employing Siacci's method and about twenty arcs; and Captain Ingalls, by assuming a mean tenuity-factor $\tau = 0{\cdot}68$, corresponding to a height of about 2 miles, on the estimate that the shot would reach a height of 3 miles, was able to obtain a very accurate result, working in a single arc over the whole trajectory (Ingalls, *Handbook of Ballistic Problems*).

Siacci's altitude-function is useful in Direct Fire, for giving immediately the angle of elevation ϕ required for a given range of R yards or X feet, between limits V and v of the velocity; also the angle of descent β.

In Direct Fire the pseudo-velocities U and u, and the real velocities V and v, are undistinguishable; so that, putting $y = 0$ in (77),

(86) $$\tan\phi = \mathrm{C}\sec\eta\left[\mathrm{I}(\mathrm{V}) - \frac{\Delta\mathrm{A}}{\Delta\mathrm{S}}\right],$$

in which $\sec\eta$ may be replaced by unity; or according to Siacci, $\sec\eta$ being replaced by $\sec^2\phi$,

(87) $$\sin 2\phi = 2\mathrm{C}\left[\mathrm{I}(\mathrm{V}) - \frac{\Delta\mathrm{A}}{\Delta\mathrm{S}}\right].$$

Also

(88) $$\tan\phi - \tan\beta = \mathrm{C}\sec\eta\,[\mathrm{I}(\mathrm{V}) - \mathrm{L}(u)]$$

in which $\sec\eta$ may be replaced by unity, so that

(89) $$\tan\beta = \mathrm{C}\left[\frac{\Delta\mathrm{A}}{\Delta\mathrm{S}} - \mathrm{I}(v)\right],$$

or, as Siacci writes it,

(90) $$\sin 2\beta = 2\mathrm{C}\left[\frac{\Delta\mathrm{A}}{\Delta\mathrm{S}} - \mathrm{I}(v)\right],$$

the two forms leading practically to the same value of β for moderate angles.

To simplify the work, so as to look out the value of $\sin 2\phi$ without the intermediate calculation of the remaining velocity v, a double-entry table has been devised by Captain Braccialini Scipione (*Problemi del Tiro*, Roma, 1883), and adapted to British units by Mr. A. G. Hadcock, late R.A., and published in the *Proc. R.A Institution*, 1898; and in *Gunnery Tables*, 1898.

In this table

(91) $$\sin 2\phi = \mathrm{C}a,$$

where a is a function tabulated for the two arguments, V the initial velocity, and $\frac{\mathrm{R}}{\mathrm{C}}$ the *reduced* range in yards.

The table is too long for insertion here, but the results for ϕ and β, as calculated for the Range Tables above, are given there for comparison.

After all care has been taken in laying and pointing, in accordance with the rules of theory and practice, absolute certainty of hitting the same spot every time is unattainable, as causes of error exist which cannot be eliminated, such as variations in the air and in the explosion of the powder charge, also in the steadiness of the shot in flight.

To obtain an estimate of the accuracy of a gun, as much actual practice as is available must be utilized, in accordance with the laws of Probability, for the calculation of the 50 per cent. zones shown in the Range Table; the article PROBABILITY must be consulted for the theory by which the percentage of hits to be expected on a given object at a known range is calculated, when the gun has been properly laid.

The Perforation of Armour.

The energy in foot-tons

(92) $$\mathrm{E} = \frac{wv^2}{2g \times 2240}$$

of a shot weighing w ℔, striking with velocity v f/s, on a target composed of iron or steel plates, or other resisting material, is used up in penetrating a certain thickness, p inches, against some unknown law of resistance of the material, as shown in the last column of the Range Table.

Empirical formulæ for the calculation of p, such as those of Fairbairn, Krupp, De Marre, Tressidder, and Gâvre, are constructed by putting

(93) $$p = k\frac{\mathrm{E}^q}{d^z}, \text{ or } \mathrm{K}\frac{w^x v^y}{d^z},$$

where d denotes the diameter of the shot, and then determining the best numbers for the indices x, y, z from experiments, plotted preferably on a logarithmic chart.

	Fair-bairn.	Krupp.	De Marre.	Tressid-der.	Gâvre.
x	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{5}{7}$
y	1	$\frac{3}{2}$	1	$\frac{3}{2}$	$\frac{10}{7}$
z	$\frac{1}{2}$	$\frac{5}{4}$	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{15}{14}$

Taking logarithmic differentials,

$$(94) \qquad \frac{\Delta p}{p} = x\frac{\Delta w}{w} + y\frac{\Delta v}{v} - z\frac{\Delta d}{d};$$

or expressed in popular language, 1 % increase in w, v, or d, varying one at a time, is such as to cause x, y, or $-z$ % increase in p; but little reliance can be placed on these formulæ for extrapolation beyond the limits of experiments for prediction of results to be expected.

For a full discussion of these empirical formulæ, and of the numerical values of the indices x, y, z, with numerous illustrations of actual practice, consult *Armour and its Attack by Artillery*, by Captain Orde Browne.

II. Interior Ballistics.

The investigation of the relations connecting the pressure, volume, and temperature of the powder gas inside the bore of the gun, of the work realized by the expansion of the powder, of the dynamics of the movement of the shot up the bore, and of the stress set up in the material of the gun, constitutes the branch of Interior Ballistics.

A gun may be considered a simple thermodynamic machine or heat engine which does its work in a single stroke, and does not act in a series of periodic cycles as an ordinary steam or gas engine.

An indicator diagram can be drawn for a gun (Fig. 3) as for a

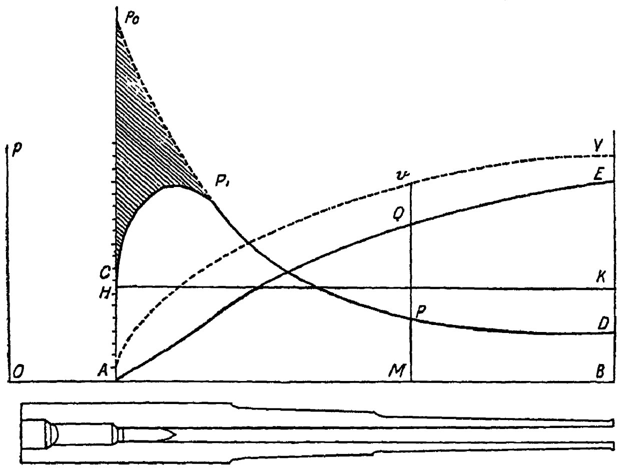


Fig. 3.

steam engine, representing graphically by a curve CPD the relation between the volume and pressure of the powder gas; and in addition the curves AQE of energy, AvV of velocity, and AtT of time can be plotted, or derived.

The velocity and energy at the muzzle B are denoted by V and E, and at any intermediate position M of the base of the shot by v and e.

After a certain discount due to friction in the bore and the energy of rotation and of recoil of the gun, the net work realized by the powder gas is represented by the area ACPM, and this is equated to the energy e of translation of the shot. The mean effective pressure (M.E.P.) in tons/inches², multiplied by $\frac{1}{4}\pi d^2$ the cross section of the bore in square inches, gives in tons the mean effective thrust X of the powder on the base of the shot; and, multiplied again by l, the length in feet of travel AM of the shot up the bore, gives the work realized in foot-tons; so that equating it to the muzzle energy

$$(1) \qquad E = \frac{wV^2}{2g \times 2240} \text{ (foot-tons)}$$

we deduce

$$(2) \qquad \text{M.E.P.} = \frac{wV^2}{2g \times 2240 \times \frac{1}{4}\pi d^2 l} \text{(tons/inches}^2\text{)}.$$

But the maximum pressure may exceed the mean in the ratio of 2 or 3 to 1, as shown in Figs. 4 and 5, representing graphically the results of Sir Andrew Noble's experiments with a 6-inch gun, capable of being lengthened to 100 calibres or 50 feet (*Proc. R.S.*, June 1894).

On the assumption of uniform pressure up the bore, practically realizable in a Zalinski pneumatic dynamite gun, the pressure curve would be a straight line parallel to AM; the energy curve AeE

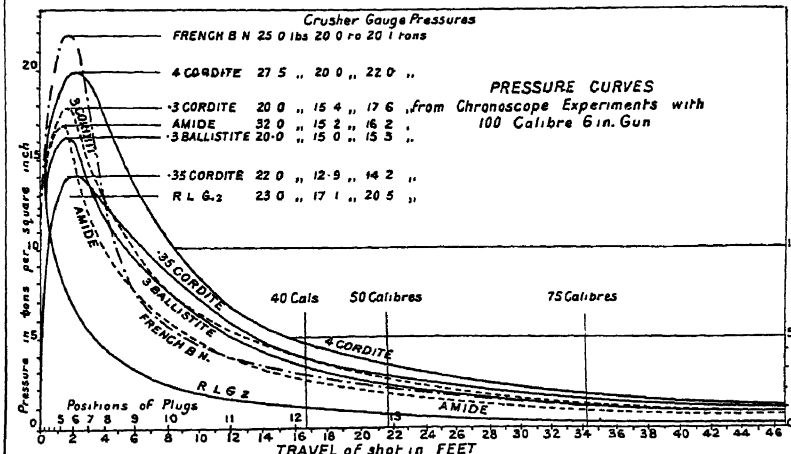


Fig. 4.

would be another straight line through A; the velocity curve AvV, of which the ordinates v are as the square roots of e, would be a parabola; and the acceleration of the shot being constant, the time curve AtT will also be a similar parabola.

If the pressure falls off uniformly, so that the pressure curve is a straight line CPD sloping downwards and cutting AM in F, then the energy curve will be a parabola curving downwards, and the velocity curve can be represented by an ellipse, or circle with centre F and radius FA; while the time curve will be a sinusoid.

But if the pressure curve is a straight line F′CP sloping upwards, cutting AM behind A in F′, the energy curve will be a parabola curving upwards, and the velocity curve a hyperbola with centre at F′.

These theorems may prove useful in preliminary calculations where the pressure curve is nearly straight; but, in the absence of any observable law, the area of the pressure curve must be read off by a planimeter, or, calculated by Simpson's rule, as an indicator diagram. To measure the pressure experimentally in the bore of a gun, the crusher gauge is used (Fig. 6); it records the maximum pressure by the compression of a copper cylinder in its interior; it may be placed in the powder chamber, or fastened in the base of the shot.

In Sir Andrew Noble's researches a number of plugs were inserted in the side of the experimental gun, reaching to the bore and carrying crusher gauges, and also chronographic appliances which registered the passage of the shot in the same manner as the electric screens in Bashforth's experiments; thence the velocity and energy of the shot was inferred, to serve as an independent control of the crusher gauge records (Figs. 4 and 5).

It was found that with modern explosives the crusher gauges

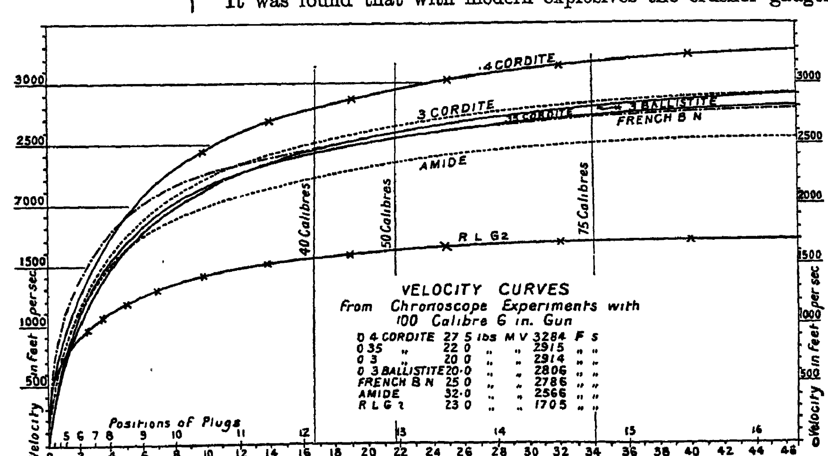


Fig. 5.

register a slightly higher pressure than the chronograph records, but a lower pressure with ordinary powder.

As a preliminary step to the determination of the pressure of

fired gunpowder in the bore of a gun, it is desirable to measure the pressure obtained by exploding charges of powder in a closed vessel, varying the weight of the charge, and thereby the density of the powder gas.

The earliest experiments of this nature are due to Benjamin Robins in 1743 and Count Rumford in 1792; and their methods have been revived by Dr Kellner, War Department chemist, who

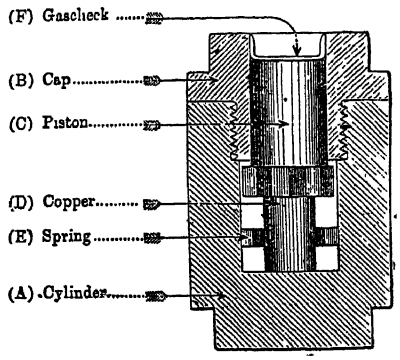


Fig. 6.

employed the steel spheres of bicycle ball bearings as safety-valves, loaded to register the pressure at which the powder gas will blow off, and thereby check the indications of the crusher gauge (*Proc. R.S.*, March 1895).

The Chevalier d'Arcy, 1760, also experimented on the pressure of powder and the velocity of the bullet in a musket barrel; this he accomplished by shortening the barrel successively, and measuring the velocity obtained by the ballistic pendulum; thus reversing Noble's procedure of gradually lengthening the gun.

But the most modern results employed with gunpowder are based on the experiments of Noble and Abel (*Phil. Trans.*, 1875–80–92–94).

Charges of powder, or other explosive, of varying weight P lb, were fired in an explosion chamber (Figs. 7, 8, and 9) of which the

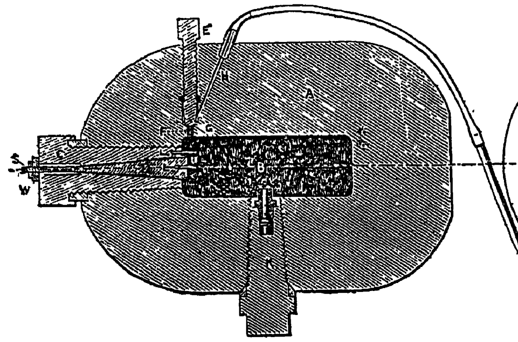


Fig. 7.

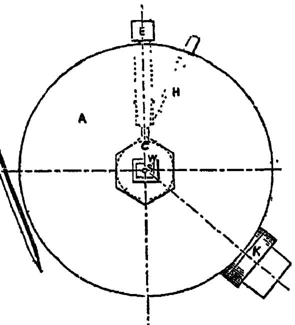


Fig. 8.

A, containing vessel of mild steel; B, charge; C, firing plug; D, conical plug; E, escape screw; F, channel of communication with charge chamber; G, mitred surface; H, passage for escape of gases when E is withdrawn; K, crusher apparatus for determining pressure; S, set screw; W, ebonite washer.

volume, C inches^3, is accurately known, and the pressure p tons/inches^2 was recorded by a crusher gauge.

The results are plotted in Figs. 10 and 11, in curves showing the relation between p and D the *gravimetric density*, which is the

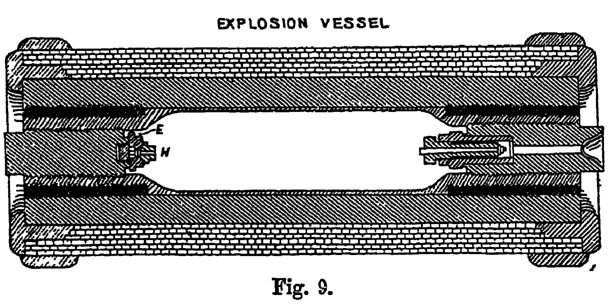


Fig. 9.

specific gravity of the P lb of powder when filling the volume C inches^3 in a state of gas; or between p and v, the reciprocal of D, which may be called the *gravimetric volume* (G. V.), being the ratio of the volume of the gas to the volume of an equal weight of water.

The results are also embodied in the following table:—

TABLE I.

G. D.	G. V.	Pressure in Tons/inches^2.	
		Pebble Powder	Cordite.
0·05	20·00	0·855	3·00
6	16·66	1·00	3·80
8	12·50	1·36	5·40
0·10	10·00	1·76	7·10
12	8·33	2·06	8·70
14	7·14	2·53	10·50
15	6·66	2·73	11·36
16	6·25	2·96	12·30
18	5·55	3·33	14·20
20	5·00	3·77	16·00
22	4·54	4·26	17·90
24	4·17	4·66	19·80
25	4·00	4·88	20·63
26	3·84	5·10	21·75
30	3·33	6·07	26·00
35	2·85	7·35	31·00
40	2·50	8·73	36·53
45	2·22	10·23	42·20
50	2·00	11·25	48·66
55	1·81	13·62	55·86
60	1·66	15·55	63·33
65	1·54	17·68	...
70	1·43	20·02	...
80	1·25	25·52	...
90	1·11	32·46	...
1·00	1·00	41·48	...

The term *gravimetric density* (G. D.) is peculiar to artillerists; it is required to distinguish between the specific gravity (S. G.) of the powder filling a given volume in a state of gas, and the specific gravity of the separate solid grains of powder.

Thus, for instance, a lump of solid lead of given S. G., when formed into a charge of lead shot composed of equal sphericles closely packed, will have a G. D. such that

(3) $$\frac{\text{G. D. of charge of lead shot}}{\text{S. G. of lump of solid lead}}=\frac{1}{6}\pi\sqrt{2}=0{\cdot}7403\,;$$

while in the case of a bundle of cylindrical sticks of cordite,

(4) $$\frac{\text{G. D. of charge of cordite}}{\text{S. G. of stick of cordite}}=\frac{1}{6}\pi\sqrt{3}=0{\cdot}9067.$$

At the standard temperature of 62° F. the volume of the gallon of 10 lb of water is 277·3 inches^3; or otherwise, 1 foot^3 or 1728 inches^3 of water at this temperature weighs 62·35 lb, and therefore 1 lb of water bulks $1728 \div 62{\cdot}35 = 27{\cdot}73$ inches^3.

Thus if a charge of P lb of powder is placed in a chamber of volume C inches^3, the

(5) $$\text{G. D.} = 27{\cdot}73\frac{\text{P}}{\text{C}}, \qquad \text{G. V.} = \frac{\text{C}}{27{\cdot}73\ \text{P}}.$$

Sometimes the factor 27·68 is employed, corresponding to a density of water of about 62·4 lb/foot^3, and a temperature 12° C., or 54° F.

With metric units, measuring P in kg., and C in litres or dm.^{3}, the G. D. = P/C, G. V. = C/P, no factor being required.

After the explosion of the powder charge P lb, it was found that

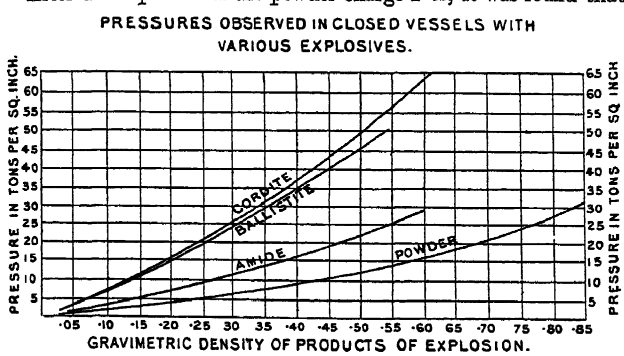


Fig. 10.

a fraction αP remained in a liquid state at S. G. unity, and therefore of volume 27·73 αP inches^3; and the remainder $(1-\alpha)$P lb was converted into a gas which filled the remaining

(6) $\quad$ C − 27·73 αP = C $(1-\alpha\text{D})$ inches^3 of the chamber;

so that the S. G. of the gas was

$$\text{(7)} \qquad \frac{27{\cdot}73\,(1-a)\mathrm{P}}{\mathrm{C}\,(1-a\mathrm{D})} = \frac{(1-a)\mathrm{D}}{1-a\mathrm{D}} = \frac{1-a}{v-a}.$$

On the assumption that the gas obeyed Boyle's law, and that the temperature of explosion was constant,

$$\text{(8)} \qquad \frac{p}{p_o} = \frac{(1-a)\mathrm{D}}{1-a\mathrm{D}} = \frac{1-a}{v-a},$$

where p_o denote the pressure when $\mathrm{D}=1$, $v=1$ and a may be called the *covolume*.

According to Noble and Abel's experiments, $p_o = 43$ tons/inches ^{2}, while the liquid residue was 57 °/ₒ of the charge, so that $a = 0{\cdot}57$; and this makes

$$\text{(9)} \qquad p = \frac{43 \times 0{\cdot}43\,\mathrm{D}}{1 - 0{\cdot}57\,\mathrm{D}} = \frac{18{\cdot}49}{v - 0{\cdot}57},$$

and the dotted line in Fig. 11 shows the theoretical curve of relation between p and v, calculated by this formula; the actual realized curve is seen to lie slightly below.

From the Table I., or by quadrature of the curve in Fig. 11, the work E in foot-tons realized by the expansion of 1 lb of the powder from one gravimetric volume to another is inferred; for if the average pressure is p tons/inches ^{2} while the gravimetric volume changes from $v - \frac{1}{2}\Delta v$ to $v + \frac{1}{2}\Delta v$, a change of volume of 27·73 Δv inches ^{3}, the work done is $27{\cdot}73\,p\,\Delta v$ inch-tons, or

$$\text{(10)} \qquad \Delta\mathrm{E} = 2{\cdot}31\,p\Delta v \text{ foot-tons};$$

and the differences $\Delta\mathrm{E}$ being calculated from the observed values of p, a summation, as in the Ballistic Tables, would give E, as tabulated in Table II.

Conversely from a table of E in terms of v, we can infer the value of p; for instance, as v changes from 4·9 to 5·1, so that $\Delta v = 0{\cdot}2$, then $\Delta\mathrm{E} = 1{\cdot}621$, making $p = 3{\cdot}5$ tons/inches ^{2}, agreeing closely with the experimental value in Table I.

TABLE II.

Work capable of being done by Exploding Gunpowder, in Expanding from Volume Unity with Unit Gravimetric Density.

(See Noble and Abel, "Researches on Explosives," *Phil. Trans. Roy. Soc.*, 29th May 1879.)

Number of Volumes.	Work in Foot-Tons.	Number of Volumes.	Work in Foot-Tons.	Number of Volumes.	Work in Foot-Tons.	Number of Volumes.	Work in Foot-Tons.	Number of Volumes.	Work in Foot-Tons.
1·00	0·000	**1·54**	33·681	**2·95**	68·568	**6·10**	99·282	**13·00**	127·036
1·01	0·980	**1·56**	34·500	**3·00**	69·347	**6·20**	99·915	**14·00**	129·602
1·02	1·936	**1·58**	35·301	**3·05**	70·109	**6·30**	100·536	**15·00**	131·970
1·03	2·870	**1·60**	36·086	**3·10**	70·854	**6·40**	101·145	**16·00**	134·168
1·04	3·782	**1·62**	36·855	**3·15**	71·585	**6·50**	101·744	**17·00**	136·218
1·05	4·647	**1·64**	37·608	**3·20**	72·301	**6·60**	102·333	**18·00**	138·138
1·06	5·547	**1·66**	38·346	**3·25**	73·002	**6·70**	102·912	**19·00**	139·944
1·07	6·399	**1·68**	39·069	**3·30**	73·690	**6·80**	103·480	**20·00**	141·647
1·08	7·234	**1·70**	39·778	**3·35**	74·365	**6·90**	104·038	**21 00**	143 258
1·09	8·051	**1·72**	40·474	**3·40**	75·027	**7·00**	104·586	**22·00**	144·788
1·10	8·852	**1·74**	41·156	**3·45**	75·677	**7·10**	105·125	**23·00**	146·242
1·11	9·637	**1·76**	41·827	**3·50**	76·315	**7·20**	105·655	**24·00**	147·629
1·12	10·406	**1·78**	42·486	**3·55**	76·940	**7·30**	106·176	**25·00**	148·960
1·13	11·160	**1·80**	43·133	**3·60**	77·553	**7·40**	106·688	**26·00**	150·232
1·14	11·899	**1·82**	43·769	**3·65**	78·156	**7·50**	107·192	**27·00**	151·452
1·15	12·625	**1·84**	44·394	**3·70**	78·749	**7·60**	107·688	**28·00**	152·622
1·16	13·338	**1 86**	45·009	**3·75**	79·332	**7·70**	108·177	**29·00**	153·743
1·17	14·038	**1·88**	45·614	**3·80**	79·905	**7·80**	108 659	**30·00**	154·819
1·18	14·725	**1·90**	46·209	**3·85**	80·469	**7·90**	109·133	**31·00**	155·857
1·19	15·400	**1·92**	46·795	**3·90**	81·024	**8·00**	109·600	**32·00**	156·856
1·20	16·063	**1·94**	47·372	**3·95**	81·570	**8·10**	110·060	**33 00**	157·824
1·21	16·716	**1·96**	47·940	**4·00**	82·107	**8·20**	110·514	**34·00**	158·771
1·22	17·359	**1·98**	48·499	**4·10**	83·157	**8·30**	110·962	**35·00**	159·678
1·23	17·992	**2·00**	49·050	**4·20**	84·176	**8·40**	111·404	**36 00**	160·556
1·24	18·614	**2·05**	50·383	**4·30**	85·166	**8·50**	111·840	**37·00**	161·411
1·25	19·226	**2·10**	51·673	**4·40**	86·128	**8·60**	112·270	**38·00**	162·241
1·26	19·828	**2·15**	52·922	**4·50**	87·064	**8·70**	112·695	**39·00**	163·046
1·27	20·420	**2·20**	54·132	**4·60**	87·975	**8·80**	113·114	**40·00**	163·828
1·28	21·001	**2·25**	55·304	**4·70**	88·861	**8·90**	113·528	**41·00**	164·8
1·29	21·572	**2·30**	56·439	**4·80**	89·724	**9·00**	113·937	**42·00**	165·7
1·30	22·133	**2·35**	57·539	**4·90**	90·565	**9·10**	114·341	**43·00**	166·3
1·32	23·246	**2·40**	58·605	**5·00**	91·385	**9·20**	114 739	**44·00**	167·0
1·34	24·324	**2·45**	59·639	**5·10**	92·186	**9·30**	115·133	**45·00**	167·6
1·36	25·371	**2·50**	60·642	**5·20**	92·968	**9·40**	115·521	**46·00**	168·3
1·38	26·389	**2·55**	61·616	**5·30**	93·732	**9·50**	115·905	**47·00**	169·0
1·40	27·380	**2·60**	62·563	**5·40**	94·479	**9·60**	116·284	**48·00**	169·6
1·42	28·348	**2·65**	63·486	**5·50**	95·210	**9·70**	116·659	**49·00**	170·3
1·44	29·291	**2·70**	64·385	**5·60**	95·925	**9·80**	117·029	**50·00**	171·0
1·46	30·211	**2·75**	65·262	**5·70**	96·625	**9·90**	117·395		
1·48	31·109	**2·80**	66·119	**5·80**	97·310	**10·00**	117·757		
1·50	31·986	**2·85**	66·955	**5·90**	97·981	**11·00**	121·165		
1·52	32·843	**2·90**	67·771	**6·00**	98·638	**12·00**	124·239		

On drawing off a little of the gas from the explosion vessel it was found that a gramme of powder gas (or cordite) at 0° C. and standard atmospheric pressure occupied 280 cm.^{3} (cordite 700 cm.^{3}), while the same gas compressed into 0·43 cm.^{3} at the temperature of explosion had a pressure of 43 tons/inches ^{2}, or $43 \times 2240 \div 14{\cdot}7 = 6552$ atmospheres, of 14·7 lb/inches ^{2}.

The absolute centigrade temperature T is thence inferred from the gas equation

$$\text{(11)} \qquad \mathrm{R} = \frac{pv}{\mathrm{T}} = \frac{p_o\,v_o}{273},$$

which, with $p = 6552$, $v = 0{\cdot}43$, $p_o = 1$, $v_o = 280$, makes $\mathrm{T} = 2748$, a temperature of 2475° C. or 4487° F.

If the powder charge exploded in the bore of a gun is supposed

PRESSURES IN CLOSED VESSELS OBSERVED AND CALCULATED

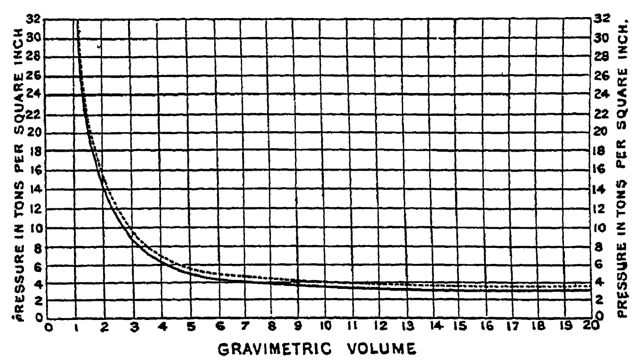


Fig. 11.

to expand according to the ordinary *adiabatic* law, then equation (8) must be changed to

$$\text{(12)} \qquad \frac{p}{p_o} = \left(\frac{1-a}{v-a}\right)^{\gamma},$$

where the index γ is the ratio $\mathrm{C}_p/\mathrm{C}_v$ of C_p the specific heat (S. H.) at constant pressure to C_v the S. H. at constant volume; and $\gamma = 1{\cdot}4$ on the average.

But, contrary to anticipation based on this adiabatic law, Noble and Abel found at an early stage of their researches that the pressure observed in a closed vessel as given theoretically at constant temperature by equation (9) did not differ greatly from the pressure in the bore of the gun itself as deduced from experiments; so that the pressure falls off much more slowly than according to the ordinary adiabatic law; and they came to the conclusion that this departure from expectation was due to the heat stored up in the liquid and solid residue.

Denoting then by β the ratio by weight of the non-gaseous to the gaseous products of the charge, and by λ the S. H. of the non-gaseous portion, supposed to be distributed in a finely divided state throughout the gas, the heat $d\mathrm{H}$ given out by the non-gaseous part during a small change of temperature $d\mathrm{T}$ is such that

$$\text{(13)} \qquad d\mathrm{H} = -\beta\lambda d\mathrm{T}.$$

The gaseous part obeys the gas-equation

$$\text{(14)} \qquad \mathrm{R} = \frac{p(v-a)}{\mathrm{T}} = \frac{p_o\,(1-a)}{\mathrm{T}_o};$$

so that

$$\text{(15)} \qquad \frac{d\mathrm{T}}{\mathrm{T}} = \frac{dp}{p} + \frac{dv}{v-a},$$

and

$$\text{(16)} \qquad \frac{d\mathrm{H}}{\mathrm{T}} = -\beta\lambda\left(\frac{dp}{p} + \frac{dv}{v-a}\right).$$

Supposing p and v to vary one at a time,

$$\text{(17)} \qquad d\mathrm{H} = \frac{\delta\mathrm{H}}{\delta p}dp + \frac{\delta\mathrm{H}}{\delta v}dv;$$

and p varying while v is constant,

$$\text{(18)} \qquad \frac{\delta\mathrm{H}}{\delta p} = \frac{\delta\mathrm{H}}{\delta\mathrm{T}}\frac{\delta\mathrm{T}}{\delta p} = \mathrm{C}_v\frac{v-a}{\mathrm{R}} = \mathrm{C}_v\frac{\mathrm{T}}{p};$$

and keeping p constant while v varies,

$$\text{(19)} \qquad \frac{\delta\mathrm{H}}{\delta v} = \frac{\delta\mathrm{H}}{\delta\mathrm{T}}\frac{\delta\mathrm{T}}{\delta v} = \mathrm{C}_p\frac{p}{\mathrm{R}} = \mathrm{C}_p\frac{\mathrm{T}}{v-a};$$

so that, in (17)

$$\text{(20)} \qquad \frac{d\mathrm{H}}{\mathrm{T}} = \mathrm{C}_v\frac{dp}{p} + \mathrm{C}_p\frac{dv}{v-a}$$

and equating the values of $d\mathrm{H}/\mathrm{T}$ in (16) and (20),

$$\text{(21)} \qquad (\mathrm{C}_v + \beta\lambda)\frac{dp}{p} + (\mathrm{C}_p + \beta\lambda)\frac{dv}{v-a} = 0.$$

Integrating

(22) $(C_v+\beta\lambda)\log p+(C_p+\beta\lambda)\log(v-\alpha)=\text{constant},$

or

(23) $$\frac{p}{p_o}=\left(\frac{1-\alpha}{v-\alpha}\right)^m$$

where

(24) $$m=\frac{C_p+\beta\lambda}{C_v+\beta\lambda}$$

reducing to the ordinary adiabatic law when $\beta=0$.

According to the experiments of Noble and Abel,

$$\alpha=0{\cdot}57,\ \beta=\frac{\alpha}{1-\alpha}=1{\cdot}3256,\ \lambda=0{\cdot}45,\ C_p=0{\cdot}2324,\ C_v=0{\cdot}1762,$$

making $m=1{\cdot}074$.

In metric units, the work done per gramme of powder in the expansion from unit G. D. or G. V. is

(25) $$\int_1^v pdv=p_o\int_1^v\left(\frac{1-\alpha}{v-\alpha}\right)^m dv$$
$$=\frac{p_o(1-\alpha)}{m-1}\left\{1-\left(\frac{1-\alpha}{v-\alpha}\right)^{m-1}\right\}$$
$$=\frac{p_o(1-\alpha)-p(v-\alpha)}{m-1}$$
$$=\frac{R}{m-1}(T_o-T).$$

In British units this must be multiplied by 2·31 to obtain E, the work in foot-tons per ℔ of powder; and with $p_o=43$ tons/inches².

(26) $$p=43\left(\frac{0{\cdot}43}{v-0{\cdot}57}\right)^{1{\cdot}074}.$$

(27) $$E=\frac{2{\cdot}31\times43\times0{\cdot}43}{0{\cdot}074}\left(1-\frac{T}{T_o}\right)$$
$$=577{\cdot}3\left(1-\frac{T}{T_o}\right),$$

so that 577·3 foot-tons is the total amount of work realizable from the infinite expansion from unit G. D. of 1 ℔ of gunpowder.

If Table II. is calculated from formula (27) the results are not very different from those obtained in the previous manner from the observed pressure in closed vessels. The table is carried up to $v=50$, and can easily be extended by means of formula (27).

In the employment of Table II. to calculate the muzzle energy and velocity to be expected from a given charge of P ℔ of powder, in expanding from the volume C inches³ of the chamber to the volume B inches³ of the bore, the initial and final gravimetric volumes (G. V.) are denoted by v_0 and v, such that

(28) $$v_o=\frac{C}{27{\cdot}73\,P},\quad v=\frac{B}{27{\cdot}73\,P};$$

these are calculated, and the difference $E(v)-E(v_o)$ of the corresponding values of E multiplied by the charge P gives the maximum realizable work in foot-tons.

In practice a *factor of effect f*, varying from 0·9 to 0·7, equivalent to a discount of 10 to 30 per cent., is required to obtain the actual net realized work stored up in the shot on leaving the muzzle.

Thus, for instance, in the 15-pounder B. L. gun, in which C=117, B=647 inches³, a charge of 4 ℔ of powder expands from $v_o=1{\cdot}054$ to $v=5{\cdot}83$, so that

(29) $E(v)-E(v_o)=97{\cdot}5113-5{\cdot}0232=92{\cdot}4881;$

and, with a factor of effect 0·7, the net muzzle energy is

(30) $0{\cdot}7\times4\times92{\cdot}4881=259$ foot-tons;

and if the shot weighs 15 ℔, this makes the muzzle velocity V = 1578 ℔.

Mr Longridge points out the necessity for some such reduction by a factor of effect f, by reason of the time occupied by the charge in combustion, during which the pressure rises to its maximum; the direct employment of Table II. assuming that the charge was consumed completely before the shot moved.

Fig. 3 shows the upper theoretical curve of pressure P_oP_1P, the area of which is tabulated in Table II.; the shaded portion represents in Longridge's theory the work to be deducted in consequence of the pressure rising gradually to a maximum p_1 along the curve CP_1, while the G. V. increases from v_o to v_1; and the actual work per ℔ of powder realized during combustion will be something less than

(31) $E_1=2{\cdot}31\,(v_1-v_o)\,p_1$ foot-tons.

The maximum pressure p_1 being supposed known, and its corresponding v_1, then during the subsequent expansion between the G.V.'s v_1 and v, the work done in foot-tons per ℔ of powder is given from Table II. by

(32) $E(v)-E(v_1).$

Suppose, for instance, that in the 15-pounder the maximum pressure is $p_1=11{\cdot}25$ tons/inches², corresponding to $v_1=2$, then

(33) $E_1=24{\cdot}6.$

(34) $E(v)-E(v_1)=48{\cdot}5,$

making the theoretical work something under 73 foot-tons per ℔; so that the factor of effect becomes about 0·9, to be accounted for by the friction in the bore and the energy of rotation.

With cordite the products of combustion are almost all gaseous, hence the absence of smoke; so that we may put $\alpha=0$, $\beta=0$ in formula (24); a good average value of m is found by experiment to be

(35) $m=1{\cdot}2;$

thence a table of the work in foot-tons per ℔ of cordite is easily calculated when the pressure p_1 tons/inches² corresponding to a given v_1 has been determined.

Thus the cordite charge of 15 oz. employed with the 15-pounder gun expands from $v_o=4{\cdot}45$ to $v=25$, and gives a muzzle velocity V = 1576 f/s to a shrapnel shell weighing 14 ℔ 1 oz.; so that the energy realized per ℔ of cordite is

(36) $$\frac{wV^2}{2g\times2240\,P}=258{\cdot}5\text{ foot-tons.}$$

If the maximum pressure $p_1=14$ tons/inches² is attained when $v_1=6$, then in accordance with Longridge's theory

(37) $E_1=2{\cdot}31\times1{\cdot}55\times14=50$ foot-tons,

and

(38) $$E(v)-E(v_1)=2{\cdot}31p_1\int_{v_1}^{v}\left(\frac{v_1}{v}\right)^m dv$$
$$=241\text{ foot-tons,}$$

making the realized work per ℔ of cordite something under 291 foot-tons; so that the factor of effect is about

(39) $f=0{\cdot}89.$

This factor f varies appreciably with the temperature, as conduction is very rapid in consequence of the small density and great heat of the cordite gas.

The discussion of the dynamical phenomena which take place in the bore during the progress of the shot is so complicated that much reliance is placed on empirical formulæ, resembling those employed for the perforation of armour plates.

Sarrau's Monomial Formula is much employed, giving the muzzle velocity

(40) $$V=HP^x w^y d^p D^q\left(\frac{B}{C}\right)^r,$$

where the symbols have their previous meaning, and H is a factor depending on the quality and structure of the powder; and this formula can, as before, be interpreted in popular language as equivalent to saying that 1 % change in P, w, d, D, B/C causes x, y, p, q, r % change in V.

In the old rule of Robins and Hutton, that the muzzle energy is proportional to the charge, ignoring the effect of calibre, density of loading, and number of expansions in the bore, we put

$$x=\tfrac{1}{2},\ y=-\tfrac{1}{2},\ p,\ q,\ r=0.$$

For quick powder, entirely consumed in the bore, Sarrau takes

(41) $x=\frac{3}{8},\ y=-\frac{1}{2},\ p=\frac{1}{4},\ q=\frac{1}{4},\ r=\frac{1}{8}.$

For slow powder, some of which is blown out of the muzzle unconsumed, he takes—

(42) $x=\frac{3}{8},\ y=-\frac{7}{16},\ p=\frac{1}{8},\ q=\frac{1}{4},\ r=\frac{3}{16}.$

These indices are readily determined by plotting a few experimental results on a logarithmic chart.

AUTHORITIES.—TARTAGLIA. *Nova Scientia.* 1537.—GALILEO. 1638.—ROBINS. *New Principles of Gunnery.* 1743.—EULER (translated by HUGH BROWN). *The True Principles of Gunnery.* 1777.—DIDION, HÉLIE, HUGONIOT, VALLIER, BAILLS, &c. *Balistique* (French).—SIACCI. *Balistica* (Italian).—MAYEVSKI, ZABUDSKI. *Balistique* (Russian).—LA LLAVE, OLLERO, MATA, &c. *Balistica* (Spanish).—BASHFORTH. *The Motion of Projectiles,* 1872. *The Bashforth Chronograph.* 1890.—INGALLS. *Exterior and Interior Ballistics, Handbook of Problems in Direct and Indirect Fire.*—BRUFF. *Ordnance and Gunnery.*—CRANZ. *Compendium de Ballistik.* 1898. *The Official Text-Book of Gunnery.*

(A. G. G.)

Gunpowder. See PROPELLANTS.

Guntur, a town of British India, in the Kistna district of Madras, a station on the branch of the Southern Mahratta Railway from Bellary to Bezwara. Population (1881), 19,646; (1891), 23,267; municipal income (1897–98), Rs.46,470. It is a centre for trade in grain and cotton, with five cotton-presses. The American Lutheran Mission supports a college. There are two high schools, two printing-presses, and two literary associations.

Gurdaspur, a town (with a population in 1891 of 5189) and district of British India, in the Lahore division of the Punjab. The District comprises an area of 1889 square miles. Population (1881), 823,965; (1891), 943,922, being 500 persons per square mile; (1901), 940,595, showing a slight decrease, compared with an increase of 15 per cent. in the previous decade. The land revenue and rates were Rs.16,56,082, the incidence of assessment being R.1–4–9 per acre; the number of police was 536; the cultivated area in 1896–97 was 812,760 acres, of which 210,375 were irrigated, including 37,101 from government canals; the number of schools in 1896–97 was 296, with 9968 pupils, the proportion of boys at school to the male population of school-going age being 12·2 per cent.; the registered death-rate in 1897 was 24·97 per 1000. There are seven printing-presses, issuing one English and one vernacular newspaper. A branch of the North-Western Railway runs for 48 miles through the district. There are 80 miles of navigable river, and 26 miles of metalled roads. The largest town is Batala. The sanitarium of Dalhousie, though situated in the native state of Chamba, is attached to Gurdaspur.

Gurgaon, a district of British India, in the Delhi division of the Punjab, comprising an area of 1984 square miles. Population (1881), 641,848; (1891), 668,929, being 337 persons per square mile; (1901), 745,877, showing an increase of 11 per cent. The land revenue and rates were Rs.13,71,138, the incidence of assessment being R.1–1–11 per acre; the number of police was 520; the cultivated area in 1896–97 was 817,975 acres, of which 217,421 were irrigated, including 92,085 from government canals; the number of schools in 1896–97 was 149, with 4834 pupils, the proportion of boys at school to the male population of school-going age being 9 per cent.; the registered death-rate in 1897 was 37·36 per 1000. There are two printing-presses, four factories for cleaning and pressing cotton, seventeen small indigo factories, and two saltpetre refineries. The largest town is Rewari. There are altogether 62 miles of railway, 30 miles of navigable river, and 79 miles of metalled roads. The district is also traversed by the Agra canal.

Guriev, or Guriev Gorodok, formerly Yaitskiy Gorodok, a district town of Russia, government of Uralsk, on the right bank of the Ural, 11 miles above its mouth, in a malarial neighbourhood. It has considerable fisheries, and is in steamer communication with Astrakhan; trade is carried on with the Kirghiz, especially at the fairs. Population, 9320.

Gurney, Edmund (1847–1888), English psychologist, was born at Hersham, near Walton-on-Thames, 23rd March 1847. He was educated at Blackheath and at Trinity College, Cambridge, where he took a high place in the classical tripos, and obtained a fellowship. His work for the schools was done, says his friend Mr Myers, "in the intervals of his practice on the piano." Dissatisfied with his own executive skill as a musician, he wrote *The Power of Sound* (1880), an essay on the philosophy of music. He then studied medicine with no intention of practising, devoting himself to physics, chemistry, and physiology. In 1880 he passed the second M.B. Cambridge examination in the science of the healing profession. These studies, and his great logical powers and patience in the investigation of evidence, he devoted to that outlying field of psychology which is called "Psychical Research." He asked whether, as universal tradition declares, there is an unexplored region of human faculty transcending the normal limitations of sensible knowledge. That there is such a region it was part of the system of Hegel to declare, and the subject had been metaphysically treated by Hartmann, Schopenhauer, Du Prel, Hamilton, and others, as the philosophy of the Unconscious, or Subconscious. But Gurney's purpose was to approach the subject by observation and experiment, especially in the hypnotic field, whereas vague and ill-attested anecdotes had hitherto been the staple of the evidence of metaphysicians. The tendency of his mind was to investigate whatever facts may give a colour of truth to the ancient belief in the persistence of the conscious human personality after the death of the body. Like Joseph Glanvil's, the natural bent of Gurney's mind was sceptical. Both thought the current and traditional reports of supernormal occurrences suggestive and worth investigating by the ordinary methods of scientific observation, and inquisition into evidence at first hand. But the method of Gurney was, of course, much more strict than that of the author of *Sadducismus Triumphatus,* and it included hypnotic and other experiments unknown to Glanvil. Mr Gurney began at what he later saw was the wrong end by studying, with Mr Myers, the "séances" of professed spiritualistic "mediums" (1874–78). Little but detection of imposture came of this, but an impression was left that the subject ought not to be abandoned. In 1882 the Society for Psychical Research was founded. (See Psychical Research.) Paid mediums were discarded, at least for the time, and experiments were made in "thought-transference" and hypnotism. Personal evidence as to uninduced hallucinations was also collected. The first results are embodied in the volumes of *Phantasms of the Living,* a vast collection (Podmore, Myers, and Gurney), and in Mr Gurney's remarkable essay, *Hallucinations.* The chief consequence was to furnish evidence for the process called "telepathy," involving the provisional hypothesis that one human mind can affect another through no recognized channel of sense. The fact was supposed to be established by the experiments chronicled in the *Proceedings of the Society for Psychical Research,* and it was argued that similar experiences occurred spontaneously, as, for example, in the many recorded instances of "deathbed wraiths" among civilized and savage races. (Tylor, *Primitive Culture,* i., chapter xi., especially pages 449–450, 1873. Lang, *Making of Religion,* pages 120–124, 1898.) The dying man is supposed to convey the hallucination of his presence as one living person experimentally conveys his thought to another, by "thought-transference." Mr Gurney's hypnotic experiments, marked by great exactness, patience, and ingenuity, were undertaken in 1885–88. Their tendency was, in Mr Myers's words, "to prove—so far as any one operator's experience in this protean subject can be held to prove anything—that there *is* sometimes, in the induction of hypnotic phenomena, some agency at work which is neither ordinary nervous stimulation (monotonous or sudden) nor suggestion conveyed by any ordinary channel to the subject's mind." These results, if accepted, of course corroborate the idea of telepathy. (See Gurney, "Hypnotism and Telepathy," *Proceedings S.P.R.,* vol. iv.) Experiments by MM. Gibert, Janet, Richet, Héricourt, and others are cited as tending in the same direction. Other experiments dealt with "the relation of the memory in the hypnotic state to the memory in another hypnotic state, and of both to the normal, or waking memory." All this work has been more appreciated by Continental than by British *savants.* The result of Mr Gurney's labours, cut short by his early and regretted death, has been to raise and strengthen the presumption that there exists an unexplored region of human faculty which ought not to be neglected by science as if the belief in it were a mere survival of savage superstition. Rather, it appears to have furnished

the experiences which, misinterpreted, are expressed in traditional beliefs. That Mr Gurney was credulous, and easily to be imposed upon, those who knew him, and knew his penetrating humour, cannot admit; nor is the theory likely to be maintained by those whom bias does not prevent from studying with care his writings. In controversy "he delighted in replying with easy courtesy to attacks envenomed with that *odium plus quam theologicum* which the very allusion to a ghost or the human soul seems in some philosophers to inspire." In discussion of themes unpopular and obscure Mr Gurney displayed the highest tact, patience, good temper, humour, and acuteness. There never was a more disinterested student. In addition to his work on music and his psychological writings, he was the author of *Tertium Quid* (1887), a collection of essays, on the whole a protest against one-sided ideas and methods of discussion. He died at Brighton on 23rd June 1888, from the effects of an overdose of narcotic medicine. (A. L.)

Gütersloh, a town of the province of Westphalia, Prussia, 11 miles S.W. from Bielefeld by the railway to Dortmund. It is the seat of silk and cotton industries, and has a trade in Westphalian hams and sausages. Printing, brewing, and distilling are also carried on. It is famous for its rye-bread (*pumpernickel*). Population (1900), 7100.

Guthrie, capital of Logan county, Oklahoma, U.S.A., and the capital of the territory, on the river Cottonwood and the Atchison, Topeka, and Santa Fé Railway, at an altitude of 939 feet. The city was founded in 1889, and one year later had a population of 2788. In 1900 the population (including what in 1890 was Guthrie, East Guthrie, and West Guthrie towns) had increased to 10,006, of whom 301 were foreign-born and 3036 negroes.

Gwalior, a native state of India, in the Central India Agency, with a total area of about 29,000 miles, and a population in 1881 of 2,951,014, and in 1891 of 3,366,496, giving an average density of 116 persons per square mile. In 1901 the population of the Gwalior Agency, which is not coextensive with the state of Gwalior, was returned as 2,149,958, showing an increase of 3 per cent. The gross revenue is about Rs.1,50,00,000 (say, one million sterling). In 1896–97 the land revenue yielded Rs.67,15,700, and Rs.38,80,323 was expended on the army. There was an accumulated balance of about Rs.10,00,00,000, of which more than half was invested. The number of schools was 261 (including two colleges and three high schools), attended by 13,772 pupils, of whom 1346 were learning English. The present Maharaja, Madhava Rao Sindhia, G.C.S.I., was born in 1877, and succeeded in 1886. During his minority the state was administered for eight years by a council of regency. He was entrusted with ruling powers in 1894, and has in all respects continued the reforming policy of the council, while paying personal attention to every department. A survey has been introduced for land revenue; large sums have been devoted to railways; active measures have been adopted for the suppression of *dakaiti*, or gang robbery—the scourge of Central India; and roads, bridges, hospitals, and schools have been built. The survey, under an English officer, shows that about one-third of the total area is cultivated, and that one-thirteenth of the cultivated area is irrigated. The assessment ranges from Rs.20 to Rs.50 per plough. The railways undertaken by the state are—(1) from Bina on the Indian Midland to Goona (74 miles); (2) an extension of this line to Bara (74 miles), opened in 1899; (3) from Bhopal to Ujain (114 miles); (4) two light railways, from Gwalior to Sipri and Gwalior to Bhind (total length, 127 miles), which were opened by the Viceroy in November 1899. On the same occasion the Viceroy opened the Victoria College, founded to commemorate the Diamond Jubilee; and the Memorial Hospital, built in memory of the Maharaja's father. The northern portion of the state suffered from famine in 1897, and the southern portion in 1900. British currency has been introduced instead of Chandori rupees, which were much depreciated. Two regiments of imperial service cavalry are maintained, and also a transport corps of ponies and carts, which did good service in the Chitral and Tirah campaigns. In 1900 the Maharaja equipped at his own cost a hospital ship for the China war, and himself accompanied it. The CITY OF GWALIOR is 76 miles by rail south of Agra. The population in 1881 was 88,066, in 1891 it was 104,083. It has a college with 400 students, a high school, a girls' school with 115 pupils, a service school to train officials, a law class, hospitals for men and for women, a museum, a palace, lighted by electricity, a paper-mill, and a printing-press, issuing a state gazette.

GYMNOSPERMS.

THE Gymnosperms form with the Angiosperms the great division of seed-bearing plants or Phanerogams. As the name implies, one characteristic is the absence of an ovary or closed chamber containing the ovules. These naked-seeded plants are of special interest on account of their great antiquity, which far exceeds that of other Flowering Plants, and as comprising different types which carry us back to the Palæozoic era and to the forests of the Coal Period. The best known and by far the largest division of the Gymnosperms is that of the cone-bearing trees (pines, firs, cedars, larches, &c.), which play a prominent part in the vegetation of the present day, especially in the higher latitudes of the northern hemisphere; certain members of this class are of considerable antiquity, but the Conifers as a whole are still vigorous, and show no signs of decadence. The division known as the Cycadales is represented by a few living genera of limited geographical range, and by a large number of extinct types which in the Mesozoic era (see PALÆOBOTANY, MESOZOIC) played a conspicuous part in the vegetation of the world. Palæobotanical evidence has rendered it probable that the Cycads sprang from a common ancestry with Ferns. Among the Cycadales we find surviving types which, in their present isolation, their close resemblance to fossil forms, and in certain morphological features, constitute links with the past that not only connect the present with former periods in the earth's history, but serve as sign-posts pointing the way back along one of the many lines which evolution has followed. The Cordaitales (see PALÆOBOTANY, PALÆOZOIC) are represented by extinct forms only, which occupied a prominent position in the Palæozoic period; these plants exhibit certain features in common with the living Araucarias, and others which invite a comparison with the Maidenhair tree (*Ginkgo biloba*), the solitary survivor of another class of Gymnosperms, the Ginkgoales (see PALÆOBOTANY, MESOZOIC). The Gnetales are a class apart, including three living genera, of which we know next to nothing as regards their past history or line of descent.

Gymnospermæ.—Trees or shrubs; leaves vary considerably in size and form. Flowers unisexual, except in a few cases (Gnetales) without a perianth. Monœcious or diœcious. Ovules naked, rarely without carpellary leaves, usually borne on carpophylls, which assume various forms. The single megaspore enclosed in the nucellus is filled with tissue (prothallus) before fertilization, and contains two or more archegonia, consisting usually of a large egg-cell and a small neck, rarely of an egg-cell only and no neck (*Gnetum* and *Welwitschia*). Microspore spherical or oval, with or without a bladder-like extension of the exine, containing a prothallus of two or more cells, one of which produces two non-motile or motile male cells. Cotyledons two or several. Secondary xylem and phloem produced by a single cambium, or by successive cambial zones; no true vessels (except in the Gnetales) in the wood, and no companion-cells in the phloem.

I. Cycadales.—A. *Cycadaceæ*, B. *Bennettitaceæ* (extinct).
II. Cordaitales (extinct).
III. Ginkgoales.—A single recent genus, *Ginkgo*.
IV. Coniferales.—A. *Taxaceæ*, B. *Pinaceæ*.
V. Gnetales.—A. *Ephedroideæ*, B. *Gnetoideæ*, C. *Welwitschioideæ*.

Cycadales.—A. *Cycadaceæ*.—Stems tuberous or columnar, not infrequently branched, fronds pinnate, bi-pinnate in the Australian genus *Bowenia*. Diœcious; flowers in the form of cones, except the female flowers of *Cycas*, which consist of a rosette of leaf-like carpels at the apex of the stem. Seeds albuminous, with one integument; the single embryo, usually bearing two partially fused cotyledons, is attached to a long tangled suspensor. Stems and roots increase in diameter by secondary thickening, the secondary wood being produced by one cambium or developed from successive cambium-rings.

The Cycads constitute a homogeneous group of a few living members confined to tropical and sub-tropical regions. As a fairly typical and well known example of the Cycadaceæ, a species of the genus *Cycas* (e.g., *C. circinalis*, *C. revoluta*, &c.) is briefly described. The stout columnar stem (see *Ency. Brit.*, vol. iv., Plate 15) may reach a height of 20 metres, and a diameter of half a metre; it remains either unbranched or divides near the summit into several short and thick branches, each branch terminating in a crown of long pinnate leaves. The surface of the stem is covered with rhomboidal areas, which represent the persistent bases of foliage- and scale-leaves. In some species of *Cycas* there is a well-defined alternation of transverse zones on the stem, consisting of larger areas representing foliage-leaf bases, and similar but smaller areas formed by the bases of scale-leaves (*F* and *S*. Fig. 1). The scale-leaves clothing the terminal bud are linear-lanceolate in form, and of a brown or yellow colour; they are pushed aside as the stem-axis elongates, and become shrivelled, finally falling off, leaving projecting bases which are eventually cut off at a still lower level. Similarly, the dead fronds fall off, leaving a ragged petiole, which is afterwards separated from the stem by an absciss-layer a short distance above the base. In some species of *Cycas* the leaf-bases do not persist as a permanent covering to the stem, but the surface is covered with a wrinkled bark, as in *Cycas Siamensis*, which has a stem of unusual form (Fig. 2). Small tuberous shoots, comparable on a large scale with the bulbils of *Lycopodium Selago*, are occasionally produced in the axils of some of the persistent leaf-bases; these are characteristic of sickly plants, and serve as a means of vegetative reproduction. In the genus *Cycas* the female flower is peculiar among Cycads in consisting of a terminal crown of separate leaf-like carpels several inches in length; the apical portion of each carpellary leaf may be broadly triangular in form, and deeply dissected on the margins into narrow woolly appendages like rudimentary pinnæ. From the lower part of a carpel are produced several laterally placed ovules, which become bright red or orange on ripening; the bright fleshy seeds, which in some species are as large as a goose's egg, and the tawny spreading carpels produce a pleasing combination of colour in the midst of the long dark green fronds, which curve gracefully upwards and outwards from the summit of the columnar stem. In *Cycas* the stem-apex, after producing a cluster of carpellary leaves, continues to elongate, and produces more bud-scales, which are afterwards pushed aside as a fresh crown of fronds is developed. The young leaves of *Cycas* consist of a straight rachis bearing numerous linear pinnæ, traversed by a single midrib; the pinnæ are circinately coiled like the leaf of a fern (Fig. 3). The male flower of *Cycas* conforms to the type of structure characteristic of the *Cycads*, and consists of a long cone of numerous sporophylls bearing many oval pollen-sacs on their lower faces. The type described serves as a convenient representative of its class. There are eight other living genera, which may be classified as follows:—

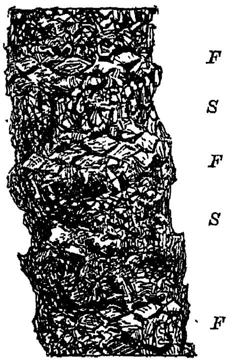


Fig. 1.—Stem of *Cycas*. *F*, foliage-leaf bases; *S*, scale-leaf bases.

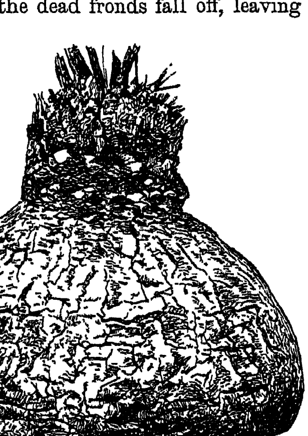


Fig. 2.—*Cycas Siamensis*.

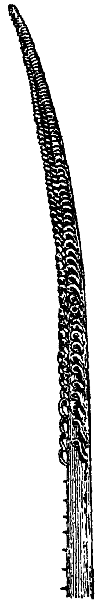


Fig. 3.—*Cycas*: young frond.

Classification.—A. *Cycadeæ*.—Characterized by (*a*) the alternation of scale- and foliage-leaves (Fig. 1) on the branched or unbranched stem; (*b*) the growth of the main stem through the female flower; (*c*) the presence of a prominent single vein in the linear pinnæ; (*d*) the structure of the female flower, which is peculiar in not having the form of a cone, but consists of numerous independent carpels, each of which bears two or more lateral ovules. Represented by a single genus, *Cycas*. (Tropical Asia, Australia, &c.)

B. *Zamieæ*.—The stem does not grow through the female flower; both male and female flowers are in the form of cones. (a) *Stangerieæ*.—Characterized by the fern-like venation of the pinnæ, which have a prominent midrib, giving off at a wide angle simple or forked and occasionally anastomosing lateral veins. A single genus, *Stangeria*, confined to South Africa. (b) *Euzamieæ*.—The pinnæ are traversed by several parallel veins. *Bowenia*, an Australian Cycad, is peculiar in having bi-pinnate fronds (Fig. 5). The various genera are distinguished from one another by the shape and manner of attachment of the pinnæ, the form of the carpellary scales, and to some extent by anatomical characters. *Encephalartos* (South Africa).—Large cones; the carpellary scales terminate in a peltate distal expansion. *Macrozamia* (Australia).—Similar to *Encephalartos*, except in the presence of a spinous projection from the swollen distal end of the carpels. *Zamia* (South America, Florida, &c.).—Stem short and often divided into several columnar branches. Each carpel terminates in a peltate head. *Ceratozamia* (Mexico).—Similar in habit to *Macrozamia*, but distinguished by the presence of two horn-like spinous processes on the apex of the carpels. *Microcycas* (Cuba).—Like *Zamia*, except that the ends of the stamens are flat, while the apices of the carpels are peltate. *Dioon* (Mexico).—Characterized by the woolly scale-leaves and carpels; the latter terminate in a thick laminar expansion of triangular form, bearing two placental cushions, on which the ovules are situated. *Bowenia* (Australia).—Bi-pinnate fronds; stem short and tuberous (Fig. 5).

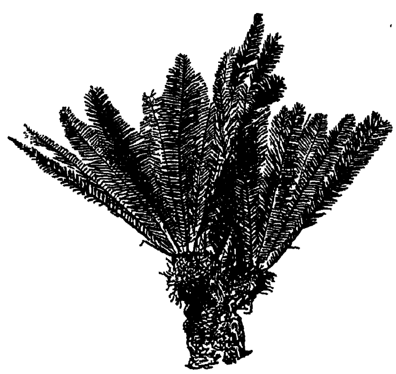


Fig. 4.—*Dioon edule*. (From a photograph of a plant in the Peradeniya Gardens, Ceylon, by R. H. Yapp.)

Stem and Leaf.

The stems of Cycads are often described as unbranched; it is true that in comparison with Conifers, in which the numerous branches, springing from the main stem, give a characteristic form to the tree, the tuberous or columnar stem of the Cycadaceæ constitutes a striking distinguishing feature. Branching, however, occurs not infrequently; in *Cycas* the tall stem often produces several candelabra-like arms; in *Zamia* the main axis may break up near the base into several cylindrical branches; in species of *Dioon* (Fig. 4), *Encephalartos*, &c., lateral branches are occasionally produced. The thick armour of petiole-bases enveloping the stem is a characteristic Cycadean feature; in *Cycas* the alternation of scale-leaves and fronds is more clearly shown than in other Cycads; in *Encephalartos*, *Dioon*, &c., the persistent scale-leaf bases are almost equal in size to those of

the foliage-leaves, and there is no regular alternation of zones such as characterizes some species of *Cycas*. Another type of stem is illustrated by *Stangeria* and *Zamia*, also by a few forms of *Cycas* (Fig. 2), in which the fronds fall off completely, leaving a comparatively smooth stem. The *Cycas* type of frond, except as regards the presence of a midrib in each pinna, characterizes the Cycads generally, except *Bowenia* and *Stangeria*. In the monotypic genus *Bowenia* the large fronds, borne singly on the short and thick stem, are bi-pinnate (Fig. 5); the segments, which are

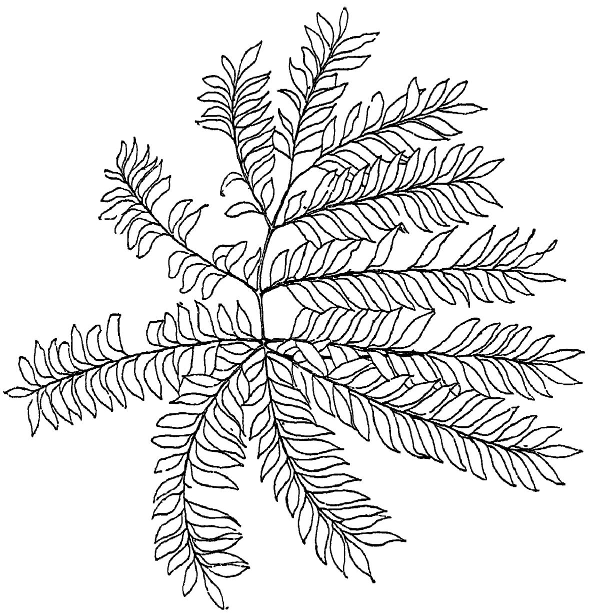


FIG. 5.—*Bowenia spectabilis*: frond.

broadly ovate or rhomboidal, have several forked spreading veins, and resemble the large pinnules of some species of *Adiantum*. In *Stangeria*, also a genus represented by one species (*S. paradoxa* of South Africa), the long and comparatively broad pinnæ, with an entire or irregularly incised margin, are very fern-like, a circumstance which led Kunze to describe the plant in 1835 as a species of the fern *Lomaria*. In rare cases the pinnæ of Cycads are lobed or branched: in *Dioon spinulosum* (Central America) the margin of the segments bears numerous spinous processes; in some species of *Encephalartos*, e.g., *E. horridus*, the lamina is deeply lobed; and in a species of the Australian genus *Macrozamia*, *M. heteromera*, the narrow pinnæ are dichotomously branched almost to the base (Fig. 6), and resemble the frond of some species of the fern *Schizæa*, or the fossil genus *Baiera* (Ginkgoales). In *Ceratozamia* the broad petiole-base is characterized by the presence of two lateral spinous processes, suggesting stipular appendages, comparable, on a reduced scale, with the large stipules of the Marattiaceæ among Ferns. The vernation varies in different genera; in *Cycas* the rachis is straight and the pinnæ circinately coiled (Fig. 3); in *Encephalartos*, *Dioon*, &c., both rachis and segments are straight; in *Zamia* the rachis is bent or slightly coiled, bearing straight pinnæ. The young leaves arise on the stem-apex as conical protuberances with winged borders, on which the pinnæ appear as rounded humps, usually in basipetal order; the scale-leaves in their young condition resemble fronds, but the lamina remains undeveloped. A feature of interest in connexion with the phylogeny of Cycads is the presence of long hairs clothing the scale-leaves, and forming a cap on the summit of the stem apex or attached to the bases of petioles; on some fossil cycadean plants these outgrowths have the form of scales, and are identical in structure with the ramenta (paleæ) of the majority of ferns.

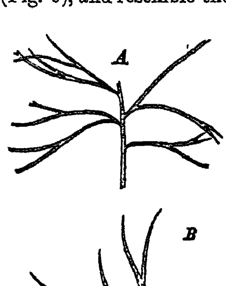


FIG. 6.—*Macrozamia heteromera*. *A*, part of frond; *B*, single pinna.

Flower.

The male flowers of Cycads are constructed on a uniform plan, and in all cases consist of an axis bearing crowded, spirally disposed sporophylls. These are often wedge-shaped and angular; in some cases they consist of a short, thick stalk, terminating in a peltate expansion, or prolonged upwards in the form of a triangular lamina. (See *Ency. Brit.*, vol. iv., Plate 15.) The sporangia (pollen-sacs), which occur on the under-side of the stamens, are often arranged in more or less definite groups or sori, interspersed with hairs (paraphyses); dehiscence takes place along a line marked out by the occurrence of smaller and thinner-walled cells bounded by larger and thicker-walled elements, which form a fairly prominent cap-like "annulus" near the apex of the sporangium, not unlike the annulus characteristic of the Schizæaceæ among Ferns. The sporangial wall, consisting of several layers of cells, encloses a cavity containing numerous oval spores (pollen-grains). In structure a cycadean sporangium recalls those of certain ferns (Marattiaceæ, Osmundaceæ, and Schizæaceæ), but in the development of the spores there are certain peculiarities not met with among the Vascular Cryptogams. With the exception of *Cycas*, the female flowers are also in the form of cones, bearing numerous carpellary scales. In *Cycas revoluta* and *C. circinalis* each leaf-like carpel may produce several laterally attached ovules, but in *C. Normanbyana* the carpel is shorter and the ovules are reduced to two; this latter type brings us nearer to the carpels of *Dioon*, in which the flower has the form of a cone, and the distal end of the carpels is longer and more leaf-like than in the other genera of the Zamieæ, which are characterized by shorter carpels with thick peltate heads bearing two ovules on the morphologically lower surface. The cones of Cycads attain in some cases (e.g., *Encephalartos*) a considerable size, reaching a length of more than a foot.

Micro-spores and mega-spores.

The pollen-grains when mature consist of three cells, two small and one large cell; the latter grows into the pollen-tube, as in the Coniferales, and from one of the small cells two large ciliated spermatozoids are eventually produced. One of the most important botanical discoveries made during the latter part of the 19th century was that by Ikeno, a Japanese botanist, who was the first to demonstrate the existence of motile male-cells in the genus *Cycas*. Similar spermatozoids have been observed also in some species of *Zamia* by Webber, an American botanist, and Lang has found traces of ciliated cells in *Stangeria*. Before following the growth of the pollen-grain after pollination, we will briefly describe the structure of a cycadean ovule. An ovule consists of a conical nucellus surrounded by a single integument. At an early stage of development a large cell makes its appearance in the central region of the nucellus; this increases in size and eventually forms three cells; the lowest of these grows vigorously and constitutes the megaspore (embryo-sac), which ultimately absorbs the greater part of the nucellus. The megaspore-nucleus divides repeatedly, and cells are produced from the peripheral region inwards, which eventually fill the spore-cavity with a homogeneous tissue (prothallus); some of the superficial cells at the micropylar end of the megaspore increase in size and divide by a tangential wall into two, an upper cell which gives rise to the short two-celled neck of the archegonia, and a

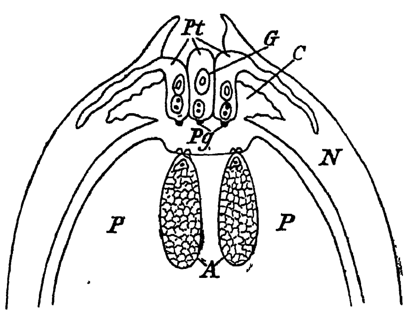


FIG. 7.—*Zamia*: part of ovule in longitudinal section. *P*, prothallus; *A*, archegonia; *N*, nucellus; *C*, pollen-chamber; *Pt*, pollen-tube; *Pg*, pollen-grain; *G*, generative cell (second cell of pollen-tube). (After Webber.)

lower cell which develops into a large egg-cell. Each megaspore may contain 2 to 6 archegonia. During the growth of the ovum nourishment is supplied from the contents of the cells immediately surrounding the egg-cell, as in the development of the ovum of *Pinus* and other Conifers. Meanwhile the tissue in the apical region of the nucellus has been undergoing disorganization, which results in the formation of a large space or pollen-chamber (Fig. 7, *C*), situated immediately above the megaspore. The pollen-grains find their way between the carpophylls, which at the time of pollination are slightly apart owing to the elongation of the internodes of the flower-axis, and pass into the pollen-chamber; the large cell of the pollen-grain grows out into a tube (*Pt*), which penetrates the nucellar tissue and often branches repeatedly; the pollen-grain itself, with the prothallus-cells, projects freely into the pollen-chamber (Fig. 7). The nucleus of the outermost (second) small cell (Fig. 7, *G*) divides, and one of the daughter-nuclei passes out of the cell, and may enter the lowest (first) small cell. The outermost cell, by the division of the remaining nucleus, produces two large spermatozoids (Fig. 8, *a*, *a*). In the course of this division two bodies make their appearance in the cytoplasm, and behave as centrosomes during the karyokinesis; they gradually become thread-like and coil themselves round each daughter nucleus. (See CYTOLOGY, VEGETABLE.) This thread gives rise to a spiral ciliated band lying in a depression on the body of each sper-

matozoid, which ends posteriorly in a short tail formed of cytoplasm; the spermatozoids eventually escape from the pollen-tube, and are able to perform ciliary movements in the watery liquid which occurs between the thin papery remnant of nucellar tissue and the archegonial necks. Before fertilization a neck-canal cell is formed by the division of the ovum-nucleus. After the body of a spermatozoid has coalesced with the egg-nucleus the latter divides repeatedly and forms a mass of tissue which grows more vigorously in the lower part of the fertilized ovum, and extends upwards towards the apex of the ovum as a peripheral layer of parenchyma surrounding a central space. By further growth this tissue gives rise to a proembryo, which consists, at the micropylar end, of a sac; the tissue at the chalazal end grows into a long and tangled suspensor, terminating in a mass of cells, which is eventually differentiated into a radicle, plumule, and two cotyledons. In the ripe seed the integument assumes the form of a fleshy envelope, succeeded internally by a hard woody shell, internal to which is a thin papery membrane—the apical portion of the nucellus—which is easily dissected out as a conical cap covering the apex of the endosperm. A central depression occurs in the apex of the endosperm, in which may be seen the remains of additional archegonia. The first leaves borne on the seedling axis are often scale-like, and these are followed by two or more larger laminæ, which foreshadow the pinnæ of the adult frond.

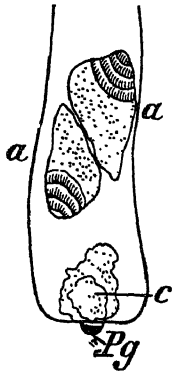


FIG. 8.—*Zamia*: proximal end of pollen-tube. *a*, *a*, spermatozoids from *G* of Fig. 7; *Pg*, pollen-grain; *c*, proximal cell (first cell). (After Webber.)

The anatomical structure of the vegetative organs of recent Cycads is of special interest as affording important evidence of relationship with extinct types, and with other groups of recent plants.

Anatomy.

Brongniart, who was the first to investigate in detail the anatomy of a cycadean stem, recognized an agreement, as regards the secondary wood, with Dicotyledons and Gymnosperms, rather than with Monocotyledons. He drew attention also to certain structural similarities between *Cycas* and *Ginkgo*. The main anatomical features of a cycad stem may be summarized as follows: The centre is occupied by a large parenchymatous pith traversed by numerous secretory canals, and in some genera by cauline vascular bundles (e.g., *Encephalartos* and *Macrozamia*). In addition to these cauline strands (confined to the stem and not connected with the leaves), collateral bundles are often met with in the pith, which form the vascular supply of terminal flowers borne at intervals on the apex of the stem. These latter bundles may be seen in sections of old stems to pursue a more or less horizontal course, passing outwards through the main woody cylinder. This lateral course is due to the more vigorous growth of the lateral vegetative branch formed near the base of each flower, which is a terminal structure, and, except in the female flower of *Cycas*, puts a limit to the apical growth of the stem. The vigorous lateral branch therefore continues the line of the main axis. The pith is encircled by a cylinder of secondary wood, consisting of single or multiple radial rows of tracheids separated by broad medullary rays composed of large parenchymatous cells; the tracheids bear numerous bordered pits on the radial walls. The large medullary rays give to the wood a characteristic parenchymatous or lax appearance, which is in marked contrast to the more compact wood of a conifer. The protoxylem-elements are situated at the extreme inner edge of the secondary wood, and may occur as small groups of narrow, spirally-pitted elements scattered among the parenchyma which abuts on the main mass of wood. Short and reticulately-pitted tracheal cells, similar to tracheids, often occur in the circummedullary region of cycadean stems. In an old stem of *Cycas*, *Encephalartos*, or *Macrozamia* the secondary wood consists of several rather unevenly concentric zones, while in some other genera it forms a continuous mass as in Conifers and normal Dicotyledons. These concentric rings of secondary xylem and phloem (Fig. 9) afford a characteristic cycadean feature. After the cambium has been active for some time producing secondary xylem and phloem, the latter consisting of sieve-tubes, phloem-parenchyma, and frequently thick-walled fibres, a second cambium is developed in the pericycle; this produces a second vascular zone, which is in turn followed by a third cambium, and so on, until several hollow cylinders are developed. It has been recently shown that several cambium-zones may remain in a state of activity, so that the formation of a new cambium does not necessarily mark a cessation of growth in the more internal meristematic rings. It occasionally happens that groups of xylem and phloem are developed internally to some of the vascular rings; these are characterized by an inverse orientation of the tissues, the xylem being centrifugal and the phloem centripetal in its development. The broad cortical region, which contains many secretory canals, is traversed by numerous vascular bundles (Fig. 9, *c*), some of which pursue a more or less vertical course, and by frequent anastomoses with one another form a loose reticulum of vascular strands; others are leaf-traces on their way from the stele of the stem to the leaves. Most of these cortical bundles are collateral in structure, but in some the xylem and phloem are concentrically arranged; the secondary origin of these bundles from procambium-strands was described by Mettenius in his classical paper of 1860. During the increase in thickness of a cycadean stem successive layers of cork-tissue are formed by phellogens in the persistent bases of leaves (Fig. 9, *pd*), which increase in size to adapt themselves to the growth of the vascular zones. The leaf-traces of Cycads are remarkable both on account of their course and their anatomy. In a transverse section of a stem (Fig. 9) one sees some vascular bundles following a horizontal or slightly oblique course in the cortex, stretching for a longer or shorter distance in a direction concentric with the woody cylinder. From each leaf-base two main bundles spread right and left through the cortex of the stem (Fig. 9, *lt*), and as they curve gradually towards the vascular ring they present the appearance of two rather flat ogee curves, usually spoken of as the leaf-trace girdles (Fig. 9, *lt*). The distal ends of these girdles give off several branches, which traverse the petiole and rachis as numerous collateral bundles. A leaf-trace, as it passes through the cortex, has a collateral structure, the protoxylem being situated at the inner edge of the xylem; when it reaches the leaf-base the position of the spiral tracheids is gradually altered, and the endarch arrangement (protoxylem internal) gives place to a mesarch structure (protoxylem more or less central and not on the edge of the xylem strand). In a bundle examined in the basal portion of a leaf the bulk of the xylem is found to be centrifugal in position, but internally to the protoxylem there is a group of centripetal tracheids; higher up in the petiole the xylem is mainly centripetal, the centrifugal wood being represented by a small arc of tracheids external to the protoxylem and separated from it by a few parenchymatous elements. Finally, in the pinnæ of the frond the centrifugal xylem may disappear, the protoxylem being now exarch in position and abutting on the phloem. Similarly in the sporophylls of some Cycads the bundles are endarch near the base and mesarch near the distal end of the stamen or carpel. The vascular system of cycadean seedlings presents some features worthy of note; centripetal xylem occurs in the cotyledonary bundles associated with transfusion-tracheids. The bundles from the cotyledons pursue a direct course to the stele of the main axis, and do not assume the girdle-form characteristic of the adult plant. This is of interest from the point of view of the comparison of recent Cycads with some fossil cycadean plants (Bennettiteæ), in which the leaf-traces follow a much simpler course than in modern Cycads. The mesarch structure of the leaf-bundles is met with in a less pronounced form in the flower peduncles of some Cycads. This fact is of importance as showing that this type of vascular structure, which characterized the stems of many Palæozoic genera, has not entirely disappeared from the stems of modern Cycads; but the mesarch bundle is now confined to the leaves and peduncles.

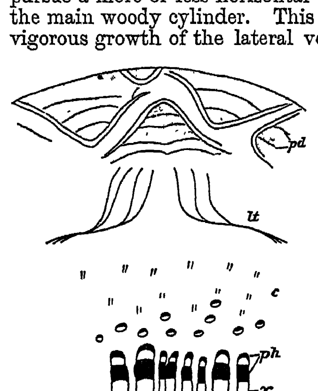


FIG. 9.—*Macrozamia*: diagrammatic transverse section of part of stem. *pd*, periderm in leaf-bases; *lt*, leaf-traces in cortex; *ph*, phloem; *x*, xylem; *m*, medullary bundles; *c*, cortical bundles. (After Worsdell.)

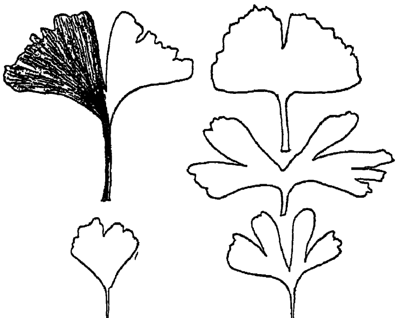


FIG. 10.—*Ginkgo biloba*: leaves.

Roots.

The roots of some Cycads resemble the stems in producing several cambium-rings; they possess 2 to 8 protoxylem-groups, and are characterized by a broad pericyclic zone. A common phenomenon in Cycads is the production of roots which grow upwards (apogeotropic), and appear as coralline branched structures above the level of the ground; some of the cortical cells of these roots are hypertrophied, and contain numerous filaments of blue-green

Algæ (Nostocaceæ), which live as endoparasites in the cell-cavities.

GINKGOALES.—This class-designation has been recently proposed to give emphasis to the isolated position of the genus *Ginkgo* (*Salisburia*) among the Gymnosperms. *Ginkgo biloba*, the Maiden-hair tree, has usually been placed by botanists in the Taxeæ in the neighbourhood of the Yew (*Taxus*), but the proposal by Eichler in 1852 to institute a special family, the Salisburieæ, indicated a recognition of the existence of special characteristics which distinguish the genus from other members of the Coniferæ. The discovery by the Japanese botanist Hirase of the development of ciliated spermatozoids in the pollen-tube of *Ginkgo*, in place of the non-motile male cells of typical Conifers, served as a cogent argument in favour of separating the genus from the Coniferales and placing it in a class of its own. In 1712 Kaempfer published a drawing of a Japanese tree, which he described under the name *Ginkgo;* this term was adopted in 1771 by Linnæus, who spoke of Kaempfer's plant as *Ginkgo biloba.* In 1797 Smith proposed to use the name *Salisburia adiantifolia* in preference to the "uncouth" genus *Ginkgo* and the "incorrect" specific term *biloba.* Both names are still in common use. On account of the resemblance of the leaves to those of some species of *Adiantum*, the appellation Maiden-hair tree has long been given to *Ginkgo biloba. Ginkgo* is of special interest on account of its isolated position among existing plants, its restricted geographical distribution, and its great antiquity (see PALÆOBOTANY, MESOZOIC). This solitary survivor of an ancient stock is almost extinct in a wild state, but a few large trees still flourish in parts of China and possibly in Japan; it is common as a sacred tree in the gardens of temples in the Far East, and often cultivated in North America and Europe. *Ginkgo biloba*, which may reach a height of over 30 metres, forms a tree of pyramidal shape with a smooth grey bark. The leaves (Figs. 10 and 11) have a long, slender petiole terminating in a fan-shaped lamina, which may be entire, divided by a median incision into two wedge-shaped lobes or subdivided into several narrow segments. The venation is like that of many ferns, e.g., *Adiantum;* the lowest vein in each half of the lamina follows a course parallel to the edge, and gives off numerous branches, which fork repeatedly as they spread in a palmate manner towards the leaf margin. The foliage-leaves occur either scattered on long shoots of unlimited growth, or at the apex of short shoots (spurs), which may eventually elongate into long shoots.

FIG. 11.—*Ginkgo adiantoides.* Fossil (Eocene) leaf from the island of Mull.

Flowers. The flowers are diœcious. The male flowers (Fig. 12), borne in the axil of scale-leaves, consist of a stalked central axis bearing loosely disposed stamens; each stamen consists of a slender filament terminating in a small apical scale, which bears usually two, but not infrequently three or four pollen-sacs (Fig. 12, *C*). The axis of the flower is a shoot bearing leaves in the form of stamens. A mature pollen-grain contains a prothallus of 3 to 5 cells (Fig. 13, *Pg*); the exine extends over two-thirds of the circumference, leaving a thin portion of the wall, which on collapsing produces a longitudinal groove similar to the median depression on the pollen-grain of a cycad. The ordinary type of female flower has the form of a long, naked peduncle bearing a single ovule on either side of the apex (Fig. 12), the base of each being enclosed by a small, collar-like rim, the nature of which has been variously interpreted. A young ovule consists of a conical nucellus surrounded by a single integument terminating as a two-lipped micropyle. A large pollen-chamber occupies the apex of the nucellus; immediately below this, two or more archegonia (Fig. 13, *a*) are developed in the upper region of the megaspore, each consisting of a large egg-cell surmounted by two neck-cells and a canal-cell which is cut off shortly before fertilization. After the entrance of the pollen-grain the pollen-chamber becomes roofed over by a blunt protuberance of nucellar tissue. The megaspore (embryo-sac) continues to grow after pollination until the greater part of the nucellus is gradually destroyed; it also gives rise to a vertical outgrowth, which projects from the apex of the megaspore as a short, thick column (Fig. 13, *e*) supporting the remains of the nucellar tissue which forms the roof of the pollen-chamber (Fig. 13, *c*). Surrounding the pitted wall of the ovum there is a definite layer of large cells, no doubt representing a tapetum, which, as in Cycads and Conifers, plays an important part in nourishing the growing egg-cell. The endosperm detached from a large *Ginkgo* ovule after fertilization bears a close resemblance to that of a cycad; the apex is occupied by a depression, on the floor of which two small holes mark the position of the archegonia, and the outgrowth from the megaspore apex projects from the centre as a short peg. After pollination the pollen-tube grows into the nucellar tissue, as in Cycads, and the pollen-grain itself (Fig. 13, *Pg*) hangs down into the pollen-chamber; two large spirally ciliated spermatozoids are produced, their manner of development agreeing very closely with that of the corresponding cells in *Cycas* and *Zamia.* After fertilization the ovum-nucleus divides and cell-formation proceeds rapidly, especially in the lower part of the ovum, in which the cotyledon and axis of the embryo are differentiated; the long, tangled suspensor of the cycadean embryo is not found in *Ginkgo.* It is often stated that fertilization occurs after the ovules have fallen, but it has been demonstrated by Hirase that this occurs while the ovules are still attached to the tree. The ripe seed, which grows as large as a rather small plum, is enclosed by a thick, fleshy envelope covering a hard woody shell with two or rarely three longitudinal keels. A papery remnant of nucellus lines the inner face of the woody shell, and, as in cycadean seeds, the apical portion is readily separated as a cap covering the summit of the endosperm.

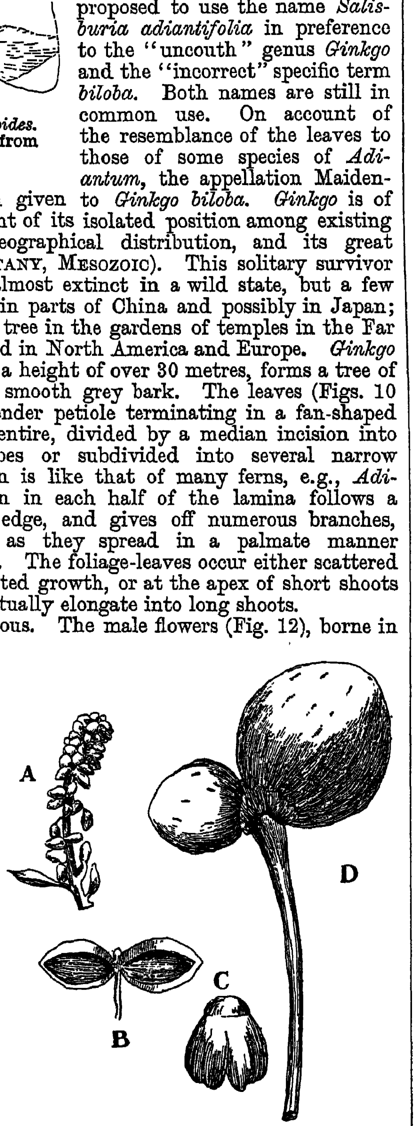


FIG. 12.—*Ginkgo biloba. A*, male flower; *B, C*, single stamens; *D*, female flower.

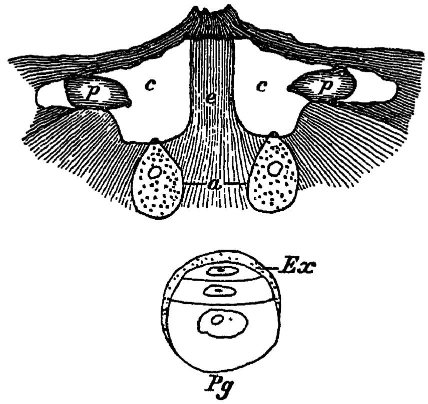


FIG. 13.—*Ginkgo:* apex of ovule, and pollen-grain. *p*, pollen-tube (proximal end); *c*, pollen-chamber; *e*, upward prolongation of megaspore; *a*, archegonia; *Pg*, pollen-grain; *Ex*, exine. (After Hirase.)

The morphology of the female flowers has been variously interpreted by botanists; the peduncle bearing the ovules has been described as homologous with the petiole of a foliage-leaf and as a shoot-structure, the collar-like envelope at the base of the ovules being referred to as a second integument or arillus, or as the representative of a carpel. The evidence afforded by normal and abnormal flowers appears to be in favour of the following interpretation: The peduncle is a shoot bearing two or more carpels. Each ovule is enclosed at the base by an envelope or collar homologous with the lamina of a leaf; the fleshy and hard coats of the nucellus constitute a single integument. The stalk of an ovule, considerably reduced in normal flowers and much larger in some abnormal flowers, is homologous with a leaf-stalk, with which it agrees in the structure and number of vascular bundles. The facts on which this description is based are derived partly from anatomical evidence, and in part from an account given by a Japanese botanist, Fujii, of several abnormal female flowers; in some cases the collar at the base of an ovule, often described as an arillus, is found to pass gradually into the lamina of a leaf bearing marginal ovules (Fig. 14, *B*). The occurrence of more than two ovules on one peduncle is by no means rare; a particularly striking example is described by Fujii, in which an unusually thick peduncle

FIG. 14.—*Ginkgo:* abnormal female flowers. *A*, peduncle; *b*, scaly bud; *B*, leaf bearing marginal ovule. (After Fujii.)

bearing several stalked ovules terminates in a scaly bud (Fig. 14, *A*, *b*). The frequent occurrence of more than two pollen-sacs and the equally common occurrence of additional ovules have been regarded by some authors as evidence in favour of the view that ancestral types normally possessed a greater number of these organs than are usually found in the recent species. This view receives support from fossil evidence.

Anatomy. Close to the apex of a shoot the vascular bundles of a leaf make their appearance as double strands, and the leaf-traces in the upper part of a shoot have the form of distinct bundles, which in the older part of the shoot form a continuous ring. Each double leaf-trace passes through four internodes before becoming a part of the stele; the double nature of the trace is a characteristic feature. Secretory sacs occur abundantly in the leaf-lamina, where they appear as short lines between the veins; they are abundant also in the cortex and pith of the shoot, in the fleshy integument of the ovule, and elsewhere. The secondary wood of the shoot and root conforms in the main to the Coniferous type; in the short shoots the greater breadth of the medullary rays in the more internal part of the xylem recalls the cycadean type. The secondary phloem contains numerous thick-walled fibres, parenchymatous cells, and large sieve-tubes with plates on the radial walls; swollen parenchymatous cells containing crystals are commonly met with in the cortex, pith, and medullary-ray tissues. The wood consists of tracheids, with circular bordered pits on their radial walls, and in the late summer wood pits are unusually abundant on the tangential walls. A point of anatomical interest is the occurrence in the vascular bundles of the cotyledons, scale-leaves, and elsewhere of a few centripetally developed tracheids, which give to the xylem-strands a mesarch structure such as characterizes the foliar bundles of Cycads. The root is diarch in structure, but additional protoxylem-strands may be present at the base of the main root; the pericycle consists of several layers of cells.

This is not the place to discuss in detail the past history of *Ginkgo* (see PALÆOBOTANY, MESOZOIC). Among Palæozoic genera there are some which bear a close resemblance to the recent type in the form of the leaves, and petrified Palæozoic seeds, almost identical with those of the Maidenhair tree, have been described from French and English localities.

Geological history. During the Triassic and Jurassic periods the genus *Baiera*—no doubt a representative of the Ginkgoales—was widely spread throughout Europe and in other regions; *Ginkgo* itself occurs abundantly in Mesozoic and Tertiary rocks, and was a common plant in the Arctic regions during the Jurassic and Lower Cretaceous periods. Some unusually perfect *Ginkgo* leaves have been found in the Eocene leaf-beds between the lava-flows exposed in the cliffs of Mull (Fig. 11). From an evolutionary point of view, it is of interest to note the occurrence of filicinean and cycadean characters in the Maidenhair tree. The leaves at once invite a comparison with Ferns; the numerous long hairs which form a delicate woolly covering on young leaves recall the hairs of certain ferns, but agree more closely with the long filamentous hairs of recent Cycads. The spermatozoids constitute the most striking link with both Cycads and Ferns. The structure of the seed, the presence of two neck-cells in the archegonia, the late development of the embryo, the partially-fused cotyledons and certain anatomical characters, are features common to *Ginkgo* and the Cycads. The Maidenhair tree is one of the most interesting survivals from the past; it represents a type which, in the Palæozoic era, may have been merged into the extinct class Cordaitales. Through the succeeding ages the Ginkgoales were represented by numerous forms, which gradually became more restricted in their distribution and fewer in number during the Cretaceous and Tertiary periods, terminating at the present day in one solitary survivor.

CONIFERALES.—Trees and shrubs characterized by a copious branching of the stem and frequently by a regular pyramidal form. Leaves simple, small, linear or short and scale-like, usually persisting for more than one year. Flowers monœcious or diœcious, unisexual, without a perianth, often in the form of cones, but never terminal on the main stem.

The plants usually included in the Coniferæ constitute a less homogeneous class than the Cycadaceæ. Some authors use the term Coniferæ in a restricted sense as including those genera which have the female flowers in the form of cones, the other genera, characterized by flowers of a different type, being placed in the Taxaceæ, and often spoken of as Taxads. In order to avoid confusion in the use of the term Coniferæ, we may adopt as a class-designation the name Coniferales, including both the Coniferæ—using the term in a restricted sense—and the Taxaceæ.

External features. The most striking characteristic of the majority of the Coniferales is the regular manner of the monopodial branching and the pyramidal shape. *Araucaria imbricata*, the Monkey-puzzle tree, *A. excelsa*, the Norfolk Island Pine, many Pines and Firs, Cedars, and other genera illustrate the pyramidal form. The mammoth Redwood tree of California, *Sequoia* (*Wellingtonia*) *gigantea*, which represents the tallest Gymnosperm, and among the Angiosperms is exceeded only by the Eucalyptus trees of Australia, is a good example of the regular tapering main stem and narrow pyramidal form. The Cypresses afford instances of tall and narrow trees similar in habit to Lombardy Poplars. The common Cypress (*Cupressus sempervirens*), as found wild in the mountains of Crete and Cyprus, is characterized by long and spreading branches, which give it a Cedar-like habit. A pendulous or weeping habit is assumed by some Conifers; e.g., *Picea excelsa* var. *virgata* represents a form in which the main branches attain a considerable horizontal extension, and trail themselves like snakes along the ground. Certain species of *Pinus*, the Yews (*Taxus*), and some other genera grow as bushes, which in place of a main mast-like stem possess several repeatedly-branched leading shoots. The unfavourable conditions in Arctic regions have produced a dwarf form, in which the main shoots grow close to the ground. Artificially induced dwarfed plants of *Pinus*, *Cupressus*, *Sciadopitys* (Umbrella Pine), and other genera are commonly cultivated by the Japanese. The dying off of older branches and the vigorous growth of shoots nearer the apex of the stem produce a form of tree illustrated by the Stone Pine of the Mediterranean region (*Pinus Pinea*), which Turner has rendered familiar in his "Childe Harold's Pilgrimage" and other pictures of Italian scenery. Conifers are not infrequently seen in which a lateral branch has bent sharply upwards to take the place of the injured main trunk. An upward tendency of all the main lateral branches, known as fastigiation, is common in some species, producing well-marked varieties, e.g., *Cephalotaxus pedunculata* var. *fastigiata*; this fastigiate habit may arise as a sport on a tree with spreading branches. Another departure from the normal is that in which the juvenile or seedling form of shoot persists in the adult tree; the numerous Coniferous plants known as species of *Retinospora* are examples of this. The name *Retinospora*, therefore, does not stand for a true genus, but denotes persistent young forms of *Juniperus*, *Thuja*, *Cupressus*, &c., in which the small scaly leaves of ordinary species are replaced by the slender, needle-like leaves, which stand out more or less at right angles from the branches. The flat branchlets of *Cupressus*, *Thuja* (Arbor Vitæ), *Thujopsis dolabrata* (Japanese Arbor Vitæ) are characteristic of certain types of Conifers; in some cases the horizontal extension of the branches induces a dorsiventral structure. A characteristic feature of the genus *Agathis* (*Dammara*), the Kauri Pine of New Zealand, is the deciduous habit of the branches; these become detached from the main trunk by a well-defined absciss-surface, which appears as a depressed circular scar on the stem.

With a few exceptions Conifers are evergreen, and retain the leaves for several years (10 years in *Araucaria imbricata*, 8 to 10 in *Picea excelsa*, 5 in *Taxus baccata*; in *Pinus* the needles usually fall in October of their third year).

Leaves. The Larch (*Larix*) sheds its leaves in the autumn, in the Chinese Larch (*Pseudolarix Kaempferi*) the leaves turn a bright yellow colour before falling. In the swamp Cypress (*Taxodium distichum*) the tree assumes a rich brown colour in the autumn, and sheds its leaves together with the branchlets which bear them; deciduous branches occur also in some other species, e.g., *Sequoia sempervirens* (Redwood), *Thuja occidentalis*, &c. The leaves of Conifers are characterized by their small size; *e.g.*, the needle-form represented by *Pinus*, *Cedrus*, *Larix*, &c., the linear flat or angular leaves, appressed to the branches, of *Thuja*, *Cupressus*, *Libocedrus*, &c. The flat and comparatively broad leaves of *Araucaria imbricata*, *A. Bidwillii*, and some species of the southern genus *Podocarpus* are traversed by several parallel veins, as are also the still larger leaves of *Agathis*, which may reach a length of several inches. In addition to the foliage-leaves several genera also possess scale-leaves of various kinds, represented by bud-scales in *Pinus*, *Picea*, &c., which frequently persist for a time at the base of a young shoot which has pushed its way through the yielding cap of protecting scales, while in some Conifers the bud-scales adhere together, and after being torn near the base are carried up by the growing axis as a thin brown cap. The Cypresses, Araucarias, and some other genera have no true bud-scales; in some species, e.g., *Araucaria Bidwillii*, the occurrence of small foliage-leaves, which have functioned as bud-scales, at intervals on the shoots affords a measure of seasonal growth. The occurrence of long and short shoots is a characteristic feature of many Conifers. In *Pinus* the needles occur in pairs, or in clusters of 3 or 5 at the apex of a small and inconspicuous short shoot of limited growth (spur), which is enclosed at its base by a few scale-leaves, and borne on a branch of unlimited growth in the axil of a scale-leaf. In the Californian *Pinus monophylla* each spur bears usually one needle, but two are not uncommon; it would seem that rudiments of two needles are always produced, but, as a rule, only one develops into a needle. In *Sciadopitys* similar spurs occur, each bearing a single needle, which in its grooved surface and in the possession of a double vascular bundle bears traces of an origin from two needle-leaves. A peculiarity of these leaves is the inverse orientation of the vascular tissue; each of the two veins has its phloem next the upper and the xylem towards the lower surface of the leaf; this

unusual position of the xylem and phloem may be explained by regarding the needle of *Sciadopitys* as being composed of a pair of leaves borne on a short axillary shoot and fused by their margins (Fig. 15, A). Long and short shoots occur also in *Cedrus* and *Larix*, but in these genera the spurs are longer and stouter, and are not shed with the leaves; this kind of short shoot, by accelerated apical growth, often passes into the condition of a long shoot, on which the leaves are scattered and separated by comparatively long internodes instead of being crowded into tufts such as are borne on the ends of the spurs. In the genus *Phyllocladus* (New Zealand, &c.) there are no green foliage-leaves, but in their place flattened branches (phylloclades) borne in the axils of small scale-leaves. The cotyledons are often two in number, but sometimes (e.g., *Pinus*) as many as fifteen; these leaves are usually succeeded by foliage-leaves in the form of delicate spreading needles, and these primordial leaves are followed, sooner or later, by the adult type of leaf, except in Retinosporas, which retain the juvenile foliage. In addition to the first foliage-leaves and the adult type of leaf, there are often produced leaves which are intermediate both in shape and structure between the seedling and adult foliage. Dimorphism or heterophylly is fairly common. One of the best known examples is the Chinese Juniper (*J. Chinensis*), in which branches with spinous leaves, longer and more spreading than the ordinary adult leaf, are often found associated with the normal type of branch. In some cases, e.g., *Sequoia sempervirens*, the fertile branches bear leaves which are less spreading than those on the vegetative shoots. Certain species of the southern hemisphere genus *Dacrydium* afford particularly striking instances of heterophylly, e.g., *D. Kirkii* of New Zealand, in which some branches bear small and appressed leaves, while in others the leaves are much longer and more spreading. A well-known fossil Conifer from Triassic strata—*Voltzia heterophylla*—also illustrates a marked dissimilarity in the leaves of the same shoot. The variation in leaf-form and the tendency of leaves to arrange themselves in various ways on different branches of the same plant are features which it is important to bear in mind in the identification of fossil Conifers. In this connexion we may note the striking resemblance between some of the New Zealand Alpine Veronicas, e.g., *Veronica Hectori*, *V. Cupressoides*, &c. (also *Polycladus cupressinus*, a Composite), and some of the Cypresses and other Conifers with small appressed leaves. The long linear leaves of some species of *Podocarpus*, in which the lamina is traversed by a single vein, recall the pinnæ of *Cycas*; the branches of some Dacrydiums and other forms closely resemble those of Lycopods; these superficial resemblances, both between different genera of Conifers and between Conifers and other plants, coupled with the usual occurrence of fossil coniferous twigs without cones attached to them, render the determination of extinct types a very unsatisfactory and frequently an impossible task.

Flowers.

A typical male flower consists of a central axis bearing numerous spirally-arranged sporophylls (stamens), each of which consists of a slender stalk (filament) terminating distally in a more or less prominent knob or triangular scale, and bearing two or more pollen-sacs (microsporangia) on its lower surface. The pollen-grains of some genera (e.g., *Pinus*) are furnished with bladder-like extensions of the outer wall, which serve as aids to wind-dispersal. The stamens of *Araucaria* and *Agathis* are peculiar in bearing several long and narrow free pollen-sacs; these may be compared with the sporangiophores of the Horsetails (*Equisetum*); in *Taxus* (Yew) the filament is attached to the centre of a large circular distal expansion, which bears several pollen-sacs on its under surface. In the Conifers proper the female reproductive organs have the form of cones, which may be styled flowers or inflorescences according to different interpretations of their morphology. In the Taxaceæ the flowers have a simpler structure. The female flowers of the Abietineæ may be taken as representing a common type. A pine cone reaches maturity in two years; a single year suffices for the full development in *Larix* and several other genera. The axis of the cone bears numerous spirally disposed flat scales (cone-scales), each of which, if examined in a young cone, is found to be double, and to consist of a lower and an upper portion. The latter is a thin flat scale bearing a median ridge or keel (e.g., *Abies*), on each side of which is situated an inverted ovule, consisting of a nucellus surrounded by a single integument. As the cone grows in size and becomes woody the lower half of the cone-scale, which we may call the carpellary scale, may remain small, and is so far outgrown by the upper half (seminiferous scale) that it is hardly recognizable in the mature cone. In many species of *Abies* (e.g., *Abies pectinata*, &c.) the ripe cone differs from those of *Pinus*, *Picea*, and *Cedrus* in the large size of the carpellary scales, which project as conspicuous thin appendages beyond the distal margins of the broader and more woody seminiferous scales; the long carpellary scale is a prominent feature also in the cone of the Weymouth Pine (*Pseudotsuga Douglasii*). The female flowers (cones) vary considerably in size; the largest are the more or less spherical cones of *Araucaria*—a single cone of *A. imbricata* may produce as many as 300 seeds, one seed to each fertile cone-scale—and the long pendent cones, 1 to 2 feet in length, of the Sugar Pine of California (*Pinus Lambertiana*) and other species. Smaller cones, less than an inch long, occur in the Larch, *Athrotaxis* (Tasmania), *Fitzroya* (Patagonia and Tasmania), &c. In the Taxodieæ and Araucarieæ the cones are similar in appearance to those of the Abietineæ, but they differ in the fact that the scales appear to be single, even in the young condition; each cone-scale in a genus of the Taxodiinæ (*Sequoia*, &c.) bears several seeds, while in the Araucariinæ (*Araucaria* and *Agathis*) each scale has one seed. The Cupressineæ have cones composed of a few scales arranged in alternate whorls; each scale bears two or more seeds, and shows no external sign of being composed of two distinct portions. In the Junipers the scales become fleshy as the seeds ripen, and the individual scales fuse together in the form of a berry. The female flowers of the Taxaceæ assume another form; in *Microcachrys* (Tasmania) the reproductive structures are spirally disposed, and form small globular cones made up of red fleshy scales, to each of which is attached a single ovule enclosed by an integument and partially invested by an arillus; in *Dacrydium* the carpellary leaves are very similar to the foliage leaves—each bears one ovule with two integuments, the outer of which constitutes an arillus. Finally in the Yew, as a type of the family Taxeæ, the ovules occur singly at the apex of a lateral branch, enclosed when ripe by a conspicuous red or yellow fleshy arillus, which serves as an attraction to animals, and thus aids in the dispersal of the seeds.

It is important to draw attention to some structural features exhibited by certain cone-scales, in which there is no external sign indicative of the presence of a carpellary and a seminiferous scale. In *Araucaria Cookii* and some allied species each scale has a small pointed projection from its upper face near the distal end; the scales of *Cunninghamia* (China) are characterized by a somewhat ragged membranous projection extending across the upper face between the seeds and the distal end of the scale; in the scales of *Athrotaxis* (Tasmania) a prominent rounded ridge occupies a corresponding position. These projections and ridges may be homologous with the seminiferous scale of the Pines, Firs, Cedars, &c. The simplest interpretation of the cone of the Abietineæ is that which regards it as a flower consisting of an axis bearing several open carpels, which in the adult cone may be very small or large and prominent, the scale bearing the ovules being regarded as a placental outgrowth from the flat and open carpel. In *Araucaria* the cone-scale is regarded as consisting of a flat carpel, of which the placenta has not grown out into the scale-like structure. The seminiferous scale of *Pinus*, &c., is also spoken of sometimes as a ligular outgrowth from the carpellary leaf. Robert Brown was the first to give a clear description of the morphology of the Abietineous cone in which carpels bear naked ovules; he recognized gymnospermy as an important distinguishing feature in Conifers as well as in Cycads. Another view is to regard the cone as an inflorescence, each carpellary scale being a bract bearing in its axil a shoot the axis of which has not been developed; the seminiferous scale is believed to represent either a single leaf or a fused pair of leaves belonging to the partially suppressed axillary shoot. In 1869 van Tieghem laid stress on anatomical evidence as a key to the morphology of the cone-scales; he drew attention to the fact that the collateral vascular bundles of the seminiferous scale are inversely orientated as compared with those of the carpellary scale; in the latter the xylem of each bundle is next the upper surface, while in the

Morphology of female flower.

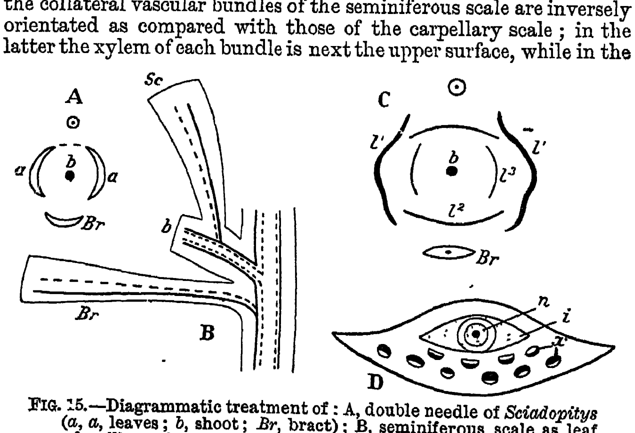


FIG. 15.—Diagrammatic treatment of: A, double needle of *Sciadopitys* (a, a, leaves; b, shoot; *Br*, bract); B, seminiferous scale as leaf of axillary shoot (b, shoot; *Sc*, seminiferous scale; *Br*, bract); C, seminiferous scale as fused pair of leaves (l^1, l^2, l^3, first, second, and third leaves; b, shoot; *Br*, bract); D, cone-scale of *Araucaria* (n, nucellus; i, integument; x, xylem) (C and D after Worsdell).

seminiferous scale the phloem occupies that position. The conclusion drawn from this was that the seminiferous scale (Fig. 15, B, *Sc*) is the first and only leaf of an axillary shoot (b) borne on that side of the shoot, the axis of which is suppressed, opposite the subtending bract (Fig. 15, A, B, C, *Br*). Another view is to apply to the seminiferous scale an explanation similar to that suggested by von Mohl

in the case of the double needle of *Sciadopitys*, and to consider the seed-bearing scale as being made up of a pair of leaves (Fig. 15, A, *a*, *a*) of an axillary shoot (*b*) fused into one by their posterior margins (Fig. 15, A). The latter view receives support from abnormal cones in which carpellary scales subtend axillary shoots, of which the first two leaves (Fig. 15, C, l^1, l^1) are often harder and browner than the others; forms have been described transitional between axillary shoots, in which the leaves are separate, and others in which two of the leaves are more or less completely fused. In a young cone the seminiferous scale appears as a hump of tissue at the base or in the axil of the carpellary scale, but Celakovsky, a strong supporter of the axillary bud theory, attaches little or no importance to this kind of evidence, regarding the present manner of development as being merely an example of a short cut adopted in the course of evolution, and replacing the original production of a branch in the axil of each carpellary scale. Eichler, one of the chief supporters of the simpler view, does not recognize in the inverse orientation of the vascular bundles an argument in support of the axillary bud theory, but points out that the seminiferous scale, being an outgrowth from the surface of the carpellary scale, would, like outgrowths from an ordinary leaf, naturally have its bundles inversely orientated. In such cone-scales as show little or no external indication of being double in origin, e.g., *Araucaria* (Fig. 15, D), *Sequoia*, &c., there are always two sets of bundles; the upper set, having the phloem uppermost, as in the seminiferous scale of *Abies* or *Pinus*, are regarded as belonging to the outgrowth from the carpellary scale and specially developed to supply the ovules. Monstrous cones are fairly common; these in some instances lend support to the axillary bud theory, and it has been said that this theory owes its existence to evidence furnished by abnormal cones. It is difficult to estimate the value of abnormalities as evidence bearing on morphological interpretation; the chief danger lies perhaps in attaching undue weight to them, but there is also a risk of minimizing their importance. Monstrosities at least demonstrate possible lines of development, but when the abnormal forms of growth in various directions are fairly evenly balanced, trustworthy deductions become difficult. The occurrence of buds in the axils of carpellary scales may, however, simply mean that buds, which are usually undeveloped in the axils of sporophylls, occasionally afford evidence of their existence. Some monstrous cones lend no support to the axillary bud theory. In *Larix* the axis of the cone often continues its growth; similarly in *Cephalotaxus* the cones are often proliferous. (In rare cases the proliferated portion produces male flowers in the leaf-axils.) In *Larix* the carpellary scale may become leafy, and the seminiferous scale may disappear. Androgynous cones may be produced, as in the cone of *Pinus rigida* (Fig. 16), in which the lower part bears stamens and the upper portion carpellary and seminiferous scales. An interesting case has been figured by Masters, in which scales of a cone of *Cupressus Lawsoniana* bear ovules on the upper surface and stamens on the lower face. One argument that has been adduced in support of the axillary bud theory is derived from the Palæozoic type *Cordaites*, in which each ovule occurs on an axis borne in the axil of a bract. The whole question is still unsolved, and perhaps insoluble. *Cordaites* is an extinct type which in certain respects resembles *Ginkgo*, Cycads, and the Araucarieæ, but its agreement with true Conifers is probably too remote to justify our attributing much weight to the bearing of the morphology of its female flowers on the interpretation of that of the Coniferæ. The greater simplicity of the Eichler theory may prejudice us in its favour, but, on the other hand, the arguments advanced in favour of the axillary bud theories are perhaps not sufficiently cogent to lead us to accept an explanation based chiefly on the uncertain evidence of monstrosities.

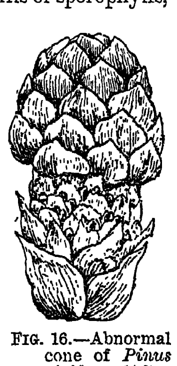


FIG. 16.—Abnormal cone of *Pinus rigida*. (After Masters.)

Micro-spores and mega-spores.

A pollen-grain when first formed from its mother-cell consists of a single cell; in this condition it may be carried to the nucellus of the ovule (e.g., *Taxus*, *Cupressus*, &c.), or more usually (*Pinus*, *Larix*, &c.) it reaches maturity before the dehiscence of the microsporangium. The nucleus of the microspore divides and gives rise to a small cell within the large cell, a second small cell is then produced; this is the structure of the ripe pollen-grain in some Conifers (*Taxus*, &c.). The large cell grows out as a pollen-tube; the second of the two small cells (body-cell) wanders into the tube, followed by the nucleus of the first small cell (stalk-cell). In *Taxus* the body-cell eventually divides into two, in which the products of division are of unequal size, the larger constituting the male generative cell, which fuses with the nucleus of the egg-cell. In *Juniperus* the products of division of the body-cell are equal and both function as male generative cells. In the Abietineæ cell-formation in the pollen-grain is carried farther. Three small cells occur inside the cavity of the microspore; two of them collapse and the third divides into two, forming a stalk-cell and a larger body-cell. The latter ultimately divides in the apex of the pollen-tube into two non-motile generative cells. The precise method of fertilization has been followed by V. H. Blackman, who also succeeded in showing that the nuclei of the sporophyte generation in *Pinus* contain twice as many chromosomes as the nuclei of the gametophyte. The ovule is usually surrounded by one integument, which projects beyond the tip of the nucellus as a wide-open lobed funnel, which at the time of pollination folds inwards, and so assists in bringing the pollen-grains on to the nucellus. In some Conifers (e.g., *Taxus*, *Cephalotaxus*, *Dacrydium*, &c.) the ordinary integument is partially enclosed by an arillus or second integument. It is held by some botanists (Celakovsky) that the seminiferous scale of the Abietineæ is homologous with the arillus or second integument of the Taxaceæ, but this view is too strained to gain general acceptance. In some species of *Araucaria* the nucellus itself projects beyond the open micropyle and receives the pollen-grains direct. During the growth of the cell which forms the megaspore the greater part of the nucellus is absorbed, except the apical portion, which persists as a cone above the megaspore; the partial disorganization of some of the cells in the centre of the nucellar cone forms an irregular cavity, which may be compared with the larger pollen-chamber of *Gingko* and the Cycads. In each ovule one megaspore comes to maturity, but, exceptionally, two may be present (e.g., *Pinus sylvestris*). The megaspore becomes filled with tissue (prothallus), and from some of the superficial cells archegonia are produced, usually three to five in number, but in rare cases ten to twenty may be present. An archegonium consists of a large oval egg-cell surmounted by a short neck composed of one or more tiers of cells, six to eight cells in each tier. Before fertilization the nucleus of the egg-cell divides and cuts off a ventral canal-cell; this cell may represent a second egg-cell. The egg-cells of the archegonia may be in lateral contact (*e.g.*, Cupressineæ) or separated from one another by a few cells of the prothallus, each ovum being immediately surrounded by a layer of cells distinguished by their granular contents and large nuclei. During the development of the egg-cell food material is transferred from these cells through the pitted wall of the ovum. The tissue at the apex of the megaspore grows slightly above the level of the archegonia, so that the latter come to lie in a shallow depression. In the process of fertilization the two male generative nuclei, accompanied by the pollen-tube nucleus and that of the stalk-cell, pass through an open pit at the apex of the pollen-tube into the protoplasm of the ovum. After fertilization the nucleus of the egg divides, the first stages of karyokinesis being apparent even before complete fusion of the male and female nuclei has occurred. The result of this is the production of four nuclei, which eventually take up a position at the bottom of the ovum and become separated from one another by vertical cell-walls; these nuclei divide again, and finally three tiers of cells are produced, four in each tier. In the Abietineæ the cells of the middle tier elongate and push the lowest tier deeper into the endosperm; the cells of the bottom tier may remain in lateral contact and produce together one embryo, or they may separate (*Pinus*, *Juniperus*, &c.) and form four potential embryos. The ripe albuminous seed contains a single embryo with two or more cotyledons; in some species of *Araucaria* (sect. *Colymbea*) the two cotyledons are partially fused, as in *Ginkgo*. The seeds of many Conifers are provided with large thin wings, consisting in some genera (e.g., *Pinus*) of the upper cell layers of the seminiferous scale, which have become detached and adhere loosely to the seed-coat as a thin membrane; this loose attachment may be of use to the seeds when they are blown against the branches of trees, in enabling them to fall away from the wing and drop to the ground. The seeds of some genera depend on animals for dispersal, the carpellary scale (*Microcachrys*) or the outer integument being brightly coloured and attractive. In some Abietineæ (e.g., *Pinus* and *Picea*)—in which the cone-scales persist for some time after the seeds are ripe—the cones hang down and so facilitate the fall of the seeds; in *Cedrus*, *Araucaria*, and *Abies* the scales become detached and fall with the seeds, leaving the bare vertical axis of the cone on the tree. In all cases, except some species of *Araucaria* (sect. *Colymbea*) the germination is epigean. The seedling plants of some Conifers (e.g., *Araucaria imbricata*) are characterized by a carrot-shaped hypocotyl, which doubtless serves as a food-reservoir.

Anatomy.

The roots of many Conifers possess a narrow band of primary xylem-tracheids with a group of narrow spiral protoxylem-elements at each end (diarch). A striking feature in the roots of several genera, excluding the Abietineæ, is the occurrence of thick and somewhat irregular bands of thickening on the cell walls of the cortical layer next to the endodermis. These bands, which may serve to strengthen the central cylinder, have been compared with the netting surrounding the delicate wall of an inflated balloon. It is not always easy to distinguish a root from a stem; in some cases (e.g., *Sequoia*) the primary tetrarch structure is easily identified in the centre of an old root, but in other

cases the primary elements are very difficult to recognize. The sudden termination of the secondary tracheids against the pith-cells may afford evidence of root-structure as distinct from stem-structure, in which the radial rows of secondary tracheids pass into the irregularly-arranged primary elements next the pith. The annual rings in a root are often less clearly marked than in the stem, and the xylem-elements are frequently larger and thinner. The primary vascular bundles in a young conifer stem are collateral, and, like those of a Dicotyledon, they are arranged in a circle round a central pith and enclosed by a common endodermis. It is in the nature of the secondary xylem that the Coniferales are most readily distinguished from the Dicotyledons and Cycadaceæ; the wood is homogeneous in structure, consisting almost entirely of tracheids with circular or polygonal bordered pits on the radial walls, more particularly in the late summer wood. In many genera xylem-parenchyma is present, but never in great abundance. A few Dicotyledons, e.g., *Drimys* (Magnoliaceæ) closely resemble Conifers in the homogeneous character of the wood, but in most cases the presence of large spring vessels, wood-fibres, and abundant parenchyma affords an obvious distinguishing feature.

The abundance of petrified coniferous wood in rocks of various ages has led many botanists to investigate the structure of modern genera with a view to determining how far anatomical characters may be used as evidence of generic distinctions. There are a few well-marked types of wood which serve as convenient standards of comparison, but these cannot be used except in a few cases to distinguish individual genera. The genus *Pinus* serves as an illustration of wood of a distinct type characterized by the absence of xylem-parenchyma, except such as is associated with the numerous resin-canals that occur abundantly in the wood, cortex, and medullary rays; the medullary rays are composed of parenchyma and of horizontal tracheids with irregular ingrowths from their walls. In a radial section of a Pine stem each ray is seen to consist in the median part of a few rows of parenchymatous cells with large oval simple pits in their walls, accompanied above and below by horizontal tracheids with bordered pits. The pits in the radial walls of the ordinary xylem-tracheids occur in a single row or in a double row, of which the pits are not in contact, and those of the two rows are placed on the same level. The medullary rays usually consist of a single tier of cells, but in the *Pinus* type of wood broader medullary rays also occur and are traversed by horizontal resin-canals. In the wood of *Cupressus*, *Cedrus*, *Abies*, and several other genera, parenchymatous cells occur in association with the xylem-tracheids and take the place of the resin-canals of other types. In the Araucarian type of wood (*Araucaria* and *Agathis*) the bordered pits, which occur in two or three rows on the radial walls of the tracheids, are in mutual contact and polygonal in shape, the pits of the different rows are alternate and not on the same level; in this type of wood the annual rings are often much less distinct than in *Cupressus*, *Pinus*, and other genera. In *Taxus*, *Torreya* (North America), and *Cephalotaxus* the absence of resin-canals and the presence of spiral thickening-bands in the tracheids constitute well-marked characteristics. An examination of the structure of the wood of branches, stems, and roots of the same species or individual usually reveals a fairly wide variation in some of the characters, such as the abundance and size of the medullary rays, the size and arrangement of pits, the presence of wood-parenchyma—characters to which undue importance has often been attached in systematic anatomical work. The phloem consists of sieve-tubes, with pitted areas on the lateral as well as on the inclined terminal walls, phloem-parenchyma, and, in some genera, fibres. In the Abietineæ the phloem consists of parenchyma and sieve-tubes only, but in most other forms tangential rows of fibres occur in regular alternation with the parenchyma and sieve-tubes. The characteristic companion-cells of Angiosperms are represented by phloem-parenchyma cells with albuminous contents; other parenchymatous elements of the bast contain starch or crystals of calcium oxalate. When tracheids occur in the medullary rays of the xylem these are replaced in the phloem-region by irregular parenchymatous cells known as albuminous cells. Resin-canals, which occur abundantly in the xylem, phloem, or cortex, are not found in the wood of the Yew. *Cephalotaxus* (Taxeæ) is also peculiar in having resin-canals in the pith (cf. *Ginkgo*). One form of *Cephalotaxus* is characterized by the presence of short tracheids in the pith, in shape like ordinary parenchyma, but in the possession of bordered pits and lignified walls agreeing with ordinary xylem-tracheids; it is probable that these short tracheids serve as reservoirs for storing rather than for conducting water. The vascular bundle entering the stem from a leaf with a single vein passes by a more or less direct course into the central cylinder of the stem, and does not assume the girdle-like form characteristic of the cycadean leaf-trace. In species of which the leaves have more than one vein (e.g., *Araucaria imbricata*, &c.) the leaf-trace leaves the stele of the stem as a single bundle which splits up into several strands in its course through the cortex. The leaf-trace in the Coniferales is simple in its course through the stem, differing in this respect from the double leaf-trace of *Ginkgo*. The anatomical characters of leaves most useful for diagnostic purposes are the position of the stomata, the presence and arrangement of resin-canals, the structure of the mesophyll and vascular bundles. The presence of hypodermal fibres is another feature worthy of note, but the occurrence of these elements is too closely connected with external conditions to be of much systematic value. A pine needle grown in continuous light differs from one grown under ordinary conditions in the absence of hypodermal fibres, in the absence of the characteristic infoldings of the mesophyll cell-walls, in the smaller size of the resin-canals, &c. The endodermis in *Pinus*, *Picea*, and many other genera is usually a well-defined layer of cells enclosing the vascular bundles, and separated from them by a tissue consisting in part of ordinary parenchyma and to some extent of isodiametric tracheids; but this tissue, usually spoken of as the pericycle, is in direct continuity with other stem-tissues as well as the pericycle. The occurrence of short tracheids in close proximity to the veins is a characteristic of coniferous leaves; these elements assume two distinct forms—(1) the short isodiametric tracheids (transfusion-tracheids) closely associated with the veins; (2) longer tracheids extending across the mesophyll at right angles to the veins, and no doubt functioning as representatives of lateral veins. It has been suggested that transfusion-tracheids represent, in part at least, the centripetal xylem, which forms a distinctive feature of cycadean leaf-bundles; these short tracheids form conspicuous groups laterally attached to the veins in *Cunninghamia*, abundantly represented in a similar position in the leaves of *Sequoia*, and scattered through the so-called pericycle in *Pinus*, *Picea*, &c. It is of interest to note the occurrence of precisely similar elements in the mesophyll of *Lepidodendron* leaves. An anatomical peculiarity in the veins of *Pinus* and several other genera is the continuity of the medullary rays, which extend as continuous plates from one end of the leaf to the other. The mesophyll of *Pinus* and *Cedrus* is characterized by its homogeneous character and by the presence of infoldings of the cell-walls. In many leaves, e.g., *Abies*, *Tsuga*, *Larix*, &c., the mesophyll is heterogeneous, consisting of palisade and spongy parenchyma. In the leaves of *Araucaria imbricata*, in which palisade-tissue occurs in both the upper and lower part of the mesophyll, the resin-canals are placed between the veins; in some species of *Podocarpus* (sect. *Nageia*) a canal occurs below each vein; in *Tsuga*, *Torreya*, *Cephalotaxus*, *Sequoia*, &c., a single canal occurs below the midrib; in *Larix*, *Abies*, &c., two canals run through the leaf parallel to the margins. The stomata are frequently arranged in rows, their position being marked by two white bands of wax on the leaf-surface.

Distribution.

The chief home of the Coniferales is in the northern hemisphere, where certain species occasionally extend beyond the Arctic circle and penetrate beyond the northern limit of dicotyledonous trees. Wide areas are often exclusively occupied by Conifers, which give the landscape a sombre aspect, suggesting a comparison with the forest vegetation of the Coal period. South of the tree-limit a belt of Conifers stretches across North Europe, Siberia, and Canada. In Northern Europe this belt is characterized by such species as *Picea excelsa* (Spruce), which extends south to the mountains of the Mediterranean region; *Pinus sylvestris* (Scottish Fir), reaching from the far north to Western Spain, Persia, and Asia Minor; *Juniperus communis*, &c. In North Siberia *Pinus Cembra* (Cembra or Arolla Pine) has a wide range; also *Abies Sibirica* (Siberian Silver Fir), *Larix Sibirica*, and *Juniperus sabina* (Savin). In the North American area *Picea alba*, *P. nigra*, *Larix Americana*, *Abies balsamea* (Balsam Fir), *Thuja Canadensis* (Hemlock Spruce), *Pinus Strobus* (Weymouth Pine), *Thuja occidentalis* (White Cedar), *Taxus Canadensis* are characteristic species. In the Mediterranean region occur *Cupressus sempervirens*, *Pinus Pinea* (Stone Pine), species of Juniper, *Cedrus atlantica*, *C. Libani*, *Callitris quadrivalvis*, *Pinus montana*, &c. Several Conifers of economic importance are abundant on the Atlantic side of North America—*Juniperus Virginiana* (Red Cedar, used in the manufacture of lead pencils and extending as far south as Florida), *Taxodium distichum* (Swamp Cypress), *Pinus rigida* (Pitch Pine), *P. mitis* (Yellow Pine), *P. tæda*, *P. palustris*, &c. On the west side of the American continent Conifers play a still more striking rôle; among them are *Chamæcyparis nutkaensis*, *Picea sitchensis*, *Libocedrus decurrens*, *Pseudotsuga Douglasii* (Douglas Fir), *Sequoia sempervirens*, *S. gigantea* (the only two surviving species of this generic type are now confined to a few localities in California, but were formerly widely spread in Europe and elsewhere), *Pinus Coulteri*, *P. Lambertiana*, &c. Farther south, a few representatives of such genera as *Abies*, *Cupressus*, *Pinus*, and Juniper are found in the Mexican Highlands, tropical America, and the West Indies. In the Far East Conifers are richly represented; among them occur *Pinus densiflora*, *Cryptomeria japonica*, *Cephalotaxus*, species of *Abies*, *Larix*, *Thujopsis*, *Sciadopitys verticillata*, *Pseudolarix Kaempferi*, &c. In the Himalaya occur *Cedrus deodara*, *Taxus*, species of *Cupressus*, *Pinus excelsa*, *Abies Webbiana*, &c. *Libocedrus tetragona*, *Fitzroya patagonica*, *Araucaria brasiliensis*, *A. imbricata*,

Saxegothœa, and others are met with in the Andes and other regions in South America. *Athrotaxis* and *Microcachrys* are characteristic Australian types. *Phyllocladus* occurs also in New Zealand, and species of *Dacrydium*, *Araucaria*, *Agathis*, and *Podocarpus* are represented in Australia, New Zealand, and the Malay regions.

Gnetales.—These are trees or shrubs with simple leaves. The flowers are diœcious, rarely monœcious, provided with one or two perianths. The wood is characterized by the presence of vessels in addition to tracheids. There are no resin-canals. The three existing genera usually spoken of as members of the Gnetales differ from one another more than is consistent with their inclusion in a single family; we may therefore better express their diverse characters by regarding them as types of three separate families—(1) *Ephedroideœ*, genus *Ephedra;* (2) *Welwitschioideœ*, genus *Welwitschia;* (3) *Gnetoideœ*, genus *Gnetum*. Our knowledge of the Gnetales leaves much to be desired, but such facts as we possess would seem to indicate that this group is of special importance as foreshadowing, more than any other Gymnosperms, the Angiospermous type. In the more heterogeneous structure of the wood and in the possession of true vessels the Gnetales agree closely with the higher Flowering Plants. It is of interest to note that the leaves of *Gnetum*, while typically Dicotyledonous in appearance, possess a Gymnospermous character in the continuous and plate-like medullary rays of their vascular bundles. The presence of a perianth is a feature suggestive of an approach to the floral structure of Angiosperms; the prolongation of the integument furnishes the flowers with a substitute for a stigma and style. The genus *Ephedra*, with its prothallus and archegonia, which are similar to those of other Gymnosperms, may be safely regarded as the most primitive of the Gnetales. In *Welwitschia* also the megaspore is filled with prothallus-tissue, but single egg-cells take the place of archegonia. In certain species of *Gnetum* described by Karsten the megaspore contains a peripheral layer of protoplasm, in which scattered nuclei represent the female reproductive cells; in *Gnetum Gnemon* a similar state of things exists in the upper half of the megaspore, while the lower half agrees with the megaspore of *Welwitschia* in being full of prothallus-tissue, which serves merely as a reservoir of food. Lotsy has described the occurrence of special cells at the apex of the prothallus of *Gnetum Gnemon*, which he regards as imperfect archegonia (Fig. 17, C, *a*); he suggests they may represent vestigial structures pointing back to some ancestral form beyond the limits of the present group. The Gnetales probably had a separate origin from the other Gymnosperms; they carry us nearer to the Angiosperms, but we have as yet no satisfactory evidence that they represent a stage in the direct line of Angiospermic evolution. It is not improbable that the three genera of this ancient phylum survive as types of a blindly-ending branch of the Gymnosperms; but be that as it may, it is in the Gnetales more than in any other Gymnosperms that we find features which help us to obtain a dim prospect of the lines along which the Angiosperms may have been evolved.

Ephedra.—This genus is the only member of the Gnetales represented in Europe. Its species, which are characteristic of warm temperate latitudes, are usually much-branched shrubs. The finer branches are green, and bear a close resemblance to the stems of *Equisetum* and to the slender twigs of *Casuarina;* the surface of the long internodes is marked by fine longitudinal ribs, and at the nodes are borne pairs of inconspicuous scale-leaves. The flowers are small, and borne on axillary shoots. A single male flower consists of an axis enclosed at the base by an inconspicuous perianth formed of two concrescent leaves and terminating in two, or as many as eight, shortly stalked or sessile anthers. The female flower is enveloped in a closely fitting sac-like investment, which must be regarded as a perianth; within this is an orthotropous ovule surrounded by a single integument prolonged upwards as a beak-like micropyle. The flower may be described as a bud bearing a pair of leaves which become fused and constitute a perianth, the apex of the shoot forming an ovule. In function the perianth may be compared with a unilocular ovary containing a single ovule; the projecting integument, which at the time of pollination secretes a drop of liquid, serves the same purpose as the style and stigma of an angiosperm. The megaspore is filled with tissue as in typical Gymnosperms, and from some of the superficial cells 3 to 5 archegonia are developed, characterized by long multicellular necks. The archegonia are separated from one another, as in *Pinus*, by some of the prothallus-tissue, and the cells next the egg-cells (tapetal layer) contribute food-material to their development. After fertilization, some of the uppermost bracts below each flower become red and fleshy; the perianth develops into a woody shell, while the integument remains membranous. In some species of *Ephedra*, e.g., *E. altissima*, the fertilized eggs grow into tubular proembryos, from the tip of each of which embryos begin to be developed, but one only comes to maturity. In *Ephedra helvetica*, as described by Jaccard, no proembryo or suspensor is formed; but the most vigorous fertilized egg, after undergoing several divisions, becomes attached to a tissue, termed the columella, which serves the purpose of a primary suspensor; the columella appears to be formed by the lignification of certain cells in the central region of the embryo-sac. At a later stage some of the cells in the upper (micropylar) end of the embryo divide and undergo considerable elongation, serving the purpose of a secondary suspensor. The secondary wood of *Ephedra* consists of tracheids, vessels, and parenchyma; the vessels are characterized by their wide lumen and by the large simple or slightly-bordered pits on their oblique end-walls.

Gnetum.—This genus is represented by several species, most of which are climbing plants, both in tropical America and in warm regions of the Old World. The leaves, which are borne in pairs at the tumid nodes, are oval in form and have a Dicotyledonous type of venation. The male and female inflorescences have the form of simple or paniculate spikes. The spike of an inflorescence bears whorls of flowers at each node in the axils of concrescent bracts accompanied by numerous sterile hairs (paraphyses); in a male inflorescence numerous flowers occur at each node, while in a female inflorescence the number of flowers at each node is much smaller. A male flower consists of a single angular perianth, through the open apex of which the flower-axis projects as a slender column terminating in two anthers. The female flowers,

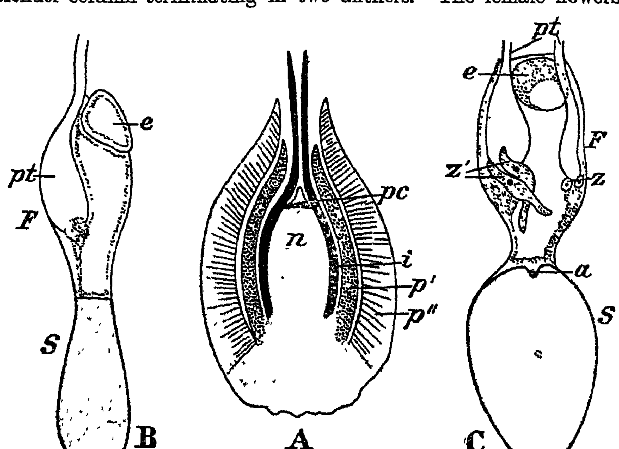


Fig. 17.—*Gnetum Gnemon.* A, female flower (*n*, nucellus; *pc*, pollen-chamber; *i*, integument; *p'*, inner perianth; *p''*, outer perianth). B, C, megaspore (*a*, imperfect archegonia; *e*, partially developed megaspore; *F*, fertile half; *S*, sterile half; *pt*, pollen-tube; *z*, zygote; *z'*, prothallus). (After Lotsy.)

which are more complex in structure, are of two types, complete and incomplete; the latter occur in association with male flowers in a male inflorescence. A complete female flower consists of a nucellus (Fig. 17, A, *n*), surrounded by a single integument (Fig. 17, A, *i*), prolonged upwards as a narrow tube and succeeded by an inner and an outer perianth (Fig. 17, A, *p'* and *p''*). The whole flower may be looked upon as an adventitious bud bearing two pairs of leaves; each pair becomes concrescent and forms a perianth, the apex of the shoot being converted into an orthotropous ovule. The incomplete female flowers are characterized by the almost complete suppression of the inner perianth. Several embryo-sacs (megaspores) are present in the nucellus of a young ovule, but one only attains full size, the smaller and partially developed megaspores (Fig. 17, B and C, *e*) being usually found in close association with the surviving and fully-grown megaspore. In *Gnetum Gnemon*, as described by Lotsy, a mature embryo-sac contains in the upper part (micropylar end) a large central vacuole and a peripheral layer of protoplasm, including several nuclei, which take the place of the archegonia of *Ephedra;* the lower part (chalazal end) of the embryo-sac, separated from the upper by a constriction, is full of parenchyma, which may be regarded as a prothallus. The upper part of the megaspore may be spoken of as the fertile half (Fig. 17, B and C, *F*), and the lower part, which serves only as food-reservoir for the growing embryo, may be termed the sterile half (Fig. 17, B and C, *S*). At the time of pollination the long tubular integument secretes a drop of fluid at its apex, which holds the pollen-grains, brought by the wind, or possibly to some extent by insect agency, and by evaporation these are drawn on to the top of the nucellus, where partial disorganization of the cells has given rise to an irregular pollen-chamber (Fig. 17, A, *pc*). The pollen-tube, containing two generative and one vegetative nucleus, pierces the wall of the megaspore and then becomes swollen (Fig. 17, B and C, *pt*); finally the two generative nuclei pass out of the tube and fuse with two of the nuclei in the fertile half of the megaspore. As the result of fertilization, the fertilized nuclei of the megaspore become surrounded by a cell-wall, and constitute zygotes, which may attach themselves either to the wall

of the megaspore or to the end of a pollen-tube (Fig. 17, C, z and z'); they then grow into long tubes or proembryos, which make their way towards the prothallus (C, z'), and eventually embryos are formed from the ends of the proembryo tubes. One embryo only comes to maturity. The embryo of *Gnetum* forms an outgrowth from the hypocotyl, which serves as a feeder and draws nourishment from the prothallus. The fleshy outer portion of the seed is formed from the outer perianth, the woody shell being derived from the inner perianth. The climbing species of *Gnetum* are characterized by the production of several concentric cylinders of secondary wood and bast, the additional cambium-rings being products of the pericycle, as in *Cycas* and *Macrozamia*. The structure of the wood agrees in the main with that of *Ephedra*.

Welwitschia.—This is by far the most remarkable member of the Gnetales, both as regards habit and the form of its flowers. In a supplement to the systematic work of Engler and Prantl the well-known name *Welwitschia*, instituted by Hooker in 1864 in honour of Welwitsch, the discoverer of the plant, is superseded by that of *Tumboa*, originally suggested by Welwitsch; but the more familiar name will, it is hoped, continue in general use as the recognized generic designation. *Welwitschia* is confined to certain localities in Damaraland on the west coast of tropical South Africa. A well-grown plant projects less than a foot above the surface of the ground; the stem, which may have a circumference of more than 12 feet, terminates in a depressed crown resembling a circular table with a median groove across the centre and prominent broad ridges concentric with the margin. The thick tuberous stem becomes rapidly narrower, and passes gradually downwards into a tap-root. A pair of small strap-shaped leaves succeed the two cotyledons of the seedling, and persist as the only leaves during the life of the plant; they retain the power of growth in their basal portion, which is sunk in a narrow groove near the edge of the crown, and the tough lamina, 6 feet in length, becomes split into narrow strap-shaped or thong-like strips which trail on the ground. Numerous circular pits occur on the concentric ridges of the depressed and wrinkled crown, marking the position of former inflorescences borne in the leaf-axil at different stages in the growth of the plant. An inflorescence has the form of a dichotomously-branched cyme bearing small erect cones; those containing the female flowers attain the size of a fir-cone, and are scarlet in colour. Each cone consists of an axis, on which numerous broad and thin bracts are arranged in regular rows; in the axil of each bract occurs a single flower; a male flower is enclosed by two opposite pairs of leaves, forming a perianth surrounding a central sterile ovule encircled by a ring of stamens united below, but free distally as short filaments, each of which terminates in a trilocular anther. The integument of the sterile ovule is prolonged above the nucellus as a spirally-twisted tube expanded at its apex into a flat stigma-like organ. A complete and functional female flower consists of a single ovule with two integuments, the inner of which is prolonged into a narrow tubular micropyle, like that in the flower of *Gnetum*. The megaspore of *Welwitschia* is filled with a prothallus-tissue before fertilization, and some of the prothallus-cells function as egg-cells; these grow upwards as long tubes into the apical region of the nucellus, where they come into contact with the pollen-tubes. After the egg-cells have been fertilized by the non-motile male cells they grow into tubular proembryos, producing terminal embryos. The stem is traversed by numerous collateral bundles, which have a limited growth, and are constantly replaced by new bundles developed from strands of secondary meristem. One of the best-known anatomical characteristics of the genus is the occurrence of numerous spindle-shaped or branched fibres with enormously-thickened walls studded with crystals of calcium oxalate.

AUTHORITIES.—**General.**—BENTHAM and HOOKER. *Genera Plantarum.* London, 1862–83.—ENGLER and PRANTL. *Die natürlichen Pflanzenfamilien.* Leipzig, 1889 and 1897.—STRASBURGER. *Die Coniferen und Gnetaceen.* Jena, 1872. *Die Angiospermen und die Gymnospermen.* Jena, 1879. *Histologische Beitrage,* iv. Jena, 1892. — COULTER. "The Origin of Gymnosperms, &c.," *Bot. Gaz.*, xxvi., 1898. — COULTER and CHAMBERLAIN. *Morphology of Spermatophytes.* New York, 1901.—**Cycadales.**—METTENIUS. "Beiträge zur Anatomie der Cycadeen," *Abh. K. Sächs. Ges. Wiss.*, 1860. — TREUB. "Recherches sur les Cycadées," *Ann. Bot. Jard. Buitenzorg,* ii., 1884. — SOLMS - LAUBACH. "Die Sprossfolge der Stangeria, &c.," *Bot. Zeit.*, xlviii., 1896.—WORSDELL. "Anatomy of Macrozamia," *Ann. Bot.*, x., 1896. "The Vascular Structure of the Sporophylls of Cycads," *Ann. Bot.*, xii., 1898. "The Comparative Anatomy of Encephalartos," *Trans. Linn. Soc.* (2), v., 1900.—SCOTT. "The Anatomical Characters presented by the Peduncle of Cycadaceæ," *Ann. Bot.*, xi., 1897.—LANG. "Studies in the Development and Morphology of Cycadean Sporangia, No. I.," *Ann. Bot.*, xi., 1897; No. II., *Ann. Bot.*, xiv., 1900.—WEBBER. "Development of the Antherozoids of Zamia," *Bot. Gaz.*, 1897. — IKENO. "Untersuchungen über die Entwickelung, &c., bei Cycas Revoluta," *Journ. Coll. Sci. Japan*, xii., 1898 (also *Pringsh. Jahrb.*, 1898).—**Ginkgoales.**—HIRASE. "Études sur la fécondation, &c., de Ginkgo biloba," *Journ. Coll. Sci. Japan,* xii., 1898. — SEWARD and GOWAN. "Ginkgo biloba," *Ann. Bot.*, xiv., 1900 (with bibliography).—IKENO. "Contribution à l'étude de la fécondation chez le Ginkgo biloba," *Ann. Sci. Nat.*, xiii., 1901.—**Coniferales.**—"Report of the Conifer Conference" (1891), *Journ. R. Hort. Soc.*, xiv., 1892. — BEISSNER. *Handbuch der Nadelholzkunde.* Berlin, 1891. — MASTERS. "Comparative Morphology of the Coniferæ," *Journ. Linn. Soc.*, xxvii., 1891; *ibid.*, 1896, &c.—PENHALLOW. "The Generic Characters of the North American Taxaceæ and Coniferæ," *Proc. and Trans. R. Soc. Canada*, ii., 1896.— BLACKMAN. "Fertilization in Pinus sylvestris," *Phil. Trans.*, 1898 (with bibliography).—WORSDELL. "Structure of the Female Flowers in Conifers," *Ann. Bot.*, xiv., 1900 (with bibliography); *ibid.*, 1899.—VEITCH. *Manual of the Conifers.* London, 1900. — **Gnetales.**—HOOKER. "On Welwitschia mirabilis," *Trans. Linn. Soc.*, xxiv., 1864.—BOWER. "Germination, &c., in Gnetum," *Journ. Mic. Sci.*, xxii., 1882; *ibid.*, 1881.—JACCARD. "Recherches embryologiques sur *l'Ephedra Helvetica*," *Diss. Inaug. Lausanne*, 1894.—KARSTEN. "Zur Entwickelungs-Geschichte der Gattung Gnetum," *Cohn's Beitrage*, vi., 1893.—LOTSY. "Contributions to the Life-History of the genus Gnetum," *Ann. Bot. Jard. Buitenzorg*, xvi., 1899. (A. C. SE.)

Gympie, goldfield municipality, in the county of March, Queensland, Australia, 107 miles north of Brisbane, with which it is connected by rail, and 61 miles south by rail from Maryborough. Numerous gold mines are worked in the district. The total value of the gold output to the end of 1899 amounted to £8,400,000. It also abounds in copper, silver, antimony, cinnabar, bismuth, and nickel. Extensive coal beds, as yet unworked, lie 40 miles to the north at Miva. Population (1871), 5800; (1901), 11,959.

"Gyp." See MARTEL, COMTESSE DE.

Gyroscope and **Gyrostat.**—The Gyroscope and Gyrostat are scientific models or instruments designed to illustrate experimentally the dynamics of rotating bodies, such as the spinning top, hoop, and bicycle, and also the precession of the equinoxes.

The instruments may be distinguished by calling the one a Gyroscope when the rotating wheel or disc is mounted in gimbals so that the principal axis of rotation always passes through a fixed point (Fig. 1). It can be made to imitate the motion of a spinning top of which the point is placed in a smooth agate cup, as in Maxwell's Dynamical Top (Figs. 2, 3) (*Collected Works*, i. p. 248). A bicycle wheel, with one of the ball bearings placed in a cup, can also be made to serve.

Gyroscope.

The Gyrostat is an instrument designed by Lord Kelvin (*Natural Philosophy*, § 345) to illustrate the more complicated state of motion of a spinning body when free to wander about on a horizontal plane, like a top spun on the pavement, or a hoop or bicycle on the road. It consists essentially of a massive fly-wheel concealed in a metal casing, and its behaviour on a table, or with various modes of suspension or support, serves to illustrate the curious reversal of the ordinary laws of statical equilibrium due to the *gyrostatic domination* of the interior invisible fly-wheel, when rotated rapidly (Fig. 4).

Gyrostat.

The toy shown in Figs. 5 and 6, which can be bought for one shilling, is acting as a gyroscope in Fig. 5 and a gyrostat in Fig. 6.

The Gyroscope, as represented in Fig. 2 by Maxwell's Dynamical Top, is provided with screws by which the centre of gravity can be brought into coincidence with the point of support. It can then be used to illustrate Poinsot's theory of the motion of a body under no forces, the gyroscope being made kinetically unsymmetrical by a setting of the screws. The discussion of this movement is required for Jacobi's theorems on the allied motion of a top and of a body under no forces (Poinsot, *Théorie nouvelle de la rotation des corps*, Paris, 1857; Jacobi, *Werke*, ii., Note B, p. 476).

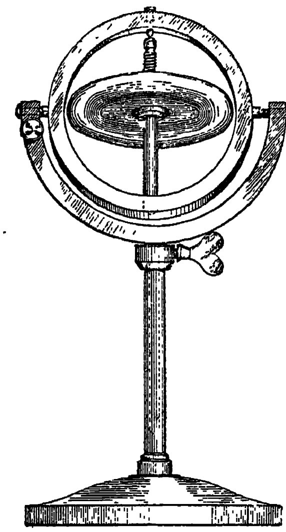


Fig. 1.

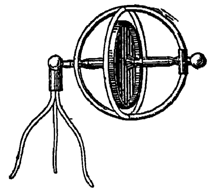


Fig. 5.

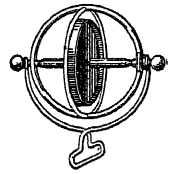


Fig. 6.

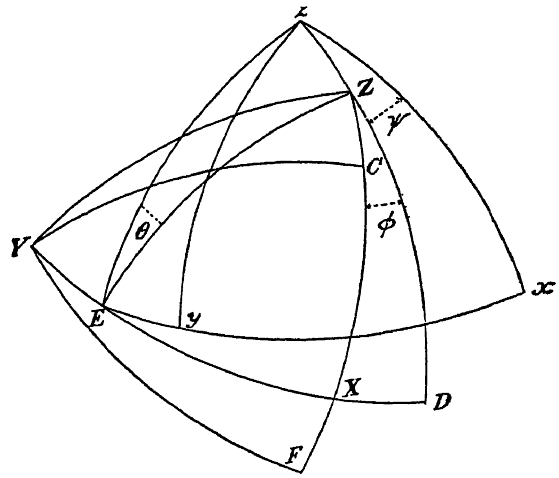


Fig. 10.

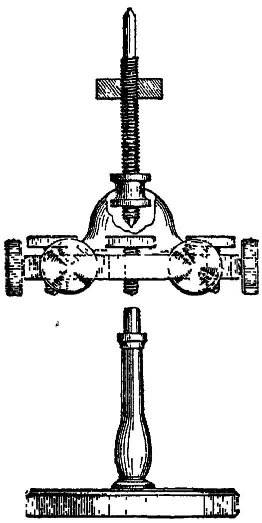
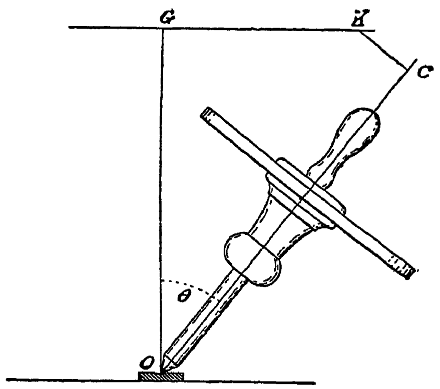


Fig. 2.



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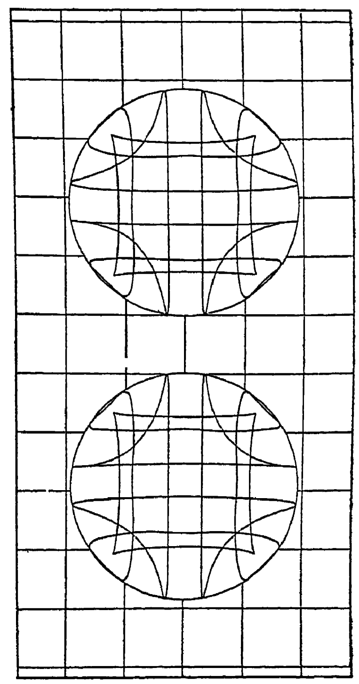

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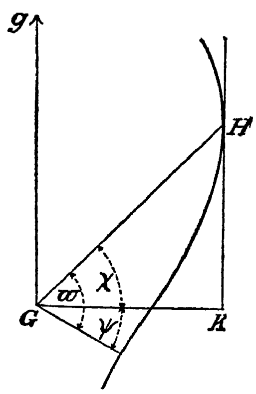


Fig. 8.

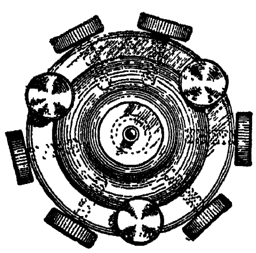


Fig. 3.

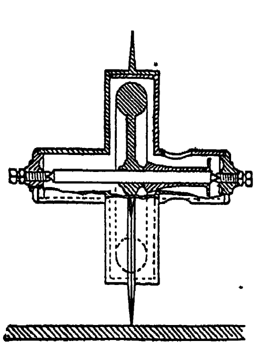


Fig. 4.

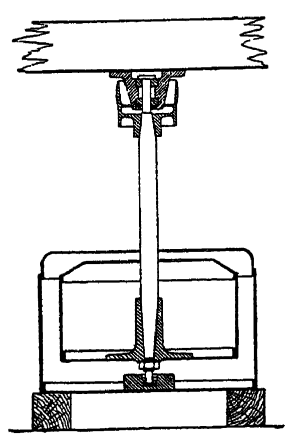


Fig. 9.

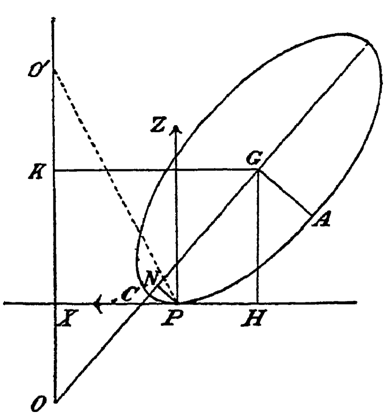


Fig. 12.

To imitate the movement of the top the centre of gravity G is displaced from the point of support O so as to give a preponderance; and the complete solution of the dynamical problem can now be carried out by single-valued elliptic functions, but only in the case of the *symmetrical* top, as it is called when OG is a principal axis of kinetic symmetry such that the moment of inertia about any axis OA at right angles to OG is the same. If this condition is not satisfied the top is called the *general* or *unsymmetrical* top, and the motion is complicated to such an extent as to have baffled the powers of mathematics, except for some special cases, discussed by Weierstrass, Kowalevski, Hess, Jukovsky, and others, principally the Russian mathematicians.

Symmetrical top.

Unsymmetrical top.

The motion of the Gyrostat, even if kinetically symmetrical, introduces analytical complications similar to those of the general unsymmetrical top, and here, too, we must await mathematical progress for a complete solution.

Contrasted mathematically, the motion of the Gyroscope, if symmetrical, can be expressed completely by the Elliptic Functions, but the Gyrostat and unsymmetrical top require functions of a higher order of complexity for a complete solution.

1. The physical constants of a given symmetrical top, expressed in C.G.S. units, which are employed in the subsequent formulæ, are denoted by M, h, C, and A. M is the weight in grammes (g) as given by the number of gramme weights which equilibrate the top when weighed in a balance; h is the distance OG in centimetres (cm.) between G the centre of gravity and O the point of support, and Mh may be called the preponderance; thus Mgh (dyne-cm.) is the moment of gravity about O when the axis OG is horizontal, Mgh sin θ being the moment when the axis OG makes an angle θ with the vertical, and $g=981$ (cm./s^2) on the average; C is the moment of inertia of the top about OG, and A about any axis through O at right angles to OG, both measured in g-cm.^{2}.

To measure A experimentally, swing the top freely about O in small plane oscillations, and determine the length, l cm., of the equivalent simple pendulum; then

$$(1)\qquad l=\frac{A}{Mh},\ A=Mhl.$$

Next make the top, or this simple pendulum, perform small conical revolutions, nearly coincident with the downward vertical position of equilibrium, and measure n, the mean angular velocity of the conical pendulum in radians / second; then

$$(2)\qquad n^2=\frac{g}{l}=\frac{Mgh}{A};$$

and $n/2\pi$ is the number of revolutions per second, $2\pi/n$ is the period of a revolution, in seconds.

2. In the popular explanation of the steady movement of the top at a constant inclination to the vertical, depending on the composition of angular velocities, such as given in Perry's *Spinning Tops*, or Worthington's *Dynamics of Rotation*, it is asserted that the moment of gravity is always generating an angular velocity about an axis OB perpendicular to the vertical plane GOC through the axis of the top OC; and this angular velocity, compounded with the resultant angular velocity about an axis OI, nearly coincident with OC, causes the axes OI and OC to keep taking up a new position by moving at right angles to the plane GOC, at a constant precessional angular velocity, say μ rad./sec., round the vertical OG (Fig. 7).

Steady motion of the top.

If, however, the axis OC is prevented from taking up this precessional velocity, the top at once falls down; thence all the ingenious attempts—for instance, in the swinging cabin of the Bessemer ship—to utilize the Gyroscope as a mechanical directive agency have always resulted in failure (*Engineer*, October 1874).

An experimental verification can be carried out with the Gyroscope in Fig. 1; so long as the vertical spindle is free to rotate in its socket, the rapidly rotating wheel will resist the impulse of tapping on the gimbal by moving to one side; but when the pinch screw prevents the rotation of the vertical spindle in the massive pedestal, this resistance to the tapping at once disappears, provided the friction of the table prevents the movement of the pedestal.

Familiar instances of the same principles are observable in the movement of a hoop, or in the steering of a bicycle; it is essential that the handles of the bicycle should be free to rotate to secure the stability of the movement.

The bicycle wheel, employed as a spinning top, can also be carried round a room held by the ball bearings, and will thus, when rotated rapidly, convey a distinct muscular impression of resistance to change of direction.

3. A demonstration, depending on the elementary principles of Dynamics, of the exact conditions required for the axis OC of a spinning top to spin steadily at a constant inclination θ to the vertical OG, is given here before proceeding to the more complicated question of the general motion, when θ, the inclination of the axis, is varying by nutation.

Elementary demonstration of the condition of steady motion.

It is a fundamental principle in Dynamics that if OH is a vector representing to scale the angular momentum of a system, and if Og is the vector representing the axis of the impressed couple or torque, then OH will vary so that the velocity of H is represented to scale by the impressed couple Og, and if the top is moving freely about O,

$$(1)\qquad Og=Mgh\sin\theta.$$

In the case of the steady motion of the top, the vector OH lies in the vertical plane GOC, in OK suppose (Fig. 7), and has a component OG=G about the vertical and a component OC=G′, suppose, about the axis OC; and G′=CR, if R denotes the angular velocity of the top with which it is spun about OC.

If μ denotes the constant precessional angular velocity of the vertical plane GOC, the components of angular velocity and momentum about OA are $\mu\sin\theta$ and $A\mu\sin\theta$, OA being perpendicular to OC in the plane GOC; so that the vector OK has the components

$$(2)\qquad OC=G',\ \text{and}\ CK=A\mu\sin\theta,$$

and the horizontal component

$$(3)\qquad GK=OC\sin\theta-CK\cos\theta$$
$$=G'\sin\theta-A\mu\sin\theta\cos\theta.$$

The velocity of K being equal to the impressed couple Og,

$$(4)\qquad Mgh\sin\theta=\mu\,.\,GK=\sin\theta\,(G'\mu-A\mu^2\cos\theta),$$

and dropping the factor sin θ,

$$(5)\qquad A\mu^2\cos\theta-G'\mu+Mgh=0,$$

the condition for steady motion.

Solving this as a quadratic in μ, the roots μ_1, μ_2 are given by

$$(6)\qquad \mu_1,\ \mu_2=\frac{G'}{2A}\sec\theta\left[1\mp\sqrt{(1-\frac{4AMgh}{G'^2}\cos\theta)}\right];$$

and the minimum value of G′=CR for real values of μ is given by

$$(7)\qquad \frac{G'^2}{4AMgh}=\cos\theta,\ \frac{CR}{An}=2\sqrt{(\cos\theta)};$$

for smaller values of R the top cannot spin steadily at the inclination θ to the upward vertical.

Interpreted geometrically

$$(8)\qquad \mu=\frac{Mgh\sin\theta}{GK}=\frac{CK}{A\sin\theta},$$

$$(9)\qquad CK\,.\,KG=AMgh\sin^2\theta;$$

and the maximum value of CK. KG is $\frac{1}{4}$OC^2 sin θ tan θ.

4. Suppose the top or gyroscope, instead of moving freely about the point O, is held in a ring or frame which is compelled to rotate about the vertical axis OG with constant angular velocity μ; then if N denotes the couple of reaction of the frame keeping the top from falling, acting in the plane GOC, equation (4) § 3 becomes modified into

Constrained motion of the gyroscope.

$$(1)\qquad Mgh\sin\theta-N=\sin\theta\,(G'\mu-A\mu^2\cos\theta),$$

$$(2)\qquad N=\sin\theta\,(A\mu^2\cos\theta-G'\mu+Mgh)$$
$$=A\sin\theta\cos\theta\,(\mu-\mu_1)\,(\mu-\mu_2);$$

and hence, as μ increases through μ_1 and μ_2, the sign of N can be determined, positive or negative, according as the tendency of the axis is to fall or rise.

When G′=CR is large, μ_2 is large, and

$$(3)\qquad \mu_1\approx\frac{Mgh}{G'}=\frac{An^2}{CR},$$

the same for all inclinations, and this is the precession observed in the spinning top and centrifugal machine.

If the axis of the top OC is pointing upwards, the precession is in the same direction as the rotation, and an increase of μ from μ_1 makes N negative, and the top rises; conversely a decrease of the precession μ causes the axis to fall (Perry, *Spinning Tops*, p. 48).

If the axis points downwards, as in the centrifugal machine with upper support, the precession is in the opposite direction to the rotation, and to make the axis approach the vertical position the precession must be reduced.

This is effected automatically in the Weston centrifugal machine (Fig. 9) by the friction of the indiarubber cushions above the support; or else the spindle is produced downwards below the drum a short distance, and turns in a hole in a weight resting on the bottom of the case, which weight is dragged round until the spindle is upright; this second

Centrifugal machine.

arrangement is more effective when liquids are treated in the drum, and wave action is set up (*The Centrifugal Machine*, C. A. Matthey).

Similar considerations apply to the stability of the whirling bowl in a cream-separating machine.

5. If the preponderance is absent, by making the C.G coincide with O, and if $A\mu$ is insensible compared with G',

(1) $$N = -G'\mu \sin\theta,$$

the formula which suffices to explain most gyroscopic action.

Gyroscopic action of railway wheels. Thus a train running round a curve experiences, in consequence of the rotation of the wheels, an increase of pressure Z on the outer rail, and a diminution Z on the inner, giving a couple, if a is the gauge,

(2) $$Za = G'\mu,$$

tending to help the centrifugal force to upset the train; and if c is the radius of the curve, b of the wheels, C their moment of inertia, and v the velocity of the train,

(3) $$\mu = \frac{v}{c},\ G' = C\frac{v}{b},$$

(4) $$Z = C\frac{v^2}{abc}\ \text{(dynes)},$$

so that Z is the fraction C/Mab of the centrifugal force Mv^2/c.

Model to illustrate drift in artillery. A gyroscope mounted axially in a small truck which runs on a model switchback road can be used to illustrate the drift from the vertical plane of fire observed with rifled projectiles.

With the right-handed rotation as usually imparted in artillery, the truck drifts to the $\left\{\begin{matrix}\text{left}\\\text{right}\end{matrix}\right\}$ on the $\left\{\begin{matrix}\text{convex}\\\text{concave}\end{matrix}\right\}$ part of the track, because the couple required for deflecting the axis of the gyroscope is supplied by the sidelong friction of the track on the wheels; and the tendency of the truck is to move against the direction of the applied force.

But the projectile in its trajectory with upward convexity drifts on the whole to the right, so that the real dynamical interpretation of drift in artillery must be sought elsewhere.

The gyroscopic action of dynamos, and other rapidly rotating machinery on a ship, due to its rolling and pitching, can be evaluated in a similar elementary manner (Worthington, *Dynamics of Rotation*).

6. If the axis OG is inclined at an angle α to the vertical, the equation (2) § 4 becomes

(1) $$N = \sin\theta\,(A\mu^2\cos\theta - G'\mu) + Mgh\sin(\theta - \alpha).$$

Suppose, for instance, that OG is parallel to the Earth's axis, and that the frame is fixed in the meridian; then α is the co-latitude, and μ is the angular velocity of the Earth, the square of which may be neglected; so that, putting $N=0$, $\theta - \alpha = E$,

(2) $$Mgh\sin E - G'\mu\sin(\alpha + E) = 0,$$

(3) $$\tan E = \frac{G'\mu\sin\alpha}{Mgh - G'\mu\cos\alpha} \approx \frac{G'\mu}{Mgh}\sin\alpha.$$

The barogyroscope. This is the theory of Gilbert's barogyroscope, described in Appell's *Mécanique rationelle*, ii. p. 387: it consists essentially of a rapidly rotated gyrostat, mounted on knife-edges by an axis perpendicular to its axis of rotation and pointing east and west; spun with considerable angular momentum G', and provided with a slight preponderance Mh, it should tilt to an angle E with the vertical, and thus demonstrate experimentally the rotation of the Earth.

Foucault's gyroscope. In Foucault's gyroscope (*Comptes Rendus*, 1852; Perry, p. 105) the preponderance is made zero, and the axis points to the pole, when free to move in the meridian.

Generally, if constrained to move in any other plane, the axis seeks the position nearest to the polar axis, like a dipping needle with respect to the magnetic pole. (*A gyrostatic working model of the magnetic compass*, by Sir W. Thomson. British Association Report, Montreal, 1884. A. S. Chessin, St Louis Academy of Science, January 1902.)

Gyroscopic horizon. A spinning top with a polished upper plane surface will provide an artificial horizon at sea, when the real horizon is obscured. The first instrument of this kind was constructed by Serson, and is described in the *Gentleman's Magazine*, vol. xxiv., 1754; also by Segner in his *Specimen theoriæ turbinum* (Halæ, 1755). The inventor was sent to sea by the Admiralty to test his instrument, but he was lost in the wreck of the *Victory*, 1744. A copy of the Serson top, from the royal collection, is now in the Museum of King's College, London. Troughton's Nautical Top (1819) is intended for the same purpose.

The instrument is in favour with French navigators; but it must be noticed that the horizon given by the top is inclined to the true horizon at the angle E given by equation (3) above; and if μ_1 is the precessional angular velocity as given by (3) § 4, and $T = 2\pi/\mu$, its period in seconds,

(4) $$\tan E = \frac{\mu}{\mu_1}\cos\text{lat} = \frac{T\cos\text{lat}}{86400},\ \text{or } E = \frac{\cos\text{lat}}{4\mu_1},$$

if E is expressed in minutes, taking $\mu = 2\pi/86400$; thus making the true latitude E nautical miles to the south of that given by the top (*Revue maritime*, 1890; *Comptes Rendus*, 1896).

Euler's coordinate angles. 7. In the ordinary treatment of the general theory of the gyroscope, the motion is referred to two sets of rectangular axes; the one Ox, Oy, Oz fixed in space, with Oz vertically upwards; and the other OX, OY, OZ fixed in the rotating wheel with OZ in the axis of figure OC.

The relative position of the two sets of axes is given by means of Euler's unsymmetrical angles θ, ϕ, ψ, such that the successive turning of the axes Ox, Oy, Oz through the angles (i) ψ about Oz, (ii) θ about OE, (iii) ϕ about OZ, brings them into coincidence with OX, OY, OZ, as shown in Fig. 10, representing the *concave* side of a spherical surface.

The component angular velocities about OD, OE, OZ are

(1) $$-\dot\psi\sin\theta,\ \dot\theta,\ \dot\phi + \dot\psi\cos\theta;$$

so that, denoting the components about OX, OY, OZ by P, Q, R,

(2) $$\begin{aligned} P &= \dot\theta\sin\phi - \dot\psi\sin\theta\cos\phi,\\ Q &= \dot\theta\cos\phi + \dot\psi\sin\theta\sin\phi,\\ R &= \dot\phi + \dot\psi\cos\theta. \end{aligned}$$

Consider, for instance, the motion of a fly-wheel of preponderance Mh, and equatoreal moment of inertia A, of which the axis OC is held in a light ring ZC at a constant angle γ with OZ, while OZ is held by another ring zZ, which constrains it to move round the vertical Oz at a constant inclination θ with constant angular velocity μ, so that

(3) $$\dot\theta = 0,\ \dot\psi = \mu;$$

(4) $$P = -\mu\sin\theta\cos\phi,\ Q = \mu\sin\theta\sin\phi,\ R = \dot\phi + \mu\cos\theta.$$

The components of angular velocity and momentum about OF, OY, are

(5) $$P\cos\gamma - R\sin\gamma,\ Q,\ \text{and } A(P\cos\gamma - R\sin\gamma),\ AQ,$$

so that, denoting the components of angular momentum of the fly-wheel about OC, OX, OY, OZ by K, h_1, h_2, h_3,

(6) $$h_1 = A(P\cos\gamma - R\sin\gamma)\cos\gamma + K\sin\gamma,$$

(7) $$h_2 = AQ,$$

(8) $$h_3 = -A(P\cos\gamma - R\sin\gamma)\sin\gamma + K\cos\gamma;$$

and the dynamical equation

(9) $$\frac{dh_3}{dt} - h_1Q + h_2P = N,$$

with K constant, and

(10) $$N = -Mgh\sin\gamma\cos zY = -Mgh\sin\gamma\sin\theta\sin\phi,$$

reduces to

(11) $$A\frac{d^2\phi}{dt^2}\sin\gamma - A\mu^2\sin\gamma\sin^2\theta\sin\phi\cos\phi + A\mu^2\cos\gamma\sin\theta\cos\theta\sin\phi - (K\mu - Mgh)\sin\theta\sin\phi = 0.$$

The positions of relative equilibrium are given by

(12) $$\sin\phi = 0,\ \text{and}\ \cos\phi = \frac{A\mu^2\cos\gamma\cos\theta - K\mu + Mgh}{A\mu^2\sin\gamma\sin\theta}.$$

For small values of μ the equation becomes

(13) $$A\frac{d^2\phi}{dt^2}\sin\gamma - (K\mu - Mgh)\sin\theta\sin\phi = 0,$$

so that $\phi = \pi$ or 0 gives the position of equilibrium, and the period of a small oscillation is $2\pi\sqrt{\{A\sin\gamma/(K\mu \sim Mgh)\sin\theta\}}$.

In the general case, denoting the periods of vibration about $\phi = \pi$, 0, and the sidelong position of equilibrium by $2\pi/(n_1, n_2, \text{or } n_3)$, we shall find

(14) $$n_1^2 = \frac{\sin\theta}{A\sin\gamma}\{K\mu - Mgh - A\mu^2\cos(\gamma - \theta)\},$$

(15) $$n_2^2 = \frac{\sin\theta}{A\sin\gamma}\{Mgh - K\mu + A\mu^2\cos(\gamma + \theta)\},$$

(16) $$n_3 = n_1 n_2/\mu\sin\theta.$$

The first integral of (11) gives

(17) $$\tfrac{1}{2}A\left(\frac{d\phi}{dt}\right)^2\sin\gamma + \tfrac{1}{2}A\mu^2\sin\gamma\sin^2\theta\cos^2\phi - A\mu^2\cos\gamma\sin\theta\cos\theta\cos\phi + (K\mu - Mgh)\sin\theta\cos\phi - H = 0,$$

and putting $\tan\frac{1}{2}\phi = z$, this reduces to

(18) $$\frac{dz}{dt} = n\sqrt{Z}$$

where Z is a quadratic in z^2, so that z is a Jacobian elliptic function of t, and we have

(19) $$\tan\tfrac{1}{2}\phi = C(\text{tn, dn, nc, or cn})nt,$$

according as the ring ZC performs complete revolutions, or oscillates about a sidelong position of equilibrium, or oscillates about the stable position of equilibrium $\phi = \pi$, or 0.

Suppose Oz is parallel to the Earth's axis, and μ is the diurnal rotation, the square of which may be neglected, then if Gilbert's barogyroscope of § 6 has the knife-edges turned in azimuth to make

an angle β with E. and W., we must put $\gamma=\frac{1}{2}\pi$, $\cos\theta=\sin\alpha\sin\beta$; and putting $\phi=\delta+\text{E}$, where δ denotes the angle between $\text{Z}z$ and the vertical plane $\text{Z}\zeta$ through the zenith ζ,

(20). $\sin\theta\cos\delta=\cos\alpha$, $\sin\theta\sin\delta=\sin\alpha\cos\beta$;

so that equations (9) and (10) for relative equilibrium reduce to

(21) $-\text{K}\mu\sin\theta\sin(\delta+\text{E})+\text{M}gh\sin\text{E}=0$,

and will change (3) § 6 into

(22) $$\tan\text{E}=\frac{\text{K}\mu\sin\alpha\cos\beta}{\text{M}gh-\text{K}\mu\cos\alpha}$$

(Gilbert, *Comptes Rendus*, 1882, p. 197).

8. In the general motion of the top, when the axis performs nutation, the vector OH of resultant angular momentum is no longer compelled to lie in the vertical plane GOC, OC being placed in OZ; but since the axis Og of the torque of gravity is always horizontal, H will describe a curve (a Poinsot herpolhode) in a fixed horizontal plane, at a height OG above O, the vertical vector OG representing the constant component G of angular momentum about the vertical.

General motion of the top.

The component G′ of the angular momentum of the top about its axis OC remains constant also, as there is nothing to alter it in the symmetrical top.

Expressed by Euler's angles θ and ψ, the vector OH has the components (Figs. 7 and 8)

$$\text{OC}=\text{G}',\ \text{CK}=\text{A}\sin\theta\frac{d\psi}{dt},\ \text{KH}=\text{A}\frac{d\theta}{dt}.$$

The velocity of H is equal to the torque of gravity $\text{M}gh\sin\theta$, perpendicular to the plane GOC, so that the *hodograph* of the curve of H (turned backwards through a right angle) is given by the vector $\text{M}gh\sin\theta e^{\psi i}$, and is therefore similar to the curve of the projection of C on a horizontal plane; so that, denoting the polar co-ordinates of H in the horizontal plane GHK by ρ and ϖ, the associated motion of the axis of the top is given by

(1) $$\text{M}gh\sin\theta e^{\psi i}=-i\frac{d}{dt}(\rho e^{\varpi i})$$

and loops in the curve of C correspond to undulations of H. Resolving in the radial direction GH for the curve of H,

(2) $$\frac{d\rho}{dt}=\text{M}gh\sin\theta\cos\text{GHK}=\text{M}gh\sin\theta\frac{\text{KH}}{\rho}$$

(3) $$\rho\frac{d\rho}{dt}=\text{AM}gh\sin\theta\frac{d\theta}{dt},$$

and integrating,

(4) $\frac{1}{2}\rho^2=\text{AM}gh(\text{E}-\cos\theta)$.

To make the equations homogeneous, put

(5) $\text{OG}=\delta,\ \text{OC}=\delta',\ 4\text{AM}gh=k^2$;

so that

(6) $\rho^2=\frac{1}{2}k^2(\text{E}-\cos\theta)$;

and denoting the perpendicular GK on the tangent at H by p,

(7) $p\sin\theta=\text{OC}-\text{OG}\cos\theta=\delta'-\delta\cos\theta$,

so that, eliminating θ,

(8) $$p^2=\frac{(\delta'-\delta\cos\theta)^2}{\sin^2\theta}=\frac{\{\delta'k^2-\delta(\text{E}k^2-2\rho^2)\}^2}{k^4-(\text{E}k^2-2\rho^2)^2}$$

(9) $$\rho^2-p^2=\frac{\text{R}}{k^4-(\text{E}k^2-2\rho^2)^2},$$

(10) $$\tan\text{KGH}=\frac{\sqrt{\text{R}}}{\delta'k^2-\delta(\text{E}k^2-2\rho^2)},$$

where

(11) $\text{R}=\rho^2\{k^4-(\text{E}k^2-2\rho^2)^2\}-\{\delta'k^2-\delta(\text{E}k^2-2\rho^2)\}^2$

and the diameter of curvature

(12) $$\frac{d\rho^2}{dp}=\frac{\frac{1}{2}k^2\text{E}\sin^3\theta}{\delta-\delta'\cos\theta}.$$

These will be found to be the equations which represent the characteristic geometrical properties of a Poinsot herpolhode, defined as the trace on a fixed tangent plane of the point of contact of a rolling quadric surface, moving about a fixed centre.

Thus, if $\delta=\pm\delta'$, as in Klein's *rosette curves* of the spinning top, in which the axis passes periodically through the highest or lowest vertical position, the quadric surface reduces to a plate, and the herpolhode is the projection of a geodesic line on a prolate spheroid.

In the steady motion of § 3 the rolling quadric surface is of revolution, and the top has a regular precession except when, as in § 4, the top is spun rapidly and K is close to C in Fig. 7; the rolling surface is now an attenuated rod-like figure, not necessarily of revolution, and a tremulous (*pseudo-regular*, Klein) precession of the top can ensue, such as would be generated if the top was spun rapidly and then dropped with its point in the cup O.

Darboux has shown that the motion of the axis of the top can be realized mechanically by means of an articulated hyperboloid, formed of rods placed along the generating lines and bound together at the points of crossing (Despeyrous, *Mécanique*, ii. p. 527). If O and H are at opposite ends of a diameter of this hyperboloid, and OG, OC are the generating lines through O, then as H is moved on the plane GHK along the herpolhode, keeping OG and the parallel generator through H vertical, the generating line OC will follow the motion of the axis of a top.

The curve of H on the rolling quadric is a line of curvature on an ellipsoid and hyperboloid of two sheets, confocal with the deformable hyperboloid (*Proceedings London Math. Society*, xxvi., xxvii.).

Since

(13) $\text{KH}^2=\text{GH}^2-\text{GK}^2$

(14) $$\text{A}^2\left(\frac{d\theta}{dt}\right)^2=2\text{AM}gh(\text{E}-\cos\theta)-\frac{(\text{G}'-\text{G}\cos\theta)^2}{\sin^2\theta},$$

and putting $\cos\theta=z,\ \frac{\text{M}gh}{\text{A}}=n^2,$

(15) $$\left(\frac{dz}{dt}\right)^2=2n^2\text{Z},$$

(16) $$\text{Z}=(\text{E}-z)(1-z^2)-\frac{(\text{G}'-\text{G}z)^2}{2\text{AM}gh}=(\text{E}-z)(1-z^2)-2\left(\frac{\delta'-\delta z}{k}\right)^2.$$

Denoting the roots of $\text{Z}=0$ by z_1, z_2, z_3, arranged in the order

(17) $z_1>1>z_2>z>z_3>-1$,

then with $\frac{d\theta}{dt}$ positive, $\frac{dz}{dt}$ negative, as in Fig. 7,

(18) $$nt=\int_z^{z_2}\frac{dz}{\sqrt{2\text{Z}}},$$

an elliptic integral of the first kind; and, by inversion, z is an elliptic function of t.

To make the reduction to Legendre's standard form, put

(19) $z=z_2\sin^2\phi+z_3\cos^2\phi$,

(20) $z-z_3=(z_2-z_3)\sin^2\phi$,

(21) $z_2-z=(z_2-z_3)\cos^2\phi$,

(22) $z_1-z=(z_1-z_3)\Delta^2\phi$,

(23) $$\kappa^2=\frac{z_2-z_3}{z_1-z_3},\ \kappa'^2=\frac{z_1-z_3}{z_1-z_3}.$$

Then

(24) $$nt=\sqrt{\left(\frac{2}{z_1-z_3}\right)}\int_\phi^{\frac{1}{2}\pi}\frac{d\phi}{\Delta\phi}=\sqrt{\left(\frac{2}{z_1-z_3}\right)}(\text{K}-\text{F}\phi).$$

(25) $$\text{F}\phi=\text{K}-mt,\ mt=\sqrt{\left(\frac{z_1-z_3}{2}\right)}nt.$$

In Jacobi's notation,

(26) $\phi=\text{am}(\text{K}-mt)$;

and in Gudermann's notation,

(27) $z=z_2\text{sn}^2(\text{K}-mt)+z_3\text{cn}^2(\text{K}-mt)$.

Denoting the roots of $\text{R}=0$ in (11) by ρ_1^2, ρ_2^2, ρ_3^2, then (18) becomes

(28) $$nt=\int_{\rho_2}^{\rho}\frac{kd\rho^2}{\sqrt{\text{R}}},$$

and

(29) $\rho^2=\rho_2^2\text{sn}^2(\text{K}-mt)+\rho_3^2\text{cn}^2(\text{K}-mt)$.

Again, resolving transversely to GH, or rather, taking the moment of the velocity V of H round G,

(30) $$p\text{V}=\rho^2\frac{d\varpi}{dt}=\text{O}g.\text{GK}=\text{M}gh\sin\theta.\text{GK},$$
$$=\text{M}gh(\text{G}'-\text{G}\cos\theta)=\tfrac{1}{2}nk(\delta'-\delta z);$$

so that, from (7)

(31) $$\text{V}=\tfrac{1}{2}nk\sin\theta=\tfrac{1}{2}\frac{n}{k}\sqrt{\{k^4-(\text{E}k^2-2\rho^2)^2\}},$$

(32) $$\frac{d\varpi}{dt}=\frac{\text{G}'-\text{G}z}{2\text{A}(\text{E}-z)},$$

(33) $$\varpi=\frac{\text{G}t}{2\text{A}}+\frac{\text{G}'-\text{EG}}{2\text{A}}\int\frac{dt}{\text{E}-z},$$
$$=\frac{\delta}{k}nt+\frac{\delta'-\text{E}\delta}{k}\int_z^{z_2}\frac{dz}{(\text{E}-z)\sqrt{2\text{Z}}},$$
$$=\frac{\delta}{k}nt+\tfrac{1}{2}\int_{\rho_2}^{\rho}\frac{(\delta'-\text{E}\delta)k^2\delta\rho^2}{\rho^2\sqrt{\text{R}}}$$

involving an elliptic integral of the third kind; (29) and (33) give the analytical determination of the curve of H.

Denoting the angle KGH by χ,

$$(34)\qquad \tan\chi=\frac{\mathrm{KH}}{\mathrm{GK}}=\frac{\mathrm{A}\sin\theta\frac{d\theta}{dt}}{\mathrm{GK}\sin\theta}=\frac{\sqrt{2\mathrm{AM}gh\mathrm{Z}}}{\mathrm{G}'-\mathrm{G}z},$$

$$(35)\qquad \sin\theta e^{\chi i}=\frac{2\frac{\delta'-\delta z}{k}+i\sqrt{2\mathrm{Z}}}{\sqrt{2(\mathrm{E}-z)}},$$

and

$$(36)\qquad \psi=\varpi-\chi,$$

so that ψ is given by one elliptic integral of the third kind.

But the component of angular momentum round the vertical

$$(37)\qquad \mathrm{OC}\cos\theta+\mathrm{CK}\sin\theta=\mathrm{G}'\cos\theta+\mathrm{A}\sin^2\theta\frac{d\psi}{dt}=\mathrm{G},$$

so that

$$(38)\qquad \frac{d\psi}{dt}=\frac{\mathrm{G}-\mathrm{G}'\cos\theta}{\mathrm{A}\sin^2\theta}=\frac{\mathrm{G}-\mathrm{G}'z}{\mathrm{A}(1-z^2)}$$
$$=\frac{\mathrm{G}-\mathrm{G}'}{2\mathrm{A}},\ \frac{1}{1-z}+\frac{\mathrm{G}+\mathrm{G}'}{2\mathrm{A}},\ \frac{1}{1+z},$$

which gives ψ by the sum of two elliptic integrals of the third kind; their addition into a single integral of the third kind (Legendre) being shown in (33).

The reduction of (18) to the standard form of Weierstrass is effected by putting

$$(39)\qquad \wp u-e_a=s-s_a=\tfrac{1}{2}\lambda^2(z-z_a)=\lambda^2\frac{\rho_a^2-\rho^2}{k^2},\ a=1,2,3,$$

where λ is a homogeneity factor at our disposal; and now

$$(40)\qquad nt=\int_s^{s_2}\frac{\lambda\,ds}{\sqrt{\mathrm{S}}},\ \mathrm{S}=4(s-s_1)(s-s_2)(s-s_3),$$

$$(41)\qquad \wp'^2u=\mathrm{S}=\tfrac{1}{2}\lambda^6\mathrm{Z}=\lambda^6\frac{\mathrm{R}}{k^6},$$

$$(42)\qquad u=\int_s^\infty\frac{ds}{\sqrt{\mathrm{S}}}=\int_{s_2}^\infty\frac{ds}{\sqrt{\mathrm{S}}}+\int_s^{s_2}\frac{ds}{\sqrt{\mathrm{S}}}=\omega_2+\frac{nt}{\lambda}.$$

If v, σ, Σ denote the values of u, s, S corresponding to $z=\mathrm{E}$, $\rho^2=0$,

$$(43)\qquad \wp v-\wp u=\tfrac{1}{2}\lambda^2(\mathrm{E}-z)=\lambda^2\frac{\rho^2}{k^2},$$

$$(44)\qquad i\wp'v=-\sqrt{(-\Sigma)}=\lambda^3\frac{\delta'-\mathrm{E}\delta}{k},$$

$$(45)\qquad \begin{aligned} z_1 &> \Sigma > z_2 > z > z_3,\\ \rho_1^2 &< 0 < \rho_2^2 < \rho^2 < \rho_3^2,\\ s_1 &> \sigma > s_2 > s > s_3,\end{aligned}$$

so that

$$(46)\qquad v=\omega_1+f\omega_3,\ \text{where } f \text{ is a real fraction.}$$

Then (33) becomes

$$(47)\qquad \varpi=\frac{\delta}{k}nt+\tfrac{1}{2}\int\frac{i\wp'v\,du}{\wp v-\wp u},$$

with the elliptic integral of the third kind in the standard form.

Darboux puts

$$(48)\qquad \frac{\delta}{k}=\frac{\mathrm{L}}{\lambda},\ \frac{\delta'}{k}=\frac{\mathrm{B}}{\lambda},$$

so that

$$(49)\qquad \mathrm{Z}=(\mathrm{E}-z)(1-z^2)-2\left(\frac{\mathrm{B}-\mathrm{L}z}{\lambda}\right)^2.$$

Adding equations (43)

$$(50)\qquad 3\wp v=\tfrac{1}{2}\lambda^2(3\mathrm{E}-z_1-z_2-z_3)=\lambda^2\mathrm{E}-\mathrm{L}^2.$$

$$(51)\qquad \lambda^2\mathrm{E}=\mathrm{L}^2+3\wp v,$$

$$(52)\qquad \lambda^2z=\lambda^2\mathrm{E}-2(\wp v-\wp u)=\mathrm{L}^2+\wp v+2\wp u.$$

Equation (44) becomes

$$(53)\qquad i\wp'v=\lambda^2(\mathrm{B}-\mathrm{LE})=\lambda^2\mathrm{B}-\mathrm{L}^3-3\mathrm{L}\wp v,$$

$$(54)\qquad \lambda^2\mathrm{B}=\mathrm{L}^3+3\mathrm{L}\wp v+i\wp'v.$$

Again

$$(55)\qquad \begin{aligned}2\wp''v&=\lambda^4\{3\mathrm{E}^2-2\mathrm{E}(z_1+z_2+z_3)+z_2z_3+z_3z_1+z_1z_2\}\\ &=\lambda^4\left(\mathrm{E}^2-4\mathrm{E}\frac{\mathrm{L}^2}{\lambda^2}+4\frac{\mathrm{LB}}{\lambda^2}-1\right)\\ &=\lambda^4(\mathrm{E}^2-1)+4\mathrm{L}\lambda^2(\mathrm{B}-\mathrm{LE})\\ &=\lambda^4(\mathrm{E}^2-1)+4\mathrm{L}i\wp'v;\end{aligned}$$

so that

$$(56)\qquad \begin{aligned}\lambda^4&=\lambda^4\mathrm{E}^2+4\mathrm{L}i\wp'v-2\wp''v\\ &=(\mathrm{L}^2+3\wp v)^2+4\mathrm{L}i\wp'v-2\wp''v,\end{aligned}$$

thus determining the homogeneity factor λ, when the data are L and v, and now

$$(57)\qquad \frac{\mathrm{G}}{2\sqrt{\mathrm{AM}gh}}=\frac{\delta}{k}=\frac{\mathrm{L}}{\lambda},$$

$$(58)\qquad \frac{\mathrm{G}'}{2\sqrt{\mathrm{AM}gh}}=\frac{\delta'}{k}=\frac{\mathrm{B}}{\lambda}$$
$$=\frac{\mathrm{L}^3+3\mathrm{L}\wp v+i\wp'v}{\lambda^3}.$$

The motion of the centre of a sphere, rolling and spinning in the interior of a spherical bowl, or on the top of a sphere, is found to be of the same character as the motion of the axis of a spinning top.

Suppose the top, spinning upright, receives a small tap, which imparts an angular velocity ω to the axis; then

$$(59)\qquad \delta'=\delta,\ \mathrm{E}=1+\frac{\omega^2}{2n^2},\ z_2=1;$$

and putting

$$(60)\qquad 1-z=2\sin^2\tfrac{1}{2}\theta=2x^2,$$

$$(61)\qquad \begin{aligned}2\mathrm{Z}&=16x^2\left\{\left(x^2+\frac{\omega^2}{4n^2}\right)(1-x^2)-\frac{\delta^2}{k^2}x^2\right\}\\ &=16x^2(x_1^2+x^2)(x_3^2-x^2).\end{aligned}$$

We must distinguish three cases:

I. $\qquad \delta>k.$

$$(62)\qquad \begin{aligned}x_3^2&=-\frac{1}{2}\left(\frac{\delta^2}{k^2}-1+\frac{\omega^2}{4n^2}\right)+\frac{1}{2}\sqrt{\left\{\left(\frac{\delta^2}{k^2}-1+\frac{\omega^2}{4n^2}\right)^2+\frac{\omega^2}{n^2}\right\}}\\ &\fallingdotseq\frac{\omega^2}{4n^2}\Big/\left(\frac{\delta^2}{k^2}-1\right),\end{aligned}$$

so that x_3 is proportional to ω, and the upright position of the top is stable.

Then

$$x=x_3\cos\sqrt{\left(\frac{\delta^2}{k^2}-1\right)}nt,$$

making $\frac{n}{2\pi}\sqrt{\left(\frac{\delta^2}{k^2}-1\right)}$ complete oscillations per second.

II. $\qquad \delta=k.$

$$(63)\qquad x_3^2=-\frac{\omega^2}{8n^2}+\sqrt{\left(\frac{\omega^2}{4n^2}+\frac{\omega^4}{64n^2}\right)}\fallingdotseq\frac{\omega}{2n},$$

and the upright position is still stable; and now $x=x_3\mathrm{cl}\sqrt{(\omega n)}t$.

III. $\qquad \delta<k.$

$$(64)\qquad \begin{aligned}x_3^2&=\frac{1}{2}\left(1-\frac{\delta^2}{k^2}-\frac{\omega^2}{4n^2}\right)+\frac{1}{2}\sqrt{\left\{\left(1-\frac{\delta^2}{k^2}-\frac{\omega^2}{4n^2}\right)t+\frac{\omega^2}{n^2}\right\}}\\ &\fallingdotseq 1-\frac{\delta^2}{k^2},\end{aligned}$$

so that $\theta_3=2\cos^{-1}\delta/k$, and the axis falls away to this inclination however small the tap, so that the upright position is unstable.

Ultimately

$$x=x_3\operatorname{sech}\sqrt{\left(1-\frac{\delta^2}{k^2}\right)}nt,$$

and

$$\psi=\frac{\delta}{k}nt-\cos^{-1}\frac{\frac{\delta}{k}}{\sqrt{(1-x^2)}},$$

$$\cos\tfrac{1}{2}\theta\cos\left(\frac{\delta}{k}nt-\psi\right)=\frac{\delta}{k}.$$

9. Some simple cases will elucidate the preceding theory.

Simple cases of the motion of a top.

First put

$$(1)\qquad \mathrm{G}'-\mathrm{GE}=0;$$

this makes $\wp'v=0$, and v a period, ω_1 or ω_2, $f=0$, or 1; $\mathrm{E}-z$ is now a factor of Z, z_1-z or z_2-z; and $\rho_1^2=0$, or $\rho_2^2=0$, so that

$$(2)\qquad \rho=\rho_3\mathrm{dn}(\mathrm{K}-mt),\ \text{or}\ \rho_3\mathrm{cn}(\mathrm{K}-mt),$$

while

$$(3)\qquad \varpi=\frac{\mathrm{L}}{\lambda}nt=pt,\ \text{suppose.}$$

$$(4)\qquad \chi=\varpi-\psi=pt-\psi,$$

$$(5)\qquad \tan\chi=\frac{\sqrt{\left\{1-z^2-2\frac{\mathrm{L}^2}{\lambda^2}(\mathrm{E}-z)\right\}}}{\frac{\mathrm{L}}{\lambda}\sqrt{\{2(\mathrm{E}-z)\}}};$$

and

$$(6)\qquad \sin\theta\sin(pt-\psi)=\sqrt{\{z_2-z)(z-z_3)\}},\ \text{or}\ \sqrt{\{(z_1-z)(z-z_3)\}},$$

$$(7)\qquad \sin\theta\cos(pt-\psi)=\frac{\mathrm{L}}{\lambda}\sqrt{\{2(z_1-z)\}},\quad \text{or}\ \frac{\mathrm{L}}{\lambda}\sqrt{\{2(z_2-z)\}};$$

$$(8)\qquad \frac{p}{n}=\frac{\mathrm{L}}{\lambda}=\sqrt{\frac{z_2+z_3}{2}},\ \text{or}\ \sqrt{\frac{z_1+z_3}{2}},$$

$$(9)\qquad \frac{\mathrm{B}}{\mathrm{L}}=z_1=\frac{1+z_2z_3}{z_2+z_3},\ \text{or}\ \frac{\mathrm{B}}{\mathrm{L}}=z_2=\frac{1+z_1z_3}{z_1+z_3}.$$

Next, take

$$(10)\qquad v=\omega_1+\tfrac{1}{2}\omega_3,\ f=\tfrac{1}{2},$$

and work with the corresponding pseudo-elliptic integral in the form

$$(11)\qquad \mathrm{I}=\tfrac{1}{2}\int_x^\kappa\frac{(1-\kappa)(\kappa+x^2)}{(\kappa-x^2)\sqrt{\mathrm{X}}}dx,$$

where

(12) $$X=(1-x^2)(\kappa^2-x^2),$$

(13) $$I=\sin^{-1}\sqrt{\frac{(1+x)(\kappa-x)}{2(\kappa-x^2)}}=\cos^{-1}\sqrt{\frac{(1-x)(\kappa+x)}{2(\kappa-x^2)}}.$$

To construct the corresponding herpolhode from (43) and (47) § 8, put

(14) $$\rho^2=a^2(\kappa-x^2),$$

so that, from (43) § 8,

(15) $$k^2=a^2\lambda^2,$$

(16) $$\rho_3^2-\rho^2=a^2x^2,$$

(17) $$\rho^2-\rho_2^2=a^2(\kappa^2-x^2),$$

(18) $$\rho^2-\rho_1^2=a^2(1-x^2),$$

(19) $$nt=\frac{k}{a}\int_x^\kappa\frac{dx}{\sqrt{X}},$$

(20) $$x=\kappa\,\mathrm{sn}(K-mt),\quad mt=\frac{\delta}{k}nt=\frac{nt}{M},$$

and in (47) § 8,

(21) $$\frac{\delta}{k}nt-\varpi=\int_x^\kappa\frac{\kappa(1-\kappa)dx}{(\kappa-x^2)\sqrt{X}}=I+\tfrac{1}{2}(1-\kappa)\int_x^\kappa\frac{dx}{\sqrt{X}}$$

(22) $$I=pt-\varpi,$$

where

(23) $$pt=\frac{\delta}{k}nt-\tfrac{1}{2}(1-\kappa)mt=\frac{L-\frac{1}{2}(1-\kappa)}{\lambda}nt=\{L-\tfrac{1}{2}(1-\kappa)\}mt,$$

and the herpolhode is given by

(24) $$\rho\sin(pt-\varpi)=a\sqrt{\frac{(1+x)(\kappa-x)}{2}}$$

(25) $$\rho\cos(pt-\varpi)=a\sqrt{\frac{(1-x)(\kappa+x)}{2}}.$$

This herpolhode becomes a purely algebraical curve by taking

(26) $$\delta=\tfrac{1}{2}(1-\kappa)a,\quad L=\tfrac{1}{2}(1-\kappa),$$

making $$p=0.$$

In the associated movement of the top we shall have

(27) $$\lambda^2\cos\theta=L^2-1+\kappa-\kappa^2+2x^2,$$

(28) $$\lambda^4=(L^2-1+3\kappa-\kappa^2)^2-8\kappa(1-\kappa)L+8\kappa(1-\kappa)^2,$$

(29) $$\lambda^2z_1=L^2+1+\kappa-\kappa^2,$$

(30) $$\lambda^2z_2=L^2-1+\kappa+\kappa^2,$$

(31) $$\lambda^2z_3=L^2-1+\kappa-\kappa^2,$$

(32) $$\lambda^2E=L^2-1+3\kappa-\kappa^2,$$

and operating as in (1), § 8,

(33) $$\tfrac{1}{2}\lambda^2\sin\theta\cos(pt-\psi)=(L-1+\kappa-x)\sqrt{\frac{(1-x)(\kappa+x)}{2}}$$

(34) $$\tfrac{1}{2}\lambda^2\sin\theta\sin(pt-\psi)=(L-1+\kappa+x)\sqrt{\frac{(1+x)(\kappa-x)}{2}}$$

(35) $$B=\frac{L^3-(1-3\kappa+\kappa^2)L-2\kappa(1-\kappa)}{M^2};$$

with the two constants L and κ at our disposal for the construction of numerical cases.

In the purely algebraical cases, when $p=0$, $L=\frac{1}{2}(1-\kappa)$,

(36) $$(2\lambda)^4=(1+\kappa)^2(9-14\kappa+9\kappa^2),$$

(37) $$(2\lambda)^2z_1=(1+\kappa)(5-3\kappa),$$

(38) $$(2\lambda)^2z_2=(1+\kappa)(-3+5\kappa),$$

(39) $$(2\lambda)^2z_3=-3+2\kappa-3\kappa^2,$$

(40) $$(2\lambda)^2E=-3+10\kappa-3\kappa^2,$$

(41) $$B=-\frac{3(1+\kappa)^2(1-\kappa)}{8\lambda^2}.$$

Stereoscopic figures of this case (Fig. 11) were drawn by the late Mr T. I. Dewar for

(42) $$\kappa=\frac{15}{17},\ \frac{3}{5},\ \text{and}\ \frac{1}{3}\ \text{(cusps)}.$$

Cusps occur in the general case when

(43) $$L=1\pm\sqrt{(\kappa+\kappa^2)}.$$

When $L=B=1$, the axis passes periodically through the highest vertical position; and there is an intermediate path for $L=B=-\kappa$.

The axis passes periodically through the lowest vertical position when $L=-B=1-\kappa$.

The axis moves like a spherical pendulum when $B=0$; putting $L=c(1-\kappa)$,

(44) $$\frac{1}{\kappa}+\kappa=\frac{2c^3-3c+2}{c^3-c},$$

in which c may be taken as an arbitrary parameter for the construction of numerical cases.

Other cases can be worked out for a parameter $v=\omega_1+f\omega_3$, where $f=\frac{1}{3}, \frac{1}{4}, \frac{1}{5}\ldots$; and in this way we can map out the analytical field of the most general case of motion.

10. So far the motion of the axis OCZ alone has been considered; Euler's third angle ϕ must be introduced for the specification of the motion of any point of the body.

Now if R denotes the angular velocity of the top about its axis OC,

(1) $$R=\frac{d\phi}{dt}+\cos\theta\frac{d\psi}{dt},$$

so that

(2) $$\frac{d\phi}{dt}=R-\cos\theta\frac{d\psi}{dt}=R-\frac{G\cos\theta-CR\cos^2\theta}{A\sin^2\theta}=\left(1-\frac{C}{A}\right)R+\frac{CR-G\cos\theta}{A\sin^2\theta}=\left(1-\frac{C}{A}\right)R-\frac{G-G'}{2A}\frac{1}{1-z}+\frac{G'+G}{2A}\frac{1}{1+z},$$

which gives ϕ by the difference of two elliptic integrals of the third kind; but these can be replaced by a single integral, as for ψ in (33) § 8, in the form

(3) $$\phi=\left(1-\frac{C}{A}\right)Rt+\frac{G't}{2A}-\tan^{-1}\frac{\sqrt{2AMghZ}}{G-G'z}+\frac{G-DG'}{2A}\int\frac{dt}{D-z},$$

where

(4) $$Z=(D-z)(1-z^2)-\frac{(G-G'z)^2}{2AMgh}=(D-z)(1-z^2)-2\left(\frac{\delta-\delta'z}{k}\right)^2,$$

so that

(5) $$z_1+z_2+z_3=D+\frac{G'^2}{2AMgh}=D+2\frac{\delta'^2}{k^2}=E+\frac{G^2}{2AMgh}=E+2\frac{\delta^2}{k^2}.$$

The result in (3) can be verified by differentiation; it shows that H describes in the plane CKH a herpolhode curve, and thus Jacobi's theorem is established on the allied motion of a top and two associated Poinsot movements (*Werke*, ii. p. 480).

The spherical top. It will simplify the formulas with very slight loss of generality, which can always be restored at any instant, if the *spherical* top, so called, is considered, in which C=A; this will merely cancel a secular term in ϕ, and make

(6) $$\frac{d\phi}{dt}=\frac{G'-G\cos\theta}{A\sin^2\theta},$$

equivalent to an interchange of G and G′ in ψ; and now

(7) $$\tfrac{1}{2}(\psi+\phi)=\frac{G+G'}{2A}\int\frac{dt}{1+z}=\frac{\delta+\delta'}{k}\int^{z_2}\frac{dz}{(1+z)\sqrt{2Z}},$$

(8) $$\tfrac{1}{2}(\psi-\phi)=\frac{G-G'}{2A}\int\frac{dt}{1-z}=\frac{\delta-\delta'}{k}\int^{z_2}\frac{dz}{(1-z)\sqrt{2Z}},$$

introducing two elliptic integrals of the third kind, with poles at $z=\mp1$, corresponding to parameters of the form

(9) $$v_1=f_1\omega_3,\quad v_2=\omega_1+f_2\omega_3,$$

where f_1 and f_2 are real fractions; and now, if v and w denote the parameters corresponding to $z=E$ and D, we shall find

(10) $$v=v_2-v_1,\quad w=v_2+v_1.$$

The most symmetrical treatment of the motion of any point fixed in the top will be found in Klein-Sommerfeld, *Theorie des Kreisels*, to which the reader is referred for details; four new functions, α, β, γ, δ, are introduced, defined in terms of Euler's angles, θ, ψ, ϕ, by

(11) $$\alpha=\cos\tfrac{1}{2}\theta\exp\tfrac{1}{2}(\psi+\phi)i,$$

(12) $$\beta=i\sin\tfrac{1}{2}\theta\exp\tfrac{1}{2}(\psi-\phi)i,$$

(13) $$\gamma=i\sin\tfrac{1}{2}\theta\exp\tfrac{1}{2}(-\psi+\phi)i,$$

(14) $$\delta=\cos\tfrac{1}{2}\theta\exp\tfrac{1}{2}(-\psi-\phi)i.$$

Next Klein takes two functions or co-ordinates λ and Λ, defined by

(15) $$\lambda=\frac{x+yi}{r-z}=\frac{r+z}{x-yi},$$

and Λ the same function of X, Y, Z, so that λ, Λ play the part of stereographic representations of the same point (x, y, z) or (X, Y, Z) on a sphere of radius r, with respect to poles in which the sphere is intersected by Oz and OZ.

These new functions are shown to be connected by the bilinear relation

(16) $$\lambda=\frac{\alpha\Lambda+\beta}{\gamma\Lambda+\delta},\quad \alpha\delta-\beta\gamma=1.$$

in accordance with the annexed scheme of transformation of coordinates—

	Ξ	H	Z
ξ	α^2	β^2	$2\alpha\beta$
η	γ^2	δ^2	$2\gamma\delta$
ζ	$\alpha\gamma$	$\beta\delta$	$\alpha\delta+\beta\gamma$

where

(17) $$\xi = x+yi,\ \eta = -x+yi,\ \zeta = -z,$$
$$\Xi = X+Yi,\ H = -X+Yi,\ Z = -Z;$$

and thus the motion in space of any point fixed in the body defined by Λ is determined completely by means of α, β, γ, δ; and in the case of the symmetrical top these functions are elliptic transcendants, to which Klein has given the name of *multiplicative elliptic functions;* and

(18) $$\alpha\delta = \cos^2\tfrac{1}{2}\theta,\ \beta\gamma = -\sin^2\tfrac{1}{2}\theta,$$
$$\alpha\delta-\beta\gamma = 1,\ \alpha\delta+\beta\gamma = \cos\theta,$$
$$\sqrt{(-4\alpha\beta\gamma\delta)} = \sin\theta;$$

while, for the motion of a point on the axis, putting $\Lambda=0$, or ∞,

(19) $$\lambda = \frac{\beta}{\delta} = i\tan\tfrac{1}{2}\theta e^{\psi i},\ \text{or}\ \lambda = \frac{\alpha}{\gamma} = -i\cot\tfrac{1}{2}\theta e^{\psi i},$$

and

(20) $$\alpha\beta = \tfrac{1}{2}i\sin\theta e^{\psi i},\ \alpha\gamma = \tfrac{1}{2}i\sin\theta e^{\phi i},$$

giving orthogonal projections on the planes GKH, CHK; and

(21) $$\alpha\frac{d\beta}{dt} - \frac{d\alpha}{dt}\beta = n\frac{\rho}{k}e^{\varpi i},$$

the vectorial equation in the plane GKH of the herpolhode of H for a spherical top.

When f_1 and f_2 in (9) are rational fractions, these multiplicative elliptic functions can be replaced by algebraical functions, qualified by factors which are exponential functions of the time t; a series of quasi-algebraical cases of motion can thus be constructed, which become purely algebraical when the exponential factors are cancelled by a suitable arrangement of the constants.

Gyrostat rolling in steady motion on a plane.

11. Equation (4) § 3 with slight modification will serve with the same notation for the steady rolling motion on a horizontal plane of a body of revolution, such as a disc, coin, hoop, wheel, cask, wine-glass, plate, dish, bowl, spinning top, gyrostat, or bicycle; but O is now the point of intersection of the axis GC with the vertical through the centres of the horizontal circles described by G the centre of gravity, and by P the point of contact, either with the ground, or any surface of revolution of which Oz is the vertical axis (Fig. 12).

Denoting by X, Z the horizontal and vertical components in dynes of the reaction at P,

(1) $$X = M\mu^2.GK,\ Z = Mg;$$

and taking moments round G,

(2) $$G'\mu\sin\theta - A\mu^2\sin\theta\cos\theta = N$$
$$= Z.PH + X.HG = Mg.PH + M\mu^2.GK.HG,$$

where A now denotes the moment of inertia in g-cm.² about an axis through G perpendicular to the axis of figure.

The term G′ must include not only CR, the angular momentum of the body due to the component angular velocity R above the axis GC, but also K, the total angular momentum of any fly-wheels fixed in the body with their axis parallel to GC.

Denoting KG by c, and GN, NP by z, x, the velocity of P

(3) $$= c\mu + xR - z\mu\sin\theta.$$

This is zero if P is the point of rolling contact, so that

(4) $$R = \frac{z\sin\theta - c}{x}\mu,$$

and therefore

(5) $$K\mu\sin\theta + C^2\frac{\sin\theta - c}{x}\mu^2\sin\theta$$
$$-A\mu^2\sin\theta\cos\theta - Mc(z\cos\theta + x\sin\theta)\mu^2$$
$$-Mg(z\sin\theta - x\cos\theta) = 0.$$

Gyrostat swung round by a thread.

But if the gyrostatic body is swinging round in relative equilibrium at the end of a thread O′P of length l inclined at an angle α to the vertical attached to the point P,

(6) $$X = Mg\tan\alpha = Mc\mu^2$$
$$= M(l\sin\alpha + z\sin\theta - x\cos\theta);$$

and the axis of resultant angular velocity being vertical, $R=\mu\cos\theta$, so that

(7) $$K\mu\sin\theta + (C-A)\mu^2\sin\theta\cos\theta = N$$
$$= T.GL = Mg\sec\alpha.GL,$$

where GL is the perpendicular from G on the thread.

Stability of a rotating projectile.

When a solid of revolution is moving in unlimited frictionless liquid with axial velocity V and sidelong velocity U, it experiences a deflecting couple

(8) $$N = (c_1 - c_3)UV,$$

in accordance with the principles of hydrodynamics, $c_3V = F\cos\theta$, and $c_1U = F\sin\theta$, being the components of the impulse F required to give the body its actual motion; so that equation (2) becomes

(9) $$G'\mu\sin\theta - A\mu^2\sin\theta\cos\theta = \frac{c_3}{c_1}(c_1-c_3)V^2\tan\theta.$$

Dividing out sin θ, which equated to zero would give perfectly centred axial motion, the quadratic in μ becomes

(10) $$A\mu^2\cos\theta - G'\mu + \frac{c_3}{c_1}(c_1-c_3)V^2\sec\theta = 0,$$

so that the least admissible value of $G'=CR$ for steady motion is given by

(11) $$\frac{R^2}{V^2} = 4\frac{A}{C^2}\frac{c_3}{c_1}(c_1-c_3).$$

Suppose the solid is an elongated projectile, fired through the air by a d cm. gun, in which the final angle of the rifling at the muzzle is β; then

(12) $$\tan\beta = \frac{\tfrac{1}{2}dR}{V}.$$

We can put

(13) $$c_1 = M + M'\alpha,\ c_3 = M + M'\gamma,\ c_1 - c_3 = M'(\alpha-\gamma),$$

where M, M′ denote the weight in grams of the body and of the displaced air or fluid, and α, γ are functions of the shape of the body; also

(14) $$C = Mk_3^2,\ A = Mk_1^2 + M'k_1'^2.$$

Now in air, the fraction M′/M is so small that the first power only need be retained, and

(15) $$\tan^2\beta = \frac{d^2k_1^2}{k_3^4}(\alpha-\gamma)\frac{M'}{M},$$

which determines β the angle of rifling suitable for stability in flight of a projectile for which α and γ are known.

Stability of an automobile torpedo.

But if the body is like an automobile torpedo, submerged in water with zero buoyancy, then M′=M, and the exact expression must be used

(16) $$\frac{G'^2}{V^2} = 4(Mk_1^2 + M'k_1'^2)\frac{1+\gamma}{1+\alpha}(\alpha-\gamma)M.$$

The term G′ is supplied in the Whitehead torpedo by the action of a fly-wheel in the interior.

General motion of a gyrostat rolling on a plane.

12. In the theoretical discussion of the general motion of a gyrostat rolling on a horizontal plane, apparently the simplest plan is to write down the most general equations of motion, and afterwards to introduce the special conditions.

Drawing through G the centre of gravity any three rectangular axes Gx, Gy, Gz, the notation employed is

u, v, w, the component linear velocities of G,
p, q, r, the component angular velocities above the axes,
h_1, h_2, h_3, the components of angular momentum,
θ_1, θ_2, θ_3, the component angular velocities of the system of rectangular axes,
x, y, z, the co-ordinates of the point of contact with the horizontal plane,
X, Y, Z, the components of the reaction of the plane,
α, β, γ, the direction cosines of the downward vertical.

The dynamical equations are

(1) $$\frac{du}{dt} - v\theta_3 + w\theta_2 = g\alpha + \frac{X}{M},$$

(2) $$\frac{dv}{dt} - w\theta_1 + u\theta_3 = g\beta + \frac{Y}{M},$$

(3) $$\frac{dw}{dt} - u\theta_2 + v\theta_1 = g\gamma + \frac{Z}{M},$$

and

(4) $$\frac{dh_1}{dt} - h_2\theta_3 + h_3\theta_2 = yZ - zY,$$

(5) $$\frac{dh_2}{dt} - h_3\theta_1 + h_1\theta_3 = zX - xZ,$$

(6) $$\frac{dh_3}{dt} - h_1\theta_2 + h_2\theta_1 = xY - yX.$$

The geometrical equations, expressing that the point of contact has no velocity, are

(7) $$u - yr + zq = 0,$$
(8) $$v - zp + xr = 0,$$
(9) $$w - xq + yp = 0.$$

In the special case of the gyrostat, where the surface is of revolution about Gz, and the body is kinetically symmetrical about Gz, we take Gy horizontal and Gzx through the point of contact, so that $y=0$; and denoting the angle between Gz and the downward vertical by θ (Fig. 12),

(10) $$\alpha=\sin\theta,\ \beta=0,\ \gamma=\cos\theta;$$

while denoting the angular velocity of the plane Gzx about the vertical by Ω,

(11) $$\theta_1=\Omega\sin\theta,\ \theta_2=-\frac{d\theta}{dt},\ \theta_3=\Omega\cos\theta.$$

The components of angular momentum are given by

(12) $$h_1=\mathrm{A}p,\ h_2=\mathrm{A}q,\ h_3=\mathrm{C}r+\mathrm{K},$$

where K is the angular momentum of interior fly-wheels whose axes are fixed parallel to Gz; and as Gz is fixed in the body

(13) $$p=\theta_1=\Omega\sin\theta,\ q=\theta_2=-\frac{d\theta}{dt}.$$

The elimination of the reactions leads to the general equations of motion, of which one integral can be written down from the principle of energy.

We shall confine ourselves to the special case in which x and z are constant, so that the body has a plane circular base, like a disc, a wine-glass, or Kelvin's gyrostat (Fig. 4).

Now, from (1), (6), with $y=0$,

(14) $$\frac{\mathrm{X}}{\mathrm{M}}=z\frac{d^2\theta}{dt^2}-(z\Omega\sin\theta-xr)\Omega\cos\theta+x\frac{d\theta^2}{dt^2}-g\sin\theta$$

(15) $$\frac{\mathrm{Y}}{\mathrm{M}}=z\frac{d\Omega\sin\theta}{dt}-x\frac{dr}{dt}+(x\sin\theta+z\cos\theta)\Omega\frac{d\theta}{dt}$$

(16) $$\frac{\mathrm{Z}}{\mathrm{M}}=-x\frac{d^2\theta}{dt}+z\frac{d\theta^2}{dt^2}+(z\Omega\sin\theta-xr)\Omega\sin\theta-g\cos\theta$$

(17) $$-z\mathrm{Y}=\mathrm{A}\frac{d\Omega\sin\theta}{dt}+\mathrm{A}\frac{d\theta}{dt}\Omega\cos\theta-(\mathrm{C}r+\mathrm{K})\frac{d\theta}{dt}$$

(18) $$z\mathrm{X}-x\mathrm{Z}=-\mathrm{A}\frac{d^2\theta}{dt}-(\mathrm{C}r+\mathrm{K})\Omega\sin\theta+\mathrm{A}\Omega^2\sin\theta\cos\theta$$

(19) $$x\mathrm{Y}=\mathrm{C}\frac{dr}{dt},\ \text{treating K as constant.}$$

The elimination of Y between (15) and (19) leads to

(20) $$x\mathrm{Y}=\mathrm{C}\frac{dr}{dt}$$
$$=\mathrm{M}xz\frac{d\Omega\sin\theta}{dt}-\mathrm{M}x^2\frac{dr}{dt}+\mathrm{M}x(x\sin\theta+z\cos\theta)\frac{\Omega d\theta}{dt}$$

(21) $$(\mathrm{C}+\mathrm{M}x^2)\frac{dr}{d\theta}-\mathrm{M}xz\frac{d\Omega\sin\theta}{d\theta}-\mathrm{M}(x^2\sin\theta+xz\cos\theta)\Omega=0;$$

or putting $\Omega\sin^2\theta=\mathrm{N}$, and $\mathrm{C}r+\mathrm{K}=\mathrm{G}'$,

(22) $$(\mathrm{C}+\mathrm{M}x^2)\sin\theta\frac{d\mathrm{G}'}{d\theta}-\mathrm{CM}xz\frac{d\mathrm{N}}{d\theta}-\mathrm{CM}x^2\mathrm{N}=0.$$

Between (15) and (17) the elimination of Y leads to

(23) $$(\mathrm{A}+\mathrm{M}z^2)\frac{d\mathrm{N}}{d\theta}+\mathrm{M}xz\mathrm{N}$$
$$-\mathrm{M}xz\sin\theta\frac{dr}{d\theta}-(\mathrm{C}r+\mathrm{K})\sin\theta=0;$$

so that from (22) and (23) putting $(\mathrm{A}+\mathrm{M}z^2)(\mathrm{C}+\mathrm{M}x^2)-\mathrm{M}^2x^2z^2=\mathrm{D}$,

(24) $$\mathrm{A}x\frac{d\mathrm{N}}{d\theta}=\left(-z\frac{d\mathrm{G}'}{d\theta}+x\mathrm{G}'\right)\sin\theta,$$

(25) $$\mathrm{ACM}x^2\mathrm{N}=\left(\mathrm{D}\frac{d\mathrm{G}'}{d\theta}-\mathrm{CM}xz\mathrm{G}'\right)\sin\theta;$$

or

(26) $$(\mathrm{C}+\mathrm{M}x^2)\frac{d\mathrm{G}'}{d\theta}\sin\theta=\mathrm{CM}xz\frac{d\mathrm{N}}{d\theta}+\mathrm{CM}x^2\mathrm{N},$$

(27) $$(\mathrm{C}+\mathrm{M}x^2)\mathrm{G}'\sin\theta=\mathrm{D}\frac{d\mathrm{N}}{d\theta}+\mathrm{CM}xz\mathrm{N}.$$

With $z=0$, as in a disc or Kelvin's gyrostat

(28) $$\mathrm{A}\frac{d\mathrm{N}}{d\theta}=\mathrm{G}'\sin\theta,\ \mathrm{CM}x^2\mathrm{N}=(\mathrm{C}+\mathrm{M}z^2)\frac{d\mathrm{G}'}{d\theta}\sin\theta;$$

leading to the differential equations of a hypergeometric series for G′ and N,

(29) $$\frac{d^2\mathrm{G}'}{d\theta^2}+\cot\theta\frac{d\mathrm{G}'}{d\theta}-\frac{\mathrm{CM}x^2}{\mathrm{A}(\mathrm{C}+\mathrm{M}x^2)}\mathrm{G}'=0,$$

(30) $$\frac{d^2\mathrm{N}}{d\theta^2}-\cot\theta\frac{d\mathrm{N}}{d\theta}-\frac{\mathrm{CM}x^2}{\mathrm{A}(\mathrm{C}+\mathrm{M}x^2)}\mathrm{N}=0;$$

of the form of Legendre's equation for a zonal harmonic of fractional order n, given by

(31) $$n(n+1)=\frac{\mathrm{CM}x^2}{\mathrm{A}(\mathrm{C}+\mathrm{M}x^2)}$$

(Appell and Korteweg, *Circolo matematico di Palermo*, Aug. 1899).

But in the general case, when z is not zero, the differential equations become

(32) $$\frac{d^2\mathrm{G}'}{d\theta^2}+\cot\theta\frac{d\mathrm{G}'}{d\theta}-\frac{\mathrm{CM}(x^2+xz\cot\theta)}{\mathrm{D}}\mathrm{G}'=0,$$

(33) $$\frac{d^2\mathrm{N}}{d\theta^2}-\cot\theta\frac{d\mathrm{N}}{d\theta}-\frac{\mathrm{CM}(x^2+xz\cot\theta)}{\mathrm{D}}\mathrm{N}=0.$$

The elimination of X and Z between equations (14), (16), (18), leads to

(34) $$\{\mathrm{A}+\mathrm{M}(x^2+z^2)\}\frac{d^2\theta}{dt^2}-(\mathrm{A}+\mathrm{M}z^2)\Omega^2\sin\theta\cos\theta$$
$$-\mathrm{M}xz\Omega^2\sin^2\theta+\{(\mathrm{C}+\mathrm{M}x^2)r+\mathrm{K}\}\Omega\sin\theta$$
$$+\mathrm{M}xzr\Omega\cos\theta+\mathrm{M}g(x\cos\theta-z\sin\theta)=0;$$

and this, in conjunction with (20) and (23) will lead to an equation, the integral of which is the equation of Energy, which can be written down in the form

(35) $$\tfrac{1}{2}\mathrm{M}(u^2+v^2+w^2)+\tfrac{1}{2}\mathrm{A}(p^2+q^2)$$
$$+\tfrac{1}{2}\mathrm{C}r^2+\mathrm{M}g(x\sin\theta+z\cos\theta)=\mathrm{H},$$

a constant; or

(36) $$\tfrac{1}{2}\{\mathrm{A}+\mathrm{M}(x^2+z^2)\}\left(\frac{d\theta}{dt}\right)^2$$
$$+\tfrac{1}{2}(\mathrm{A}+\mathrm{M}z^2)\Omega^2\sin^2\theta$$
$$-\mathrm{M}xzr\Omega\sin\theta$$
$$+\tfrac{1}{2}(\mathrm{C}+\mathrm{M}x^2)r^2$$
$$+\mathrm{M}g(x\sin\theta+z\cos\theta)=\mathrm{H}.$$

Put $x=0$ and we fall back on the original equations for a top spinning with its point in a small smooth fixed cup, like the Maxwell top.

13. To find the small oscillations about a state of steady motion where the axis has a mean inclination α to the vertical, put

(1) $$\theta=\alpha+\mathrm{P}e^{\lambda ti},\ \sin\theta=\sin\alpha(1+\mathrm{P}e^{\lambda ti}\cot\alpha),$$
$$\cos\theta=\cos(\alpha 1-\mathrm{P}e^{\lambda ti}\tan\alpha)$$
$$\mathrm{N}=\mathrm{H}+\mathrm{Q}e^{\lambda ti},\ \mathrm{G}'=\mathrm{L}+\mathrm{R}e^{\lambda ti},$$

where P, Q, R are small, and

(2) $$\frac{d\mathrm{N}}{d\theta}=\frac{\mathrm{Q}}{\mathrm{P}},\ \frac{d\mathrm{G}'}{d\theta}=\frac{\mathrm{R}}{\mathrm{P}},$$

to the order considered.

A substitution in (34) § 12 will lead to the condition of steady motion, and a relation between P, Q, R, which in conjunction with equations (24) to (27) will lead on elimination of P, Q, R to the equation which determines λ^2; and if λ^2 is positive the motion is stable (Routh, *Rigid Dynamics*, ii., § 241).

Take the case where the gyrostat is performing small nutations about a position of steady motion when the gyrostat proceeds with its axis horizontal in a straight course with velocity V.

Then in (1), with

(3) $$z=0,\ \alpha=\tfrac{1}{2}\pi,\ \sin\theta=1,\ \cos\theta=-\mathrm{P}e^{\lambda ti},$$

and

$$\mathrm{H}=0,\ \mathrm{L}=\frac{\mathrm{V}}{x}+\mathrm{K},$$

we shall find $\mathrm{R}=0$, and

(4) $$\frac{\mathrm{Q}}{\mathrm{P}}=\frac{\mathrm{C}\frac{\mathrm{V}}{x}+\mathrm{K}}{\mathrm{A}}=\frac{(\mathrm{A}+\mathrm{M}x^2)\lambda^2+\mathrm{M}gx}{(\mathrm{C}+\mathrm{M}x^2)\frac{\mathrm{V}}{x}+\mathrm{K}};$$

(5) $$\mathrm{A}(\mathrm{A}+\mathrm{M}x^2)\lambda^2=\left\{(\mathrm{C}+\mathrm{M}x^2)\frac{\mathrm{V}}{x}+\mathrm{K}\right\}\left(\mathrm{C}\frac{\mathrm{V}}{x}+\mathrm{K}\right)-\mathrm{AM}gx,$$

and λ^2 must be positive for the motion to be stable.

Thus, putting $\mathrm{V}=0$, so that

(6) $$\mathrm{A}(\mathrm{A}+\mathrm{M}x^2)\lambda^2=\mathrm{K}^2-\mathrm{AM}gx,$$

it is possible for the gyrostat to maintain itself upright on its edge without advance, as in Fig. 6, provided

(7) $$\mathrm{K}^2-\mathrm{AM}gx \text{ is positive.}$$

In a solid rolling disc, or coin, or symmetrical body rolling on its edge,

(8) $$\mathrm{K}=0,\ \mathrm{A}(\mathrm{A}+\mathrm{M}x^2)\lambda^2=\mathrm{C}(\mathrm{C}+\mathrm{M}x^2)\frac{v^2}{x^2}-\mathrm{AM}gx,$$

and the right-hand side must be positive for the straight advance to be stable.

For further theory and experiments consult Routh, *Advanced Rigid Dynamics*, chap. v., and Thomson and Tait, *Natural Philosophy*, § 345; also Bourlet, *Traité des bicycles* (analysed in Appell, *Mécanique rationelle*, ii. p. 297, and Carvallo, *Journal de l'école polytechnique*, 1900); Whipple, *Quarterly Journal of Mathematics*, vol. xxx., for mathematical theories of the bicycle.

In some experiments, described by Lord Kelvin in *Nature*, February 1877 and November 1880, the fly-wheel of the gyrostat is replaced by a spheroid of thin copper, filled with water; if spun rapidly the motion is stable if the spheroid is oblate, but becomes highly unstable for the prolate form, as exemplified by the difficulty

of spinning a raw egg; but the motion should become stable again when the egg-shaped spheroid is elongated to more than three diameters long (*Proc. Cam. Phil. Soc.*, 1882).

If the fly-wheel is fixed symmetrically at the centre of a spherical case which can roll on a horizontal plane, the preceding results can be modified so as to lead to analytical equations comparable in some cases with Kirchhoff's equations for the motion of a solid in unlimited liquid.

14. Lord Kelvin has also studied, theoretically and experimentally, the vibration of a chain of stretched gyrostats (*Proc. London Math. Society*, 1875; Perry, *Spinning Tops*, p. 127, for a diagram).

Supposing the gyrostats, each of axial length $2a$, connected by light cords each of length $2l$, stretched to a tension T, and supposing x, y denote the component slight displacements from the central straight line of the centre of a gyrostat, and that p, q, 1 denote the direction cosines of the axis of gyrostat, and r, s, 1 the direction cosines of a cord, distinguishing the different bodies by suffixes; then, as in Routh's *Advanced Rigid Dynamics*, p. 266, neglecting the squares of small quantities, we can put

(1) $$\theta_1 = -\frac{dq}{dt},\ \theta_2 = \frac{dp}{dt},\ \theta_3 = r;$$

(2) $$h_1 = A\theta_1,\ h_2 = A\theta_2,\ h_3 = K;$$

in the dynamical equations

(3) $$\frac{dh_1}{dt} - h_2\theta_3 + h_3\theta_2 = L, \ \ldots$$

so that for the k^{th} gyrostat, these equations reduce to

(4) $$A\ddot{q}_k - K\dot{p}_k = Ta(s_k + s_{k+1} - 2q_k),$$

(5) $$A\ddot{p}_k + K\dot{q}_k = Ta(r_k + r_{k+1} - 2p_k).$$

Also, for the motion of translation

(6) $$M\ddot{x}_k = T(r_{k+1} - r_k),\ M\ddot{y}_k = T(s_{k+1} - s_k).$$

The geometrical relations are

(7) $$x_{k+1} - x_k = a(p_{k+1} + p_k) + 2lr_{k+1}$$
$$y_{k+1} - y_k = a(q_{k+1} + q_k) + 2ls_{k+1}.$$

Putting

(8) $$x + yi = w,\ p + qi = \varpi,\ r + si = \sigma,$$

these three pairs of equations can be written

(9) $$A\ddot{\varpi}_k - K\dot{\varpi}_k i + 2Ta\varpi_k - Ta(\sigma_{k+1} + \sigma_k) = 0,$$

(10) $$M\ddot{w}_k - T(\sigma_{k+1} - \sigma_k) = 0,$$

(11) $$w_{k+1} - w_k - a(\varpi_{k+1} + \varpi_k) - 2l\sigma_{k+1} = 0.$$

For circularly polarized vibrations assume a solution

(12) $$w_k,\ \varpi_k,\ \sigma_k = (L,\ P,\ Q)\exp(nt - ck)i,$$

so that n/c is the velocity of propagation: then

(13) $$P(-An^2 + Kn + 2Ta) - QTa(e^{-ci} + 1) = 0,$$

(14) $$-LMn^2 - QT(e^{-ci} - 1) = 0,$$

(15) $$L(e^{-ci} - 1) - Pa(e^{-ci} + 1) - 2Qle^{-ci} = 0;$$

leading on elimination of L, P, Q, to

(16) $$\cos c = \frac{(-An^2 + Kn + 2Ta)\left(1 - \frac{Mln^2}{T}\right) - Ma^2n^2}{-An^2 + Kn + 2Ta + Ma^2n^2}$$

(17) $$2\sin^2 \tfrac{1}{2}c = Mn^2\frac{(-An^2 + Kn + 2Ta)\frac{l}{T} + 2a^2}{-An^2 + Kn + 2Ta + Ma^2n^2}.$$

Put

(18) $$M = 2(a + l)\rho,\ K = 2(a + l)\kappa,$$
$$z = 2(a + l)k,$$
$$ck = ez,$$

so that
$$c = 2(a + l)e;$$

then

(19) $$\sin^2(a + l)e = \rho(a + l^2)n^2\frac{1 + \frac{\kappa ln}{Ta} - 2\frac{Aln^2}{Ta(a + l)}}{T + \kappa n\frac{a + l}{a} - \frac{An^2}{a} + 2\rho a(a + l)n^2}.$$

With $a + l$ infinitesimal, and neglecting the rotary inertia a,

(20) $$\frac{n^2}{e^2} = \frac{T}{\rho}\,\frac{1 + \frac{a + l}{a}\,\frac{\kappa n}{T}}{1 + \frac{l}{a}\,\frac{\kappa n}{T}} \approx \frac{T}{\rho}\left(1 + \frac{\kappa n}{T}\right).$$

This agrees with the result obtained by Larmor (*Proc. London Math. Society*, 1890) for the propagation of vibrations along a cord provided with a continuous distribution of gyrostatic momentum; the differential equation of vibration is of the form

(21) $$\frac{d^2w}{dt^2} = \frac{T}{\rho}\,\frac{d^2w}{dz^2} - ih\frac{d^3w}{dz^2dt},$$

so that, for the circularly polarized vibrations

(22) $$w = L\exp(nt - ez)i$$

(23) $$n^2 = \frac{T}{\rho}e^2 + hne^2,\ \frac{n}{e} = \sqrt{\left(\frac{T}{\rho} + hn\right)}.$$

For circular polarization in the opposite direction

(24) $$w' = x - yi = L'\exp(nt - e'x)i,$$

and now the velocity of propagation

(25) $$\frac{n}{e'} = \sqrt{\left(\frac{T}{\rho} - hn\right)}.$$

In this way a mechanical analogue is obtained of the action of a magnetized medium on polarized light (Larmor, *Aether and Matter*, Appendix E).

Gyrostat suspended by a thread.

15. In the discussion of the small vibration of a single gyrostat about the vertical position, when suspended by a single thread of length $2l = b$, we can dispense with the suffix k in the preceding equations (9), (10), (11), § 14, and write

(1) $$A\ddot{\varpi} - K\dot{\varpi}i + Ta\varpi - Ta\sigma = 0,$$

(2) $$M\ddot{w} + T\sigma = 0,\ \text{with } T = Mg,$$

(3) $$w - a\varpi - b\sigma = 0.$$

Putting

(4) $$w,\ \varpi,\ \sigma = (L,\ P,\ Q)\exp nti$$

in these equations, and eliminating L, P, Q,

(5) $$(-An^2 + Kn + Mga)(g - bn^2) - Mga^2n^2 = 0,$$

and the period of a fundamental vibration is $2\pi/n$, where n is a root of this quartic equation (5).

For a gyrostat, spinning upright on its point on a smooth horizontal plane, put $b = \infty$, and change the sign of a; then

(6) $$An^2 - Kn + Mga = 0,$$

so that the condition

(7) $$K^2 > 4AMga$$

is required for stability.

Here A denotes the moment of inertia about an axis through the centre of gravity; in the same condition required for stability when the point is held in a small smooth cup ($b = 0$), A must be taken to represent the moment of inertia about a parallel axis through the point.

Spinning upright inside a smooth spherical surface of radius b, the sign of a must be changed to obtain the conditions at the lowest point.

For a gyrostat spinning upright on the summit of a smooth sphere of radius b, the sign of a and b must be changed, or else the sign of g, which amounts to the same thing.

Denoting the component horizontal displacements of the point by ξ, η, then

(8) $$br = \xi,\ bs = \eta,\ b\sigma = \xi + \eta i = \zeta, \text{ suppose}$$

(9) $$w = a\varpi + \zeta.$$

Now if the point is forced to take the motion (ξ, η, 0) by component forces X, Y, Z, the equations of motion of the gyrostat become

(10) $$-A\ddot{q} + K\dot{p} = -Zaq + Ya,$$

(11) $$+A\ddot{p} + K\dot{q} = +Zap - Xa,$$

(12) $$X + Yi = M\ddot{w},\ Z = -Mg;$$

so that

(13) $$A\ddot{\varpi} - K\dot{\varpi}i + Mga\varpi + Ma\ddot{w} = 0$$

or

(14) $$(A + Ma^2)\ddot{\varpi} - K\dot{\varpi}i + Mga\varpi + Ma\ddot{\zeta} = 0.$$

Thus if the point of the gyrostat is made to take the motion given by $\zeta = R\exp(nti)$, the forced vibration of the axis is given by $\varpi = P\exp(nti)$, where

(15) $$P\{-(A + Ma^2)n^2 + Kn + Mga\} - RMan^2 = 0.$$

The flexure joint.

In Lord Kelvin's experiments the gyrostats are joined up by equal light rods and short lengths of elastic wire, with rigid attachment to the rod and the case of a gyrostat, so as to keep the system still, and free from entanglement and twisting due to pivot-friction of fly-wheels.

When this gyrostatic chain is made to rotate with angular velocity n in relative equilibrium as a plane polygon passing through Oz, each gyrostatic case moves as if its axis produced was attached to Oz by a flexure joint, so that its instantaneous axis of resultant angular velocity bisects the angle $\pi - \theta$, if the axis makes an angle θ with Oz; and the components of angular velocity about Oz being n and about the axis being $-n$, the resultant angular velocity is $2n\cos\frac{1}{2}(\pi - \theta) = 2n\sin\frac{1}{2}\theta$, and the components of this angular velocity are

(16) $-2n\sin\frac{1}{2}\theta\sin\frac{1}{2}\theta = -n(1 - \cos\theta)$, along the axis

(17) $-2n\sin\frac{1}{2}\theta\cos\frac{1}{2}\theta = -n\sin\theta$, perpendicular to the axis of the gyrostat.

The component angular momentum in the direction Ox is therefore

(18) $$L = -An\sin\theta\cos\theta - Cn(1 - \cos\theta)\sin\theta + K\sin\theta,$$

and Ln is therefore the couple acting on the gyrostat.

If ϕ denotes the angle which a rod makes with Oz, and T denotes the constant component of the tension of a rod parallel to Oz, the couple acting is

(19) $$Ta \cos \theta_k (\tan \phi_{k+1} + \tan \phi_k) - 2Ta \sin \theta_k,$$

which is to be equation to Ln, so that

(20) $$-An^2 \sin \theta_k \cos \theta_k - Cn(1-\cos \theta_k) \sin \theta_k + Kn \sin \theta_k + 2Ta \sin \theta_k - Ta \cos \theta_k (\tan \phi_{k+1} + \tan \phi_k) = 0.$$

In addition

(21) $$Mn^2 x_k + T(\tan \phi_{k+1} - \tan \phi_k) = 0,$$

with the geometrical relation

(22) $$x_{k+1} - x_k - a(\sin \theta_{k+1} + \sin \theta_k) - 2L \sin \phi_{k+1} = 0.$$

When the polygon is nearly coincident with Oz, these equations can be replaced by

(23) $$(-An^2 + Kn + 2Ta)\theta_k - Ta(\phi_{k+1} + \phi_k) = 0,$$

(24) $$Mn^2 x_k + T(\phi_{k+1} - \phi_k) = 0,$$

(25) $$x_{k+1} - x_k - a(\theta_{k+1} + \theta_k) - 2L\phi_k = 0;$$

and the rest of the solution proceeds exactly as before, in § 14.

Gyroscopic pendulum. The elastic flexure joint is useful for supporting the gyroscopic pendulum, consisting of a rod and a gyroscope on its axis.

Expressed by Euler's angles the kinetic energy

(26) $$T = \tfrac{1}{2}A(\dot\theta^2 + \sin^2 \theta \dot\psi^2) + \tfrac{1}{2}C(1-\cos \theta)^2 \dot\psi^2 + \tfrac{1}{2}C'(\dot\phi + \dot\psi \cos \theta)^2,$$

where A refers to rod and gyroscope, C to rod and case, and C′ to revolving fly-wheel; and applying Lagrange's equations, the time is given as a function of $\cos \theta$ by a *hyperelliptic* integral.

A diagram is given in Perry's *Spinning Tops*, p. 126; but if the support is a smooth ball-and-socket joint, the motion is given by elliptic functions, as developed previously.

Authorities.—For a complete list of the mathematical works on the subject of the Gyroscope and Gyrostat from the outset, Professor Cayley's Report to the British Association, 1862, on the *Progress of Dynamics* should be consulted. Modern authors will be found cited in Klein-Sommerfeld, *Theorie des Kreisels*, 1897.

(A. G. G.)

Gyula-Fehérvár (German, *Karlsburg*), a corporate town of Hungary, in the county of Alsó-Fehér. It is the seat of the Transylvanian Roman Catholic bishop, and contains a royal tribunal, a chamber of advocates, several schools and important financial institutions, a museum, &c. Its origin dates from the Roman period. In the 16th century, when Transylvania separated from Hungary, it was the residence of the Transylvanian princes, but after that time it decayed. The fortress was constructed by order of Charles III. between 1715 and 1735; hence the German name of the town. Population (1891), 8167; (1900), 11,507.

Haarlem, capital of the province of North Holland (Netherlands), 11 miles west of Amsterdam by rail, at the foot of the dunes and near the confluence of the Spaarne and the Y. Profiting by the advantages of its situation, the town uses the dune water for bleaching and brewing purposes, and the fertile Kennemerland for agriculture. The industrial rise of Leyden, Brabant, Flanders, and the commercial rise of Amsterdam, have lessened the importance of Haarlem, but it is still a considerable market for agricultural produce (butter and cheese) and cattle, and has a flourishing trade in "Dutch bulbs." More recent industries are the manufacture of tram and railway carriages and machinery, type-founding, bank-note and stamp printing, &c. Here, too, are the works of the Dutch railway. A steam tramway was opened in 1898, and the Colonial museum has been added to that of industrial art, both founded by the Society for Promoting Industry. Population (1900), 64,069.

Hackensack, capital of Bergen county, New Jersey, U.S.A., in 40° 53′ N. lat. and 74° 03′ W. long., on the W. bank of the river Hackensack. Its site is level, and it has a regular plan. It is on four railways—the New Jersey and New York; the New York, Ontario, and Western; the New York, Susquehanna, and Western; and the West Shore. Population (1880), 4248; (1890), 6004; (1900), 9443, of whom 2009 were foreign-born and 515 were negroes.

Haddington, or East Lothian, a maritime county of Scotland, bounded on the N. by the Firth of Forth, on the E. by the North Sea, on the S. by Berwickshire, and on the W. by Edinburghshire.

Area and Population.—In 1891 the boundary between Haddington and Midlothian was altered in the parishes of Humbie and Fala and Soutra, the whole of the former and part of the latter being transferred to Midlothian, and between Haddington and Berwickshire in the parish of Oldhamstocks, which, deprived of its Berwick portion, was placed wholly in Haddington. According to the latest official estimate, the area of the county (foreshore excluded) is 171,377 acres, or 267·7 square miles. The population was in 1881, 38,502; in 1891, 37,485; in 1891 on the above area, 37,377, of whom 18,169 were males and 19,208 females; in 1901, 38,662. On the old area, land only (271 square miles), the number of persons to the square mile in 1891 was 138, and the number of acres to the person, 4·6. In the registration county the decrease of population between 1881 and 1891 was 2·55 per cent. Between 1881 and 1891 the excess of births over deaths was 5001, and the decrease of the resident population was 980. The following table gives particulars of births, deaths, and marriages in 1880, 1890, and 1899:—

Year.	Deaths.	Marriages.	Births.	Percentage of Illegitimate.
1880	627	175	1166	6·1
1890	623	194	968	7·23
1899	567	205	955	6·0

The following table gives the birth-rate, death-rate, and marriage-rate per thousand of the population for a series of years:—

	1880.	1881-90.	1890.	1891-98	1899.
Birth-rate . .	30·32	29·15	25·75	27·02	26·19
Death-rate . .	16·31	15·95	16·57	16·38	15·55
Marriage-rate .	4·55	5·39	5·16	5·79	5·62

In 1891 there were 515 Gaelic-speaking persons in the county, and 70 foreigners. Valuation in 1889–90, £278,715; 1899–1900, £278,783.

Constitution and Government.—The county returns one member to Parliament. The principal towns are Haddington (3992), North Berwick (2784), Dunbar (3581), Tranent (2584), and Prestonpans (1721). There are 24 civil parishes, forming two combinations with Berwick and Midlothian parishes, with poorhouse at Prestonkirk and Inveresk; the number of paupers and dependants in September 1899 was 958. Haddingtonshire forms part of the sheriffdom of the Lothians and Peebles, and there is a resident sheriff-substitute at Haddington, who sits also at Dunbar, Tranent, and North Berwick.

Education.—Twenty-six school boards manage 41 schools, which had an average attendance of 5062 in 1898–99, while three voluntary schools had 187. There are high schools at North Berwick and Haddington, and seven other schools earned grants in 1898–99 for giving higher education. The County Council spends a proportion of the "Residue" grant in supporting short courses of instruction in technical subjects, chiefly agriculture, in experiments in feeding cattle and growing crops, and in paying the travelling expenses of technical students.

Agriculture.—Though it no longer stands high above the other counties in the kingdom in respect of successful farming on a large scale, East Lothian is still famous for the richness of its corn and root crops, the size of its holdings, and the good housing of its farm labourers. In 1895 the average size of the 558 holdings was 201 acres; 14·70 per cent. were under 5 acres, 24·55 were between 5 and 50, and 60·75 were over 50 acres. The number between 50 and 100 acres was 36; between 100 and 300, 129; between 300 and 500, 120; between 500 and 1000, 52, and there were two over 1000. In 1898 the percentage of cultivated area was 65·3, a figure exceeded only by Fife and Linlithgow. Among the grain crops oats are almost a constant. Wheat is reviving after a steady and prolonged fall in acreage, while barley has varied remarkably little during the decade ending 1899. The

following table gives the principal acreages at intervals of ten years from 1880:—

Year.	Area under Crops.	Corn Crops.	Green Crops.	Clover.	Permanent Pasture.	Fallow.
1880	115,804	45,299	26,163	27,088	16,242	1012
1890	115,691	40,506	24,036	30,175	20,296	276
1899	111,902	39,463	24,624	27,539	19,852	44

The following table gives particulars of the live stock at intervals of five years from 1880:—

Year.	Total Horses.	Total Cattle.	Cows or Heifers in Milk or Calf.	Sheep.	Pigs.
1880	3753	8,237	1807	111,886	2490
1885	3467	11,327	1864	132,447	2583
1890	3620	12,379	1832	142,070	2220
1895	3788	9,506	1808	127,483	2138
1899	3555	10,115	2011	131,221	2171

The acreage under wood in 1895 was 10,472. In 1891, 4132 men and 1654 women were returned as being engaged in agriculture.

Industries and Trade.—The coalfield in Haddington West is 30 square miles in extent, with ten seams. In 1890, 300,159 tons of coal, valued at £101,304, were raised; in 1899, 450,588 tons, valued at £168,971. Fireclay as well as limestone is worked. Apart from the industries connected with agriculture, there are none of importance. The Haddington coast is embraced in the Leith fishery district, and the ports of the county are Dunbar, North Berwick, Port Seton, and Prestonpans, which had among them in 1899 179 boats of 2556 tons, and 669 resident fishermen and boys; and the value of the fish landed—chiefly cod, haddocks, whitings, and crabs—was £17,167. Of 4854 men in industrial employment in 1891, 1531 were engaged in raising minerals.

AUTHORITIES.—D. CROAL. *Sketches of East Lothian.* Haddington, 1873.—R. SCOT-SKIRVING. "The Agriculture of East Lothian," *Transactions of Highland and Agricultural Society*, 1873.—F. WATT. *Picturesque Scotland.* London, 1882.—P. M'NEILL. *Tranent and its Surroundings.* Edinburgh, 1883.—JOHN MARTINE. *Reminiscences of the County of Haddington.* Haddington, 1890 and 1894.—W. SINCLAIR. *Pictorial Guide to Haddington.*—Dr WALLACE JAMES. *Writs and Charters of Haddington.* Haddington, 1898. (W. WA.)

Haddington, a royal burgh and the county town of Haddingtonshire, Scotland, on the river Tyne, 17 miles east of Edinburgh by road, the terminus of a branch of the North British Railway. There are four bridges over the Tyne, and another is in course of construction, and the market cross has been restored. Haddington is the retail centre for a large district, and its grain markets, once the largest in Scotland, are still of considerable importance. The Knox Institute, built in 1880, contains a lecture room, and took the place of the ancient and famous grammar school. There is, besides, a public school, which had an average attendance of 457 in 1898–99, while a Roman Catholic school had 130. Population (1881), 4043; (1901), 3992.

Haeckel, Ernst Heinrich (1834– ——), German biologist, was born at Potsdam on 16th February 1834. He studied medicine and science at Würzburg, Berlin, and Vienna, having for his masters such men as Johannes Müller, Virchow, and Kölliker, and in 1857 graduated at Berlin as M.D. and M.Ch. At the wish of his father he began to practise as a doctor in that city, but his patients were few in number, one reason being that he did not wish them to be many, and after a short time he turned to more congenial pursuits. In 1861, at the instance of Gegenbaur, he became *privat-docent* at Jena; in the succeeding year he was chosen extraordinary professor of comparative anatomy and director of the Zoological Institute in the same university; in 1865 he was appointed to a chair of zoology which was specially established for his benefit. This last position he continued to retain in spite of repeated invitations to migrate to more important centres, such as Strassburg or Vienna, and at Jena he has spent his life, with the exception of the time devoted to travelling in various parts of the world, whence in every case he brought back a rich zoological harvest.

As a field naturalist Haeckel displayed extraordinary power and industry. Among his monographs may be mentioned those on *Radiolaria* (1862), *Siphonophora* (1869), *Monera* (1870), *Calcareous Sponges* (1872), and *Arabian Corals* (1876), as well as several *Challenger* reports, viz., *Deep-Sea Medusæ* (1881), *Siphonophora* (1888), *Deep-Sea Keratosa* (1889), and *Radiolaria* (1887), the last being accompanied by 140 plates and enumerating several thousand new species. This output of systematic and descriptive work would alone have constituted a good life's work, but Haeckel has in addition written copiously on biological theory. It happened that just when he was beginning his scientific career Darwin's *Origin of Species* was published (1859), and such was the influence it exercised over him that he became the apostle of Darwinism in Germany. He was, indeed, the first German biologist to give a whole-hearted adherence to the doctrine of organic evolution and to treat it as the cardinal conception of modern biology. It was he who first brought it prominently before the notice of German men of science in his memoir on the *Radiolaria*, which was completely pervaded with its spirit, and later at the Congress of Naturalists at Stettin in 1863. Darwin himself has placed on record the conviction that Haeckel's enthusiastic propagandism of the doctrine was the chief factor of its success in Germany. His book on *General Morphology* (1866), published when he was only thirty-two years old, was called by Huxley a suggestive attempt to work out the practical application of evolution to its final results; and if it does not take rank as a classic, it will at least stand out as a landmark in the history of biological doctrine in the 19th century. Although it contains a statement of most of the views with which Haeckel's name is associated, it did not attract much attention on its first appearance, and accordingly its author rewrote much of its substance in a more popular style and published it a year or two later as the *Natural History of Creation* (*Natürliche Schöpfungsgeschichte*), which was far more successful. In it he divided morphology into two sections—tectology, the science of organic individuality; and promorphology, which aims at establishing a crystallography of organic forms (see *Ency. Brit.*, vol. xvi. pp. 842–844). Among other matters, he laid particular stress on the "fundamental biogenetic law" that ontogeny recapitulates phylogeny, that the individual organism in its development is to a great extent an epitome of the form-modifications undergone by the successive ancestors of the species in the course of their historic evolution (*Ency. Brit.*, xx. p. 422). His well-known "gastraea" theory is an outcome of this generalization. He divided the whole animal creation into two categories—the Protozoa or unicellular animals, and the Metazoa or multicellular animals, and he pointed out that while the former remain single-celled throughout their existence, the latter are only so at the beginning, and are subsequently built up of innumerable cells, the single primitive egg-cell (*ovum*) being transformed by cleavage into a globular mass of cells (*morula*), which first becomes a hollow vesicle and then changes into the *gastrula*. The simplest multicellular animal he conceived to resemble this gastrula with its two primary layers, ectoderm and endoderm, and the earliest hypothetical form of this kind, from which the higher animals might be supposed to be actually descended, he called the "gastraea." This theory was first put forward in the memoir on the calcareous sponges, which in its sub-title was described as an attempt at an analytical

solution of the problem of the origin of species, and was subsequently elaborated in various *Studies on the Gastraea Theory* (1873–84). Haeckel, again, was the first to attempt to draw up a genealogical tree (*Stammbaum*) exhibiting the relationship between the various orders of animals with regard both to one another and their common origin. His earliest attempt in the *General Morphology* was succeeded by many others, but his efforts in this direction may perhaps be held to culminate in the paper he read before the fourth International Zoological Congress, held at Cambridge in 1898, when he traced the descent of the human race in twenty-six stages from organisms like the still-existing *Monera*, simple structureless masses of protoplasm, and the unicellular *Protista*, through the chimpanzees and the *Pithecanthropus erectus*, of which a few fossil bones were discovered in Java in 1894, and which he holds to be undoubtedly an intermediate form connecting primitive man with the anthropoid apes. In 1900 he made a voyage to Java and the East Indies for scientific purposes, and on his return published *Aus Insulinde, Malayische Reisebriefe* (1901).

Not content with the study of the doctrine of evolution in its zoological aspects, Haeckel also applied it to some of the oldest problems of philosophy and religion. What he terms the integration of his views on these subjects he published under the title of *Die Welt-räthsel*, which in 1900 appeared in English as *The Riddle of the Universe*. In this book he displays the courage of his convictions to an extent which the reader may feel ceases to be meritorious in the absence of adequate argument. Adopting an uncompromising monistic attitude, he asserts the essential unity of organic and inorganic nature. According to his "carbon-theory," which has been far from achieving general acceptance, the chemico-physical properties of carbon in its complex albuminoid compounds are the sole and the mechanical cause of the specific phenomena of movement which distinguish organic from inorganic substances, and the first development of living protoplasm, as seen in the *Monera*, arises from such nitrogenous carbon-compounds by a process of spontaneous generation. Psychology he regards as merely a branch of physiology, and psychical activity as a group of vital phenomena which depend solely on physiological actions and material changes taking place in the protoplasm of the organism in which it is manifested. Every living cell has psychic properties, and the psychic life of multicellular organisms is the sum-total of the psychic functions of the cells of which they are composed. Moreover, just as the highest animals have been evolved from the simplest forms of life, so the highest faculties of the human mind have been evolved from the soul of the brute-beasts, and more remotely from the simple cell-soul of the unicellular Protozoa. As a consequence of these views Haeckel is led to deny the immortality of the soul, the freedom of the will, and the existence of a personal God.

There is a biography by W. Bölsche (Dresden, 1900).

Hagen, an industrial town of Prussia, province of Westphalia, 15 miles by rail north-east of Elberfeld Barmen. It is the seat of important iron and cotton industries, and also of paper, cloth, and tobacco factories, tanneries, distilleries, and breweries. Among its principal buildings are the Luther church (1886–89), the Roman Catholic church (1895), and the royal engineering school (1891–1894). There are also a municipal park and a bronze statue of the Emperor Frederick III. (1899). Population (1885), 29,614; (1900), 50,609. In April 1901 the rural commune of Eckesey (12,326) was incorporated with Hagen, making the total population of Hagen and its environs 62.935.

Hagerstown, capital of Washington county, Maryland, U.S.A., west of the Blue Ridge, on the Baltimore and Ohio, the Norfolk and Western, the Western Maryland, and the Cumberland Valley railways, at an altitude of 567 feet. It is the seat of Kee Mar College, a Lutheran institution for women, established in 1852, and having, in 1898, 15 instructors and 110 students. Population (1880), 6627; (1890), 10,118; (1900), 13,591, of whom 394 were foreign-born and 1277 negroes.

Hagonoy, a town in the extreme south-western portion of the province of Bulacan, Luzon, Philippine Islands. It is the centre of a rich agricultural region, producing rice, Indian corn, coffee, and sugar. Alcohol is made in considerable quantities from the fermented juice of the nipa palm, which grows in the neighbouring swamps. The women of this town are very skilful in weaving the native fabrics. The language is Tagalog. Population, 20,000.

Hague, The (in Dutch *'S Gravenhage*, or *den Haag*), chief town of the province of South Holland (Netherlands), 13 miles N.W. of Rotterdam by rail. Its western portion being built upon high, dry, and sandy soil (the south and south-eastern on low-lying moorland), contains the healthiest, pleasantest, and most prosperous quarters, and the parks, gardens, and woods. The museums, libraries, scientific institutions, and art collections, and the attractiveness of the environs (Scheveningen, Wassenaer, Haagsche Bosch), make the town a popular resort for people of private means, ex-officials, colonials from India, artists, and scientific men, more especially as rents are low. Accordingly it has of late years grown more rapidly than any other in the kingdom, and many new streets and quarters have been built. Its industries have changed little, but the manufacture at Rozenburg of fine earthenware (Rozenburg-Delftsch) must be specially mentioned. A few buildings have been renewed or restored, among them the ministry of justice, the town hall, and the railway stations. The new buildings include one for the arts and sciences, a school for imbeciles, and one for technical instruction. A new fishing port is proposed near the end of the Hague-Scheveningen canal. Population (1869), 90,277; (1900), 206,023.

Hahn-Hahn, Ida, Countess (1805–1880), German authoress, was born at Tressow, in Mecklenburg-Schwerin, on 22nd June 1805. Her maiden name was Hahn, but she became Countess Hahn-Hahn on her marriage with her cousin in 1826. In 1829 the husband's irregularities led to a divorce. The countess travelled, produced some volumes of poetry indicating true lyrical feeling, and in 1838 appeared as a novelist with *Aus der Gesellschaft*, a title which, proving equally applicable to her subsequent novels, was retained as that of a series, the book originally so entitled being renamed *Ida Schönholm*. For several years the countess continued to produce novels bearing a certain subjective resemblance to those of George Sand, but less hostile to social institutions, and dealing almost exclusively with aristocratic society. The authoress's patrician affectations at length drew upon her the merciless ridicule of Fanny Lewald in a parody of her style entitled *Diogena* (1847), and this and the revolution of 1848 together seem to have co-operated in inducing her to embrace the Roman Catholic religion in 1850. She justified her step in a polemical work entitled *From Babylon to Jerusalem* (1851), which elicited a cutting reply from Professor Abeken. In 1852 she retired into a convent at Antwerp, but continued to write; her later publications, however, passed unnoticed as mere party manifestoes. Her earlier works do not deserve the neglect into which they have fallen. If their sentimentalism is some-

times wearisome, it is grounded on genuine feeling and expressed with passionate eloquence. *Ulrich* and *Faustine*, both published in 1841, mark the culmination of her power; but *Sigismund Forster* (1843), *Cecil* (1844), and *Sibylle* (1846) also obtained considerable popularity. She died at Mainz on the 12th of January 1880. (R. G.)

Haidarabad, or HYDERABAD, a native state of India, also known as the Nizam's Dominions and the Deccan, occupying the eastern portion of the plateau of Southern India. In 1887, on the occasion of Queen Victoria's Jubilee, the Nizam made an offer to the Viceroy of pecuniary aid for frontier defence, which led to the organization of the imperial service troops now maintained by several native chiefs. In 1900 he paid a visit to the Viceroy at Calcutta, being the first Nizam to leave his own dominions. The visit was returned by Lord Curzon in April 1902.

The following table gives the area and population of the several districts of Haidarabad state according to the census of 1901:—

Area and Population of Haidarabad, 1901.

Divisions.	Districts.	Area in Square Miles.	Number of Towns and Villages	Population, Census of 1901. Males.	Females.	Total.	Density of Population to Square Mile.	Population, Census of 1891.
Western.	Bidar	4,180	1,444	352,211	357,062	709,273	170	901,984
	Nander	3,343	1,174	250,481	250,796	501,277	150	632,529
	Naldrug	4,010	862	273,703	267,222	540,925	135	649,272
		11,533	3,480	876,395	875,080	1,751,475	152	2,183,785
Northern	Elgandal	7,207	1,551	580,498	545,080	1,125,578	156	1,094,601
	Indor	4,822	1,119	318,533	318,739	637,272	132	639.598
	Mehdak	2,017	634	199,940	195,338	395,278	196	364,735
	Sirpur Tandur	5,029	946	134,760	133,413	268,173	53	231,754
		19,075	4,250	1,233,731	1,192,570	2,426,301	134	2,330,688
North-Western	Aurangabad	6,176	1,836	359,354	359,695	719,049	116	828,975
	Parbhani	5,087	1,510	322,225	319,590	641,815	126	805,335
	Birh	4,460	1,013	237,500	233,222	470,722	106	642,722
		15,723	4,359	919,079	912,507	1,831,586	116	2,277,032
Eastern.	Warangal	9,779	1,519	499,788	466,665	966,453	99	853,129
	Mahbubnagar	6,497	1,355	360,102	350,915	711,017	109	674,649
	Nalgonda	4,131	961	351,564	332,667	684,231	166	624,617
		20,407	3,835	1,211,454	1,150,247	2,361,701	125	2,152,395
Southern	Gulbarga	4,064	1,109	396,451	385,078	781,529	191	649,258
	Linsugur	4,907	1,278	335,737	334,566	670,303	136	620,014
	Raichor	3,661	925	257,714	251,383	509,097	139	512,455
		12,632	3,312	989,902	971,027	1,960,929	156	1,781,727
	Atraf-i-Balda	3,328	851	426,126	403,954	830,080	251	804,823
Railways		..	..	8,085	4,740	12,825	..	6,590
Grand Total		82,698	20,087	5,664,772	5,510,125	11,174,897	135	11,537,040

The average density is 135 persons per square mile, ranging from 196 in Mehdak, on the west, to 53 in Sirpur Tandur, on the north. Classified according to religion, in 1891 Hindus numbered 10,315,249, or 89 per cent. of the total population. In the west they speak Marathi, in the south and east Telugu. Mahommedans numbered 1,138,666, or 10 per cent., being most numerous in Haidarabad city. Christians numbered 20,429, of whom half were Roman Catholics. Jains numbered 27,845; Sikhs, 4637; Parsis, 1058; Jews, 26; and aboriginal tribes, 29,130. The preliminary returns of the census of 1901 gave the total as 11,174,897, showing a decrease of 362,143, or 3 per cent., compared with an increase of 1,691,446, or 17 per cent., in the preceding decade. In some districts, where the famine of 1900 was most severe, the rate of decrease was as high as 20 per cent.

The yearly revenue of the state is estimated at Rs.4,00,00,000, of which about half is derived from the land. The Haidarabad Contingent consists of six regiments of cavalry, four batteries of artillery, and six battalions of infantry—total, 7660 men, all under British officers, maintained at a cost of about Rs.40,00,000. The currency is based on the *halli* rupee, which contains approximately the same weight of silver as the British rupee, but its exchange value has fallen heavily since the closing of the mints. The conventional rate of exchange is 128 *halli* rupees = 100 British rupees. An independent post-office is also maintained. Railways have been made by an English company under a guarantee from the state. The main line of the Great Indian Peninsula traverses the south-western corner of the state, whence a branch runs from Wadi to Haidarabad city, now continued through Warangal to Bezwada on the East Coast system. There is also a short branch to the Singareni coalfields. Another line was opened in 1900 in the north-east of the state, from Manmad junction by Aurangabad along the valley of the Godavery to Haidarabad city (386 miles). The total length of railway open in 1900 was 715 miles, the gross earnings being £422,102 and the net profits £205,400. The coal mine at Singareni is worked by an English company, employing 6800 persons, of whom 4860 are adult males. In 1898 the output was 394,622 tons, valued at Rs.11,83,870. Attempts to work gold and diamond mines have not been successful. There are three cotton mills, belonging to companies, at Haidarabad city, Aurangabad, and Gulbarga, with 623 looms and 52,476 spindles, employing 2480 hands. The state has suffered from bad seasons, which culminated in 1900 in actual famine. The total number of persons in receipt of relief rose to nearly 500,000 in June 1900.

The CITY OF HAIDARABAD is situated on the river Musi, about 1700 feet above the sea. Population, together with Secunderabad and the suburbs (1881), 367,417; (1891), 415,039; (1901), 446,291. Haidarabad is thus the fourth most populous city in India, being surpassed only by the three Presidency towns, which are all seaports. The city proper is surrounded by a stone wall, with a circuit of about 6 miles. Secunderabad (6 miles) is the headquarters of a first-class military district under the Madras command. A little farther north (9 miles) is Bolaram, another military cantonment. The old fortress of Golconda, now used as a state treasury and prison, is about 7 miles to the west.

J. B. GRIBBLE. *A History of the Deccan.* London, 1896.

(J. S. CO.)

Haidarabad, or HYDERABAD, a city and district of British India, in the Sind province of Bombay. The city is on a hill about 3 miles from the left bank of the Indus, and had a population in 1881 of 48,153, and in 1891 of 54,048. An excellent water supply is derived from the Indus. Communication is maintained with the railway station of Kotri, on the opposite bank of the river, by a steam ferry from Gidu-Bandar; but the stream has been bridged, and a railway runs thence into Rajputana. There are manufactures of silk, gold, and silver embroidery, lacquered ware and pottery, and three factories for ginning cotton. It has three high schools, with about 800 pupils, training colleges for masters and mistresses, a medical school, an agricultural school for village officials,

a technical school, and three printing-presses, each issuing a vernacular periodical. The city suffered from plague in 1896–97, but the death-rate for 1897 was only 38·9 per 1000. The DISTRICT OF HAIDARABAD has an area of 9033 square miles, with a population in 1881 of 754,624, and in 1891 of 918,646, giving an average density of 102 persons per square mile, being the highest in Sind. In 1901 the population was 990,502, showing an increase of 1 per cent., compared with an increase of 16 per cent. in the previous decade. The land revenue was Rs.21,46,338, the incidence of assessment being Rs.2–5–6 per acre; the cultivated area in 1897–98 was 942,471 acres, of which 916,659 were irrigated, including 842,445 from Government canals; the number of police was 1174; the children at school in 1897–98 numbered 15,853, being 2·1 per cent. of the total population; the registered death-rate in 1897 was 14·4 per 1000. The principal crops are millet, rice, oil-seeds, cotton, and wheat. There is a special manufacture at Hala of glazed pottery and striped cotton cloth. A railway crosses the district eastwards from Haidarabad to Shadipalli, which will be extended across the Indus on one side and into Rajputana on the other, thus affording a direct route, on the metre gauge, from Northern India nearly to Karachi.

Haifa, a coast town of Palestine, situated at the foot of Mount Carmel, on the south side of the bay of Acre. Its roadstead is protected from south and west winds, and the town, from its more favourable position, is attracting much of the trade of Acre. A railway to Damascus has been commenced, and it is proposed to construct a port. If these works are completed, Haifa will become the most important port on the coast of Syria. The German colony of "Templars," established near the town in 1869, has been the means of greatly increasing its prosperity. In 1900 the exports, cereals and oil, were valued at £178,738. The population numbered 12,000 (Germans 500, Moslems 6000, Christians 4000, Jews 1500). About 2 miles north-west of Haifa is the celebrated Carmelite monastery.

(C. W. W.)

Hainan, a large island off the southern coast of China, forming part of the province of Kwangtung. The trade of Kiungchow, which is the only treaty port in the island, has risen from 1,215,000 Haikwan taels, or £175,300, in 1878 to 4,647,000 Haikwan taels, or £670,600, in 1899. This trade is almost entirely with the British colony of Hong Kong, with which the port is connected by small coasting steamers, but since 1893 it has had regular steamboat communication with Haiphong in Tongking. The population of Kiungchow, including its shipping port of Hoihow, is estimated at 52,000. The number of foreign residents in 1900 was about 30, most of them officials or missionaries.

Hainaut (French, *Hainaut;* Flemish, *Henegouwen*), a Belgian province bordering on West and East Flanders, Brabant, Namur, and the French department Du Nord. A part of the ancient Countship of Hainaut of the 9th century, it was under the government of France known as the "departement de Jemappes"—the name of a place where the French arms were victorious in 1792. The land rises in a southerly direction up to a height of 1200 feet. The western half of the province belongs to the basin of the Scheldt, the eastern half to the basin of the Meuse. These two basins communicate with one another by the Charleroi canal. In the way of mineral products, coal is extracted in the three regions of Borinage, Centre, and Charleroi basins, the mining employing 83,000 workers. The province has also quarries of marble, of building-, paving-, and lime-stone, employing 11,000 workers. The crops include cereals, beetroot, flax, hemp, and tobacco. Though agriculture is in a high state of excellence, the province is essentially industrial. The principal industries are: metallurgy in all its branches, employing 24,000 workers—rolling mills, steam engines, railway material, &c.; glass works, employing 14,000 persons; numerous sugar refineries, chemical works, &c. The province is divided into six administrative arrondissements. The chief towns are: Mons (55,600 inhabitants), capital of the province; Tournai (36,800), Charleroi (24,400); and, among the industrial towns, Jumet (25,000), La Louvière (16,000). The province covers 1437 square miles, with (1899) a population of 1,133,672, or 789 to the square mile. Between 1876 and 1899 the population of the province decreased 177,318, having been at the former date 956,354.

Haiphong, a town in Tongking, French Indo-China, on one of the branches of the Song-Koi (or Red River) delta. So recently as 1880 wide marshes and submerged rice-fields extended round the junction of the Kwa-Kam and the Song Tam Bac mouths of the Red River. On the same site to-day stands Haiphong, the largest town of Tongking with the exception of Hanoi. It has a population of about 17,000, of whom 630 are European (exclusive of officials and the garrison) and 5000 Chinese, and is the great port of Tongking. Since 1893 the opening of navigation on the Red River and the establishment of regular services to Hong Kong, Pakhoi, and Hoihow (on Hainan island) has greatly increased the traffic. The steamers to the interior of Tongking number more than 1800 entering and clearing. The excavation of the Kwa-Nam-Triu, in course of completion, will permit the largest vessels to reach Haiphong without being delayed by the bar. The town was constituted a municipality 19th July 1888. Since 1893 it has been lighted by electricity. There are extensive artillery workshops and military stores in the Annamese citadel. Haiphong is a naval station for warships on the reserve and for dismantled gunboats. The streets are regularly laid out and planted with trees. The Boulevard Paul Bert is the finest European street. The most noteworthy buildings are the Residency, the tribunal, the Indo-Chinese Bank, the Treasury, and the mansion of the Governor-General. There are also fine promenades and a race-course, and the town boasts three printing-offices and three French newspapers. Fourteen miles from Haiphong, along a fairly good road, lies the bathing resort of *Do-Son,* the only seaside town in Tongking in which sea-bathing can be enjoyed. The Governor-General has a villa there. Since 1891 many houses have been built, and the beach has been much frequented. All the great Indo-Chinese banks have branch establishments at Haiphong, and its chamber of commerce is of sufficient importance to entitle its president to a seat upon the superior council of Indo-China.

(J. M. A. DE L.)

Hajipur, a town of British India, in the Muzaffarpur district of Bengal, on the Gandak, just above its confluence with the Ganges above Patna. It is the terminus of the branch of the Tirhut Railway from Muzaffarpur, and of another branch under construction along the Ganges to Katihar. Population (1881), 25,078; (1891), 21,487.

Hakata. See FUKUOKA.

Hake, Thomas Gordon (1809–1895), English poet, was born at Leeds in 1809. A physician by profession, he had given up practice for many years before his death, and had devoted himself to a literary life. In 1839 he published a prose epic *Vates,* which attracted the attention of D. G. Rossetti, and in after years he became

an intimate member of Rossetti's circle of friends and followers. In 1871 he published *Madeline*, (1873) *Parables and Tales*, (1883) *The Serpent Play*, (1890) *New Day Sonnets*, and in 1892 he published his *Memoirs*. Dr Hake's works had much subtlety and felicity of expression, and were warmly appreciated in a somewhat restricted literary circle. He was given a Civil List literary pension in 1893, and died on 11th January 1895.

Hakodate, a town on the south-east of the island of Yezo, Japan, situated in 41° 46′ N. lat. 140° 44′ E. long., for many years regarded as the capital of the island until Sapporo was officially raised to that rank. It is one of the ports originally opened to foreign trade, and the development of its commerce is exhibited in the following table :—

Year.	Exports.	Imports.	Total.
1884	£67,663	£898	£68,561
1889	126,858	19,105	145,963
1893	79,953	3,040	82,993
1899	211,605	172,646	384,251

The staple exports are beans, pulse, and peas, marine products, sulphur, furs, and timber; the staple imports, comestibles (especially salted fish), kerosene, and oil-cake. The town is not situated so as to profit largely by the development of the resources of Yezo. The population grew from 55,677 in 1890 to 78,040 in 1899, and its prosperity has increased in a corresponding ratio, but as a port for foreign trade its outlook is indifferent. Good steamers ply between Hakodate and Yokohama twice or thrice a week, and there is daily communication with Aomori, 56 miles distant, whence train may be taken for Tôkyô. Hakodate has now a tramway, and is provided with waterworks, the water being carried from the Aka-gawa, 7 miles distant. A fort has been constructed near the summit of the Peak, a great rock which has been likened to Gibraltar, and it is consequently no longer accessible to viewgazers.

Hal, a town of Belgium, in the province of Brabant, 10 miles south of Brussels by rail. It has several industries, including the manufacture of beetroot sugar, considerable beer brewing, and the building of canal boats. Population (communal, 1899), 12,026.

Halberstadt, a town of Prussia, province of Saxony, 56 miles by rail N.W. of Halle. Gleim's house became the property of the municipality in 1899. The leading industries are the manufacture of cigars, gloves, and sugar, distilling, brewing, and tanning. There are also large railway workshops. Population (1885), 34,025; (1900), 42,644.

Halévy, Ludovic (1834– ——), French author, was born in Paris on the 1st of January 1834. His father, Léon Halévy, was a clever and versatile writer, who tried almost every branch of literature—prose and verse, vaudeville, drama, history—without, however, achieving decisive success in any. His uncle, Fromental Halévy, the celebrated author of *La Juive*, was for many years *directeur du chant* at the Opéra; hence the double and early connexion of Ludovic Halévy with the Parisian stage. At the age of six he might have been seen playing in that *Foyer de la danse* with which he was to make his readers so familiar, and, when a boy of twelve, he would often, of a Sunday night, on his way back to the College Louis le Grand, look in at the Odéon, where he had free admittance, and see the first act of the new play. At eighteen he joined the ranks of the French administration and occupied various posts, the last being that of secrétaire-rédacteur to the Corps Législatif. In that capacity he enjoyed the special favour and friendship of the famous duke of Morny, then President of that assembly. In 1865 Ludovic Halévy's increasing popularity as an author enabled him to retire from the public service. Ten years earlier he had become acquainted with the musician Offenbach, who was about to start a small theatre of his own in the Champs Élysées, and he wrote a sort of prologue, *Entrez, messieurs, mesdames*, for the opening night. Other little productions followed, *Ba-ta-clan* being the most noticeable among them. They were produced under the pseudonym of Jules Servières. The name of Ludovic Halévy appeared for the first time on the bills on the 1st of January 1856. Soon afterwards the unprecedented run of *Orphée aux Enfers*, a musical parody, written in collaboration with Hector Crémieux, made his name famous. In the spring of 1860 he was commissioned to write a play for the manager of the *Variétés* in conjunction with another vaudevillist, Lambert Thiboust. The latter having abruptly retired from the collaboration, Halévy was at a loss how to carry out the contract, when on the steps of the theatre he met Henri Meilhac (1831–1897), then comparatively a stranger to him. He proposed to Meilhac the task rejected by Lambert Thiboust, and the proposal was immediately accepted. Thus began a connexion which was to last over twenty years, and which proved most fruitful both for the reputation of the two authors and the prosperity of the minor Paris theatres. Their joint works may be divided into three classes: the *opérettes*, the farces, the comedies. The *opérettes* afforded excellent opportunities to a gifted musician for the display of his peculiar humour. They were broad and lively libels against the society of the time, but savoured strongly of the vices and follies they were supposed to satirize. Amongst the most celebrated works of the joint-authors were *La Belle Hélène* (1864), *Barbe Bleue* (1866), *La Grande Duchesse de Gerolstein* (1867), and *La Périchole* (1868). After 1870 the vogue of Parody rapidly declined. The decadence became still more apparent when Offenbach was no longer at hand to assist the two authors with his quaint musical irony, and when they had to deal with interpreters almost destitute of singing powers. They wrote farces of the old type, consisting of complicated intrigues, with which they cleverly interwove the representation of contemporary whims and social oddities. They generally failed when they attempted comedies of a more serious character and tried to introduce a higher sort of emotion. A solitary exception must be made in the case of *Frou-frou* (1869), which, owing perhaps to the admirable talent of Aimée Desclée, remains their unique *succès de larmes*.

Meilhac and Halévy will be found at their best in light sketches of Parisian life, *Les Sonnettes*, *Le Roi Candaule*, *Madame attende Monsieur*, *Toto chez Tata*. In that intimate association between the two men who had met so opportunely on the *perron des Variétés*, it was often asked who was the leading partner. The question was not answered until the connexion was finally severed and they stood before the public, each to answer for his own work. It was then apparent that they had many gifts in common. Both had wit, humour, observation of character. Meilhac had a ready imagination, a rich and whimsical fancy; Halévy had taste, refinement, and pathos of a certain kind. Not less clever than his brilliant comrade, he was more human. Of this he gave evidence in two delightful books, *Monsieur et Madame Cardinal* and *Les petites Cardinal*, in which the lowest orders of the Parisian middle class are faithfully described. The pompous, pedantic, venomous Monsieur Cardinal will long survive as the true image of sententious and self-glorifying immorality. M. Halévy's peculiar qualities are even more visible in the simple and striking scenes of the *Invasion*, published soon after the conclusion of the

Franco-German war, in *Criquette* and *L'Abbé Constantin* (1882), two novels, the latter of which went through innumerable editions. Zola had presented to the public an almost exclusive combination of bad men and women; in *L'Abbé Constantin* all are kind and good, and the change was eagerly welcomed by the public. Some enthusiasts still maintain that the *Abbé* will rank permanently in literature by the side of the equally chimerical *Vicar of Wakefield.* At any rate, it opened for M. Ludovic Halévy the doors of the French Academy, to which he was elected in 1888.

Hale, Edward Everett (1822- ——), American author and Unitarian minister, was born in Boston, 3rd April 1822, being the son of Nathan Hale, editor of the Boston *Daily Advertiser*, and the nephew of Edward Everett, the orator and statesman. He graduated at Harvard in 1839, entered the Unitarian ministry, and, after a pastorate in Worcester, Massachusetts, became minister of the South Congregational (Unitarian) Church in Boston in 1856. There he remained until his resignation in 1899. While he always deemed his life-work to be that of a Christian minister, and his strong personality affected New England life for half a century, he was a constant and voluminous contributor to the periodical press; he edited many magazines and newspapers, of which the monthly *Old and New* was the most ambitious; and is the author or editor of sixty or seventy volumes — fiction, juvenile stories, books of travel, sermons, biography, and history. His best-known short story is *The Man without a Country*, which, published in the *Atlantic Monthly* in 1863, at the darkest period of the American Civil War, did much to strengthen the Union cause in the North. In this, and in some of his other non-romantic tales, he employed a minute realism which led many readers to suppose the narrative a record of unaltered fact. The story *Ten Times One is Ten* (1870), with its hero Harry Wadsworth and its motto, "Look up and not down, look out and not in, look before and not behind, and lend a hand," led to the formation, in many parts of the United States, of "Lend a Hand Clubs," "Look-up Legions," or "Harry Wadsworth Clubs"; while out of the romantic Waldensian religious story *In His Name* (1874) there similarly grew orders of "King's Daughters," "King's Sons," and other organized bodies for religious work. Of his other writings in prose and verse—all marked by abounding vivacity, earnest humanity, and rapidity of workmanship—the most important are the two volumes, largely based on painstaking original research, in collaboration with his son, Edward Everett Hale, Jun., on *Franklin in France* (1887–88: Part I. "The Alliance"; Part II. "The Treaty of Peace and Franklin's Life till his Return"); the autobiographical record of his own *New England Boyhood* (1893) in Boston in the 'twenties and 'thirties; and the account, from first-hand sources and personal knowledge, of *James Russell Lowell and his Friends* (1899). Dr Hale interested himself successively in the anti-slavery movement, the protective tariff, popular education, and working-men's home life. A collected and revised edition of his writings began to appear in 1899.

Halfaya, a historical town of Anglo-Egyptian Sudan, which gives its name to the district of Khartum. For several years after its occupation by the Egyptians (1821) it continued to be the chief station about the confluence of the Blue and White Niles. It stands 7 miles above the confluence, and before the Mahdist revolt was the residence of the powerful sheikh of the Jalin Arabs. But it lost most of its importance when the seat of government was removed by Mehemet Ali to Khartum.

Halicz, a town in the government district of Stanislau, Galicia, Austria, at the confluence of the Luckow with the Dniester. It is commanded by the ruins of the old castle of Halicz, the seat of the ruler of the former kingdom from which Galicia has derived its Polish name. Its principal resources are the recovery of salt from the neighbouring brine wells, soap-making, and the trade in timber. Population (1890), 3887; (1900), 4809.

Halifax, a municipal, county (1888), and parliamentary borough of the West Riding of Yorkshire, England, on the Hebble near its influx into the Calder, 7 miles south-west by west of Bradford, 209 miles by rail north-north-west of London. The municipal borough is divided into 15 wards under a mayor, 15 aldermen, and 45 councillors. The corporation possesses waterworks, gasworks, electric works, tramways, a bonding warehouse, two public libraries, an art gallery and museum (1886), a technical school (1895, costing over £26,000), a court house and police station, erected at a cost of £27,000, a fire brigade station, and six parks. Modern public buildings include the handsome post office (1887), a new infirmary (1896), and a higher-grade board school. There are two newspapers. The manufacture of carpets is a large industry, one establishment employing 5000 hands. In 1891, 2280 persons were employed in the making of machines, 4070 males and 7506 females in the worsted, 1365 males and 965 females in the woollen, 1159 males and 1364 females in the cotton, and 970 persons in the iron and steel manufacture. The municipal and county borough, coextensive with the parliamentary borough till 1892, was extended then, and again in 1900, and now has an area of 13,636 acres. Population (1891), 97,714; (1901), 104,933.

Halifax, city and port of entry, the capital of Nova Scotia and of Halifax county, on the south-east coast of the province. Recent improvements are the new Dalhousie College, the Intercolonial Railway station, a dry dock constructed by a company with Imperial, Dominion, and civic subsidies, having a capacity for ships of 600 feet in length, and used by the Admiralty and by the Government of the United States for repairing ships of war; spacious wharves, warehouses, freight sheds, &c., and a grain elevator with a capacity of some 750,000 bushels, constructed at the deep-water terminus of the Intercolonial Railway; armouries for the militia, and a new building for the school for deaf and dumb. There are twenty-six churches, five banks, and branches of two others. Halifax is the American terminus of the Direct Cable Company. It is one of the termini of the subsidized mail steamers plying between Great Britain and Canada, and secures a portion of the winter trade. The city is lighted by gas and electricity, and an electric street railway traverses the principal streets. In 1900 there were 148 teachers employed and 7988 pupils attended the city schools, being 1 in 4·8 of the population. There are two manual training schools, one for boys and one for girls. In 1900 the number of British and foreign vessels entered was 1080, tonnage 866,989; cleared 1185, tonnage 840,796. Moreover, in connexion with the coasting trade 4030 vessels of 495,394 tons entered in 1900, and 3790 of 529,284 tons cleared. The net debt in 1899 was $3,153,516, taxable property $23,260,962. Exports in 1890 were valued at $5,292,498, in 1900 at $6,758,403; imports in 1890 at $6,669,858, in 1900 at $6,335,691. Population (1881), 36,100; (1891), 38,495; (1901), 40,787.

Hall, a town in northern Tirol, Austria, on the left bank of the Inn, 4 miles east of Innsbruck. Among its new industries are corn-milling, the manufacture of felt hats, bone buttons, and fire-engines. An important

feature of the town is its growing popularity as a health resort, its brine and mineral springs possessing valuable properties. Population, Roman Catholic and German (1890), 5763; (1900), 6191.

Hall, or BAD-HALL, a market-place and spa in the government district of Steyr, Upper Austria. Its saline springs, strongly impregnated with iodine and bromine, have been known since the 9th century, and have the reputation of being very efficacious in scrofulous affections and venereal skin diseases. There is a kurhaus, a children's hospital, and a bathing establishment for poor patients. It is annually visited by about 3500 patients. Population (1890), 866; (1900), 984.

Hall, Christopher Newman (1816–1902), English Congregational divine, son of the proprietor and printer of the *Maidstone Journal*, was born at Maidstone on 22nd May 1816, and educated at Totteridge and Highbury College. He also attended classes at University College, and took the London B.A. degree. Like the other students of Highbury College, he was often sent to preach at different towns, and had already acquired some practice when he was called (1842) to his first pastorate at the Albion Congregational Church at Hull. During the twelve years of his ministry the membership was greatly increased, and a branch chapel and school were opened. At Hull Newman Hall first began his active work in temperance reform, and in defence of his position wrote the *Scriptural Claims of Teetotalism.* In 1854 he accepted a call to Surrey Chapel, London, founded in 1783 by the Rev. Rowland Hill. A considerable sum had been bequeathed by the latter for the perpetuation of his work on the expiration of the lease; but, owing to some legal flaw in the will, the money was not available, and Newman Hall undertook to raise the necessary funds for a new church. By weekly offertories and donations the money for the fine new church at the junction of the Kennington and Westminster Bridge Roads was collected, and within four years of opening (1876) the total cost (£63,000) was cleared. In 1892 Newman Hall resigned his post, and afterwards devoted himself to general evangelical work. Most of his writings are small booklets or tracts of a distinctly evangelical character. The best known of these is *Come to Jesus*, of which no fewer than four million copies were circulated in forty different languages. Newman Hall visited the United States during the Civil War, and did much to promote a friendly understanding between England and America. A Liberal in politics, and a keen admirer of John Bright, few preachers of any denomination have exercised so far-reaching an influence as "the Dissenters' Bishop," as he came to be termed. He died 18th February 1902.

Halle, a town of Prussia, province of Saxony, 21 miles by rail north-west of Leipzig on the way to Magdeburg, and on the river Saale. The oldest parts of the town, between the churches of St Mary and St Maurice, have been modernized by driving some new streets through them. The town council assembly rooms were built in 1890–92, the front being adorned with statues of Charlemagne, the Great Elector, King Frederick I., and the Emperor William I.; and the town hall was in part restored in 1884. Amongst the public institutions should be mentioned the archæological museum (opened in 1891), the industrial art museum, the provincial museum and mineralogical museum (these two in the former palace of the archbishops of Magdeburg), the numerous medical institutes (which make up a quarter by themselves, on the east side of the town), the agricultural institute belonging to the university—one of the foremost institutions of the kind in Germany—the institute of physics with a meteorological institute, the convict prison, the Leopoldine Carolinian Academy, the provincial blind asylum (brought hither from Barby), the Riebeck old age asylum (1894–96), the new theatre (1886), the church of St Stephen's (1894) and the church of St John's (1893), a monument to the surgeon von Volkmann (1894), and the Gothic church of St Francis and St Elizabeth (1894–96). A new building was completed for the university library in 1880. A handsome new central railway station was opened on the east of the town in 1890, its cost being over half a million sterling. In 1900–1 the university was attended by 1620 students, and had 155 professors. Of late Halle has assumed the character and appearance of a manufacturing town, the principal establishments being sugar and starch factories, engineering works, factories for making agricultural machinery, printing works, breweries, distilleries, chemical factories, and salt works (some 8500 tons of salt being produced annually). In 1900 the town was enlarged by the incorporation of the communes of Giebichenstein (15,072 in 1895), Trotha (3656), Cröllwitz (2861), and Gimritz (90). Giebichenstein has a saline spring, which is visited by nearly 1000 persons annually, and is a favourite summer resort of the people of Halle, as is also the green island of Peissnitz, or the Nightingale Island, on the west of the town. Population (1885), 81,982; (1895), 116,304; (1900), 156,611.

Hallé, Sir Charles [originally KARL HALLE] (1819–1895), the eminent pianist and conductor, was born at Hagen, in Westphalia, 11th April 1819. He studied under Rink at Darmstadt in 1835, and as early as 1836 went to Paris, where for twelve years he lived in constant intercourse with Cherubini, Chopin, Liszt, and other musicians, and enjoyed the friendship of the great literary lights of the time, such as Alfred de Musset and George Sand. He had started a set of chamber concerts with Alard and Franchomme with great success, and had completed one series of them when the revolution of 1848 drove him from Paris, and he settled, with his wife and two children, in London. His pianoforte recitals, given at first from 1850 in his own house, and from 1861 in St James's Hall, were an important feature of London musical life, and it was due in great measure to them that a knowledge of Beethoven's pianoforte sonatas became general in English society. At the Musical Union founded by John Ella, and at the Popular Concerts from their beginning, Hallé was a frequent performer, and from 1853 was director of the Gentlemen's Concerts in Manchester, where, in 1857, he started a series of concerts of his own, raising the orchestra to a pitch of perfection quite unknown at that time in England. In 1888 he married Madame Norman Néruda, the famous violinist, and in the same year was knighted; in 1890 and 1891 he toured with his wife in Australia and elsewhere. He died at Manchester, 25th October 1895. Hallé was one of the most important influences in the musical education of England; if his pianoforte-playing, by which he was mainly known to the public in London, seemed remarkable rather for precision than for depth, for crystal clearness rather than for warmth, and for perfect realization of the written text rather than for strong individuality, it was at least of immense value as giving the composer's idea with the utmost fidelity. Those who were privileged to hear him play in private, like those who could appreciate the power, beauty, and imaginative warmth of his conducting, would have given a very different verdict; and they were not wrong in judging Hallé to be a man of the widest and keenest artistic sympathies, with an extraordinary gift of insight into music of every school, as well as a strong sense of humour. He fought a long and arduous

battle for the best music, and never forgot the dignity of his art. In spite of the fact that his technique was that of his youth, of the period before Liszt, the ease and certainty he attained in the most modern music was not the less wonderful because he concealed the mechanical means so completely. (J. A. F. M.)

Hallgrímsson, Jónas (1807–1844), the chief lyrical poet of Iceland, was born in 1807 at Steinsstaðir in Eyjafjarðarsýsla in the north of that island, and educated at the famous school of Bessastaðr. In 1832 he went to the University of Copenhagen, and shortly afterwards turned his attention to the natural sciences, especially geology. Having obtained pecuniary assistance from the Danish Government, he travelled through all Iceland for scientific purposes in the years 1837–1842, and made many interesting geological observations. Most of his writings on geology are in Danish. His renown was, however, not acquired by his writings in that language, but by his Icelandic poems and short stories. He was well read in German literature, Heine and Schiller being his favourites, and the study of the German masters and the old classical writers of Iceland opened his eyes to the corrupt state of Icelandic poetry and showed him the way to make it better. The misuse of the Eddic metaphors made the lyrical and epical poetry of the day hardly intelligible, and, to make matters worse, the language of the poets was mixed up with words of German and Danish origin. The great Danish philologist and friend of Iceland, Rasmus Rask, and the poet Bjarni Thórarensen had done much to purify the language, but Jónas Hallgrímsson completed their work by his poems and tales, in a purer language than ever had been written in Iceland since the days of Snorri Sturluson. The excesses of Icelandic poetry were specially seen in the so-called *rímur*, ballads of heroes, &c., which were fiercely attacked by Jónas Hallgrímsson, who at last succeeded in converting the educated to his view. Most of the principal poems, tales, and essays of Jónas Hallgrímsson appeared in the periodical *Fjölnir*, which he began publishing at Copenhagen in 1835, together with Konráð Gíslason, a well-known philologist, and the patriotic Thómas Sæmundsson. *Fjölnir* had in the beginning a hard struggle against old prejudices, but as the years went by its influence became enormous; and when it at last ceased, its programme and spirit still lived in *Ný Félagsrit* and other patriotic periodicals which took its place. Jónas Hallgrímsson, who died in 1844, is the father of a separate school in Icelandic lyric poetry. He introduced foreign thoughts and metres, but at the same time revived the metres of the Icelandic classical poets. Although his poetical works are all comprised in one small volume, he strikes every string of the old harp of Iceland. (S. BL.)

Halliwell-Phillips, James Orchard (1820–1889), English Shakespearean scholar, son of Thomas Halliwell, was born in London, 21st June 1820, and educated privately and at Jesus College, Cambridge. He devoted himself to antiquarian research, particularly in early English literature. In 1839 he edited Sir John Mandeville's *Travels;* in 1842 published an *Account of the European MSS. in the Chetham Library*, besides a newly discovered metrical romance of the 15th century (*Torrent of Portugal*). He became best known, however, as a Shakespearean editor and collector. In 1848 he brought out his *Life of Shakespeare*, which passed through several editions; in 1853–65 a subscription edition of the works in folio; in 1863 a *Calendar of the Records at Stratford-on-Avon;* in 1864 a *History of New Place.* He was mainly instrumental in the purchase of New Place for the Corporation of Stratford-on-Avon, and in the formation there of the Shakespeare Museum. His publications in all numbered more than sixty volumes. He assumed the name of Phillips in 1872, under the will of the grandfather of his first wife, a Worcestershire heiress. His house, Hollingbury Copse, near Brighton, was full of rare and curious works, and he generously left many of them to the public. He died 3rd January 1889.

Hallstatt, a market-place in the government district of Gmunden, Upper Austria, on the lake of the same name. The salt mine of Hallstatt, which is one of the oldest in existence, was rediscovered in the 14th century. The neighbourhood (evidently an ancient Celtic settlement) is further remarkable for the great number of antiquities of the Roman and still earlier periods which have been found there. These comprise ornaments and other objects in bronze, iron, gold, pottery, glass, amber, and ivory. (See works by Baron von Sacken, and Meyer on *Das Gräberfeld von Hallstatt.*) Some of these relics have been retained in the Hallstatt Museum, but the most important have been removed to the Natural History Museum in Vienna and the provincial museum at Linz. Population (1890), 789; (1900), 737—all German, two-thirds Catholic and one-third Protestant.

Halmahera, or JILOLO, an island in the East Indian Archipelago, east of the north part of Celebes, belonging to the Dutch residency of Ternate. Without the neighbouring islands its area is 6648 square miles; with them, 7495 square miles. Of its four peninsulas, the northern and the southern are reckoned to the sultanate of Ternate, the north-eastern and south-eastern to that of Tidore; the former having eleven, the latter three districts. Since 1879, Campen's explorations in the north and Kükenthal's on the south-eastern peninsula have added to our still very incomplete knowledge of the island. According to Campen, the four peninsulas are traversed in the direction of their longitudinal axis by mountain chains 3000 to 4000 feet high, covered with forest, without a central chain at the nucleus of the island whence the peninsulas diverge. The mountain chains are frequently interrupted by plains, such as those of Wadyi and Kobee. The northern part of the mountain chain of the northern peninsula is volcanic, its volcanoes, Sallo (better, Tallama Kiëé), Onu, Ibu, &c., being a continuation of the volcanoes of Makian, Ternate, and Tidore. Coral formations on heights in the interior would indicate oscillations in several periods, but a detailed geology of the island is still wanting. Besides sago and rice, the island grows dammar and cocoanuts. The sea also yields trepang and pearl shells. A little trade is carried on by the Chinese and Makassars of Ternate, who, crossing the narrow isthmus of Dodinga, enter the bay of Kayu on the east coast. The population is estimated at 30,000, the greater part in the northern peninsula, predominantly Mahommedans.

In a Dutch work, *The Century of Missionary Labour in Netherlands-India* (Utrecht, 1901), Mr Coolsma shows that the Dutch Missionary Society of Utrecht, who have worked in the northernmost peninsula since 1866, have been fairly successful among the savage Alfoors (slave-drivers and head-hunters like their Borneo kinsmen), but less so among the Mahommedans, who have often incited the Alfoors against them and their converts. At the end of 1900 the latter numbered 3000. The influence of the Dutch Government over the sultans of Ternate and Tidore has steadily increased. The pirates of Tobèlo have been virtually extirpated since the Dutch expedition of 1878. But slavery still exists in the interior.

Halmstad, a seaport town of Sweden, on the east shore of the Cattegat, 76 miles south-south-east of Gothenburg by rail. It possesses cloth, jute, hat, wood-pulp, moss litter, and paper factories, in addition to foundries,

engineering shops, shipbuilding yards, glass-works, granite quarries, and breweries; and is famous for its potatoes and its salmon. It has a growing trade in the export of granite, timber (1,980,000 cubic feet in 1888, 8,000,000 in 1899), wood-pulp, and hats. The granite goes almost entirely to Germany. Butter is extensively made in the district, but is exported through Gothenburg and Helsingborg. The imports consist principally of coal (55,000 tons in 1899), machinery, and grain. The port was cleared by 1098 vessels, of an aggregate of 93,600 tons, in 1888; and by 2035 vessels, of 188,500 tons, in 1900. The harbour, which is accessible in all weathers, was widened and deepened in 1888–89. There are an inner harbour, 15 feet deep, an outer harbour, and roads giving anchorage in 24 to 36 feet, but exposed to south and north-west winds. Population (1880), 8505; (1900), 15,362.

Halos.—The refraction of sunlight or moonlight, through ice-crystals forming cirrus clouds, gives rise to coloured *Halos*, *Parhelia*, *Paraselenæ*, &c. Halos are at once distinguished from rainbows, for they surround the luminary, while the primary and secondary rainbows, at least, have their centres opposite to it.

The usual form of ice-crystals in the air is a regular hexagonal prism, terminated by plane ends perpendicular to the axis. Sometimes the prisms are long and narrow, sometimes they are mere hexagonal plates. Two alternate faces of the hexagon give an ice-prism of 60°, a face and an end a prism of 90°. The refractive index of ice is about 1·31. Let us study the effects of innumerable prisms having these angles, and falling in all aspects or positions in the quarter where the sun appears to be situated. The result of an average distribution will, of course, be symmetrical with regard to the line joining the eye and the sun, and the refracted rays will be crowded together in the direction of minimum deviation. The minimum deviation produced by an ice-prism of 60° is the angle 22° very nearly; and for a prism of 90°, about 46°. This is, of course, on the supposition that the refraction is in a plane perpendicular to the edge of the prism. Hence if we consider one kind of homogeneous light only, the sun should appear to be surrounded by two circular rings of light, each of a breadth equal to the sun's apparent diameter, and of mean angular radii 22° and 46° respectively. As these are due to the minimum of deviation by each class of prisms, the scattered rays directly refracted by any one of the prisms, as well as the rays which have passed obliquely through it, are seen *outside* the corresponding halo. The minimum deviation will be least for the least refrangible rays, so that in both these halos the red rays form the *interior* border. In this respect they resemble the secondary, not the primary, rainbow. The cause which produces impurity of the colours of the rainbow affects those of the halos even more profoundly. In fact, only the red is at all pure, and the overlapping (due partly to the sun's diameter, but still more to oblique refraction) is so great that, as a rule, a mere trace of green and blue can be seen, the external portion of each halo being nearly white. This gives the phenomenon a very singular character.

Let us now take account of the fact that the crystals free in air will, on the whole, tend to fall in one or more particular positions, *i.e.*, the long prisms mainly endwise, or it may be with their axes horizontal; the plates flatwise, or edgewise, as the case may be. The effect will be to intensify those parts of the halo which are due to the majority of the crystals. When the sun is near the horizon, and the vertical ice-prisms are exceptionally numerous, the parts of the halo of 22° which are at the same level as the sun are coloured spectra, sometimes dazzlingly bright, and they are called *Parhelia*, or, vulgarly, *Mock-Suns*. When the sun is *not* on the horizon, the paths of the rays through the vertical prisms are no longer in planes perpendicular to their edges. Here also there is a position of minimum deviation, but the deviation is greater than before, increasing with the obliquity of the rays. Also a ray, passing anyhow through a prism, makes equal angles with the edge (in this case vertical) before and after passing. This is evident, without calculation, from the principle of reversal. Hence, as the sun rises higher, the parhelia gradually separate outwards from the halo, still keeping, however, at the same apparent altitude as the sun.

If there be an excess of hexagonal prisms, or plates, with their axes horizontal, these also will produce parhelia, which will be situated on the halo above and below the sun, if the axes of the prisms are perpendicular to the line joining the sun and the spectator. But as they are as likely to lie in any other (horizontal) direction, there

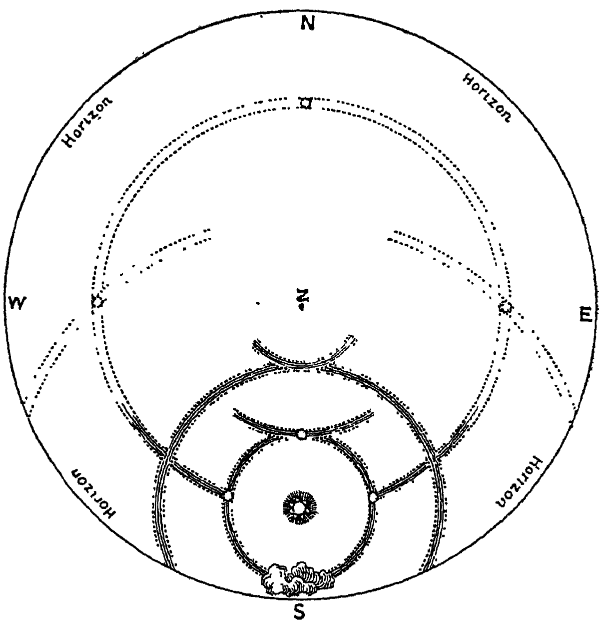


Diagram of Halos and Mock-Suns. (After Hevelius.)

will be a continuous series of parhelia, forming a new halo, which *touches* that of 22° externally above and below, and may even, in favourable circumstances (such as the requisite altitude of the sun, &c.), assume a complete quasi-elliptic form. This halo is brightest at its upper and lower portions, which are usually the only parts visible, and they are therefore commonly called the tangent-arcs to the halo of 22°.

Similar remarks apply to the halo of 46°, and the hexagonal pyramids, which sometimes terminate the ice-prisms, produce analogous results. The parhelia, also, are sometimes themselves bright enough to produce secondary halos; the reflection of the sun's rays from the surfaces of the crystals gives, from an excess of horizontal prisms, a colourless, vertical, great circle passing through the sun, and from an excess of vertical faces, a colourless, horizontal, small circle at the same altitude as the sun. All the features described, with the exception of the colourless vertical great circle, will be easily recognized in the accompanying diagram, which is reduced from a drawing by Hevelius of a remarkable series of halos and mock-suns seen by him at Danzig in 1661. There is, however, one feature in this figure, namely, the whitish, incomplete circle of about 90° radius surrounding the sun, which has been observed by others than Hevelius,

but is not yet explained. For full details on this very interesting subject see the remarkable memoir by Bravais (*Journal de l'École Polytechnique*, 1847), who studied the phenomena in high latitudes. The general explanation of the production of halos was suggested by Mariotte, but was first accurately given by Young.

Halos must not be confounded with *Coronæ*—those concentric rings which encircle the sun or moon when seen through a mist or cloud. Halos are red inside, coronæ outside. Halos have definite radii depending on the definite angles of ice-crystals; the size of the coronæ, whose radii are as 1 : 2 : 3, &c., depends on the size of the drops of water in a mist or cloud, being smaller as the drops are larger. Thus their diminution in radius shows that the drops are becoming larger, and implies approaching rain. They are due to diffraction, and can be explained only by the help of the undulatory theory.

(P. G. T.)

Halsbury, Hardinge Stanley Giffard, 1st Earl of (1825-——), Lord High Chancellor of England, son of Stanley Lees Giffard, LL.D., was born in London on 3rd September 1825. He was educated at Merton College, Oxford, where he took the degree of B.A. in 1852 and M.A. in 1855. Called to the bar at the Inner Temple in 1850, he joined the North Wales and Chester Circuit. Afterwards he had a large practice at the Central Criminal Court and the Middlesex Sessions, and he was for several years junior prosecuting counsel to the Treasury. He was engaged in most of the celebrated trials of his time, including the Overend and Gurney and the Tichborne cases. He became Queen's Counsel in 1865, and a bencher of the Inner Temple. Mr Giffard twice contested Cardiff in the Conservative interest, in 1868 and 1874, but he was still without a seat in the House of Commons when he was appointed Solicitor-General by Mr Disraeli in 1875 and received the honour of knighthood. In 1877 he succeeded in obtaining a seat, when he was returned for Launceston, which borough he continued to represent until his elevation to the peerage in 1885. He was then created Baron Halsbury and appointed Lord Chancellor, thus forming a remarkable exception to the rule that no criminal lawyer ever reaches the Woolsack. Lord Halsbury resumed the position in 1886, and again in 1895 and 1900, his tenure of the office, broken only by the brief Liberal ministries of 1886 and 1892–95, being longer than that of any Lord Chancellor since Lord Eldon. In 1898 he was created Earl of Halsbury and Viscount Tiverton. Among Conservative Lord Chancellors Lord Halsbury must always hold a high place, his grasp of legal principles and mastery in applying them being pre-eminent among the judges of his day.

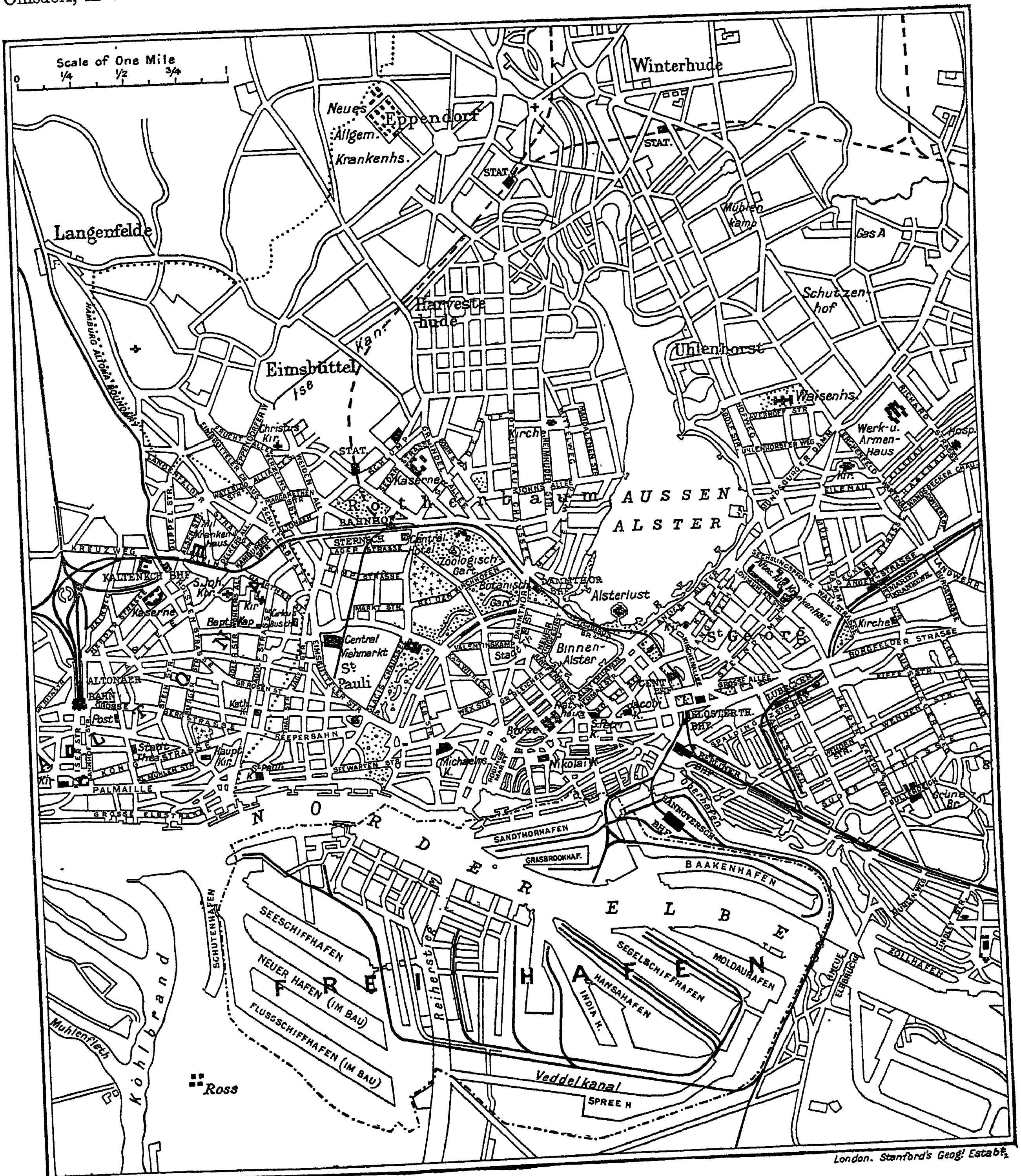
Halstead, a market-town in the Maldon parliamentary division of Essex, England, on the Colne, 14 miles north-west by west of Colchester by rail. A new post office, a cottage hospital, and a fever hospital have been erected, and there is a town hall. About 1200 hands are employed in the manufacture of silk and crape. The old civil parish of Halstead became divided under the Local Government Act, 1894, into two parishes, Halstead (urban) and Halstead (rural). Area of urban district, 636 acres. Population (1881), 5804; (1891), 6056; (1901), 6072. The urban district is coterminous with the civil parish of Halstead (urban). Population of the rural district of Halstead in 1901, 10,176.

Hamar, or Storehammer (Great Hamar), a town of Norway, county Hedemarken, on the east shore of Lake Mjösen, 78 miles by rail north of Christiania, on the railway to Trondhjem. The existing town was laid out in 1849, and made a bishop's see in 1864. Near the same site there stood an older town, which, together with a bishop's see, was founded in 1152 by the Englishman Nicholas Breakspeare (afterwards Pope Adrian IV.); but both town and cathedral were destroyed by the Swedes in 1567. A few scanty ruins of the latter still remain. Population (1900), 6003.

Hamburg, a seaport town of Germany, capital of the free state of Hamburg, situated on the right bank of the Elbe, 75 miles from the North Sea and 178 by rail west-north-west from Berlin, the largest and most important seaport on the continent of Europe, and (next after London and New York) the third largest port in the world. Probably there is no place which during the last thirty years of the 19th century grew at a faster rate commercially than Hamburg. Its commerce is, however, almost entirely of the nature of transit trade, for it is not only the chief distributing centre for the middle of Europe of the products of all other parts of the world, but it is also the chief outlet for German, Austrian, and even to some extent Russian (Polish) raw products and manufactures.

Public Buildings and Institutions.—The centre of the civic life of Hamburg is the new Rathhaus, a huge German Renaissance building, constructed of sandstone in 1886–97, and richly adorned with sculptures both outside and inside. It is the place of meeting of the civic council and of the senate, and affords accommodation for the town archives. Immediately adjoining it, and connected with it by a couple of wings, is the Börse (1839–41, enlarged 1880–84, and in part restored 1894); it shelters the commercial library of nearly 100,000 volumes. A little to the east of them is the Johanneum (1834), in which are preserved the town library of about 600,000 volumes and 5000 MSS., and the collection of Hamburg antiquities. In the courtyard is a statue (1885) of the Reformer Bugenhagen. In the Fischmarkt, immediately south of the Johanneum, a handsome fountain was erected in 1890. Directly west of the town hall is the new (rebuilt) Stadthaus, the chief police station of the town, with a bronze statue of the burgomaster Petersen (1898) in front of it. Several new public buildings have been erected along the circuit of the former walls. Near the west extremity, abutting upon the Elbe, the moat was filled in in 1894–97, and some good streets were built along the site, whilst the Kersten Miles Brücke, adorned with statues of four Hamburg heroes, was thrown across the Helgoland Allee. Farther north, along the line of the former town wall, stand the criminal law courts (1879–82, enlarged 1893) and the civil law courts (finished in 1901). Close to the latter will stand a new Supreme Court. Farther on are the chemical and the physical laboratories and the Hygienic Institute. Facing the Botanischer Garten a new central Post Office, in the Renaissance style, was built in 1887. At the west end of the Lombard Brücke (which divides the Aussen from the Binnen Alster) the municipality have erected a monument, designed by Schilling, to commemorate the war of 1870–71. A few streets south of that is a monument to Lessing (1881). The Kunst-halle (enlarged in 1885–86) faces the east end of Lombard Brücke. The new Naturhistorisches Museum, completed in 1891, stands a little distance farther south. Then to the east of it comes the Museum for Art and Industry, founded in 1878, now one of the most important institutions of the kind in Germany; there is a trades school connected with it. The Hansa fountain (65 feet high), erected in 1878, is close by. On the north-east side of the suburb of St Georg a botanical museum and laboratory have been established. There is

a new General Hospital at Eppendorf, outside the town on the north, built on the pavilion principle, and one of the finest structures of the kind in Europe; and at Ohlsdorf, in the same direction, a crematorium was built in 1891 in conjunction with the town cemeteries (370 acres). In 1899 a new central railway station was begun on the Glockengiesserwall between the Aussen Alster and the Frei Hafen. It only remains to mention



PLAN OF HAMBURG.

Hagenbeck's zoological garden, the schools of music and navigation, and the commercial school. In 1900 a high school for shipbuilding was founded, and in 1901 an institute for seamen's and tropical diseases, with a laboratory for their physiological study, was opened, and also the first public Free Library in the city. The river is spanned just above the Frei Hafen by a triple-arched railway bridge, 1339 feet long, made in 1868–73 and doubled in width in 1894. Some 270 yards higher up is an iron bridge (1888) for vehicles and foot passengers. The southern arm of the Elbe, on the south side of the island of Wilhelmsburg, is crossed by

another railway bridge of four arches and 2050 feet in length.

Harbour.—It was the accession of Hamburg to the German Customs Union in 1888 which gave such a vigorous impulse to her more recent commercial development. At the same time a portion of the port was set apart as a free harbour, altogether an area of 750 acres of water and 1750 acres of dry land. In anticipation of this event a gigantic system of docks, basins, and quays was constructed, at a total cost of some £7,000,000 (of which the imperial treasury contributed £2,000,000), between the confluence of the Alster and the railway bridge (1868–73), an entire quarter of the town inhabited by some 24,000 people being cleared away to make room for these accessories of a great port. On the north side of the Elbe there are the Sandthor basin (3380 feet long, 295 to 427 feet wide), in which British and Dutch steamboats and steamboats of the Sloman (Mediterranean) Line anchor. South of this lies the Grasbrook basin (quayage of 2100 feet, and 1693 feet alongside), which is used by French, Swedish, and transatlantic steamers. At the quay point between these two basins there are vast state granaries. On the outer (*i.e.*, river) side of the Grasbrook dock is the quay at which the emigrants for South America embark, and from which the mail boats for East Africa, the boats of the Woermann (West Africa) Line, and the Norwegian tourist boats depart. To the east of these two is the small Magdeburg basin, penetrating north, and the Baaken basin, penetrating east, *i.e.*, parallel to the river. The latter affords accommodation to the transatlantic steamers, including the emigrant ships of the Hamburg-America Line,[1] though their "ocean mail boats" generally load and unload at Brunshausen, 30 miles lower down the Elbe and on the opposite (left) bank, but from 1901 at Cuxhaven. On the south bank of the stream there follow in succession, going from east to west, the Moldau dock for river craft, the sailing vessel dock (3937 feet long, 459 to 886 feet wide, 26¼ feet deep), the Hansa dock, India dock, petroleum dock, several swimming and dry docks; and in the west of the free port area three other large docks, one of 77 acres for river craft, the others each 56 acres in extent, and one 23¾ feet deep, the other 26¼ feet deep, at low water, constructed in 1900–1. In 1897 Hamburg was provided with a huge floating dock, 558 feet long and 84 feet in maximum breadth, capable of holding a vessel of 17,500 tons and draught not exceeding 29 feet, so constructed and equipped that in time of need (war) it could be floated down to Cuxhaven. During the last 25 years of the 19th century the channel of the Elbe was greatly improved and deepened. During the last two years of the century some £360,000 was spent by Hamburg alone in regulating and correcting this lower course of the river. (See ELBE.)

Commerce and Shipping.—The details of the commercial development of the port are set forth in the subjoined tables.

As will be seen from Table I., it is with what may be termed the newer countries that the commerce has grown most rapidly; and this generalization is still further supported by the development of the trade with the South American states, West and East Africa, and the Far East. The imports from Great Britain more than doubled in annual value between 1851 and 1900; but the percentages which these totals bear to the entire sea-borne trade of Hamburg steadily decreased, *e.g.*, from 60 per cent. in 1851–60, and 64 per cent. in 1861–70, to 54 per cent. in 1871–80, to 40 per cent. in 1891–95, and to only 11 per cent. in 1900. Of the trade with older countries, there has been the greatest advance in the relations with Russia: in 1851–60 Hamburg imported less than £50,000 worth of Russian goods, but in 1900 the imports (by sea only) were valued at £4,460,500. The principal imports in the year 1898, and their values, were as follows:—Wool and woollens, £14,898,000; cereals, £11,931,400; sugar and molasses, £10,475,700; raw cotton and cottons, £8,706,200; coffee, £8,457,900; metals, £7,070,800; machinery, £6,098,100; skins and hides, £5,338,300; lard, butter, cheese, eggs, and milk, £4,666,200; flax, jute, and hemp, £4,421,300; tobacco, £4,287,700; iron, £4,101,750; chemicals, £3,814,500; gutta-percha, india-rubber, and gums, £2,787,900. In 1900 the imports were thus classified:—raw materials and partly manufactured goods, £61,677,400; foodstuffs, £35,137,000; textiles, £3,617,400; building materials and fuel, £3,446,600; and other industrial products, £7,925,600.

Table I. shows particulars of the average annual imports for the periods specified (bullion and coin not included):—

Imports.	1881-90.	1891-95	1900.[2]	Increase per cent. 1851-1900.
Total by sea . .	£52,288,800	£77,949,500	£111,804,000	601[3]
Total by rail and river . . .	45,103,000	58,090,000	..	723
Grand Total .	£97,391,800	£136,039,500	..	645
From Great Britain	£20,924,400	£19,573,200	£22,272,200	223
From Australia .	438,800	1,453,100	2,440,900	76,160
From British North America . .	71,400	272,000	..	45,300
From Cape Colony .	215,300	412,500	252,400	1,053
From British India	1,174,600	5,825,800	8,219,300	4,406
From the United States . . .	6,075,500	9,905,200	23,700,000	3,003

[2] In 1899 the imports by rail and river amounted to £66,935,000, and the imports by sea to £99,225,000, or altogether to £166,160,000.
[3] These are calculated to 1899.

Table II. shows the average annual value of the exports for the periods specified (bullion and coin excluded):—

Exports.	1881-90.	1891-95.	1900.	Increase per cent. 1851-1900.
Total by sea .	£49,070,700	£63,359,600	£88,776,000	751
Total by rail and river . .	40,293,000	56,405,500	..[4]	661
Grand Total .	£89,363,700	£119,765,100	..	705
To Great Britain .	No returns.	£19,351,400	£19,262,500	468

[4] In 1899 the exports by sea amounted to £80,315,000, and by rail and river to £70,500,000; or altogether to £150,815,000.

In 1900 the exports to the United States reached a value of £10,833,200; the exports to Brazil a value of £3,088,400; to Sweden and Norway, £6,184,200; to Russia, £3,608,500. The greater portion of the exports (53·5 per cent. of the whole) goes to the German states. The various items are almost the same, and at approximately the same amounts, as the imports.

Table III. shows the average number and aggregate tonnage of the vessels which entered the port annually, river craft being distinguished from ocean-going vessels, at the periods specified:—

		1851-60.	1881-90.	1891-95.	1899.[5]	Tonnage, Increase per cent. 1851-96.
By sea .	Vessels	4,649	7,015	8,928	13,312	
	Tonnage	756,099	3,870,047	5,954,214	7,765,950	1027
By river .	Vessels	4,383	10,783	13,967	17,598	..
	Tonnage	411,659	1,889,141	2,985,541	4,268,426	1036
Total	Vessels	9,032	17,798	22,895	30,905	..
	Tonnage	1,167,758	5,759,188	8,939,755	12,034,376	1035
From Gt. Britain	Vessels	2,050	2,891	3,227	3,868	..
	Tonnage	447,290	1,840,297	2,184,051	2,361,000	528

[5] Owing to the introduction of the new measurement system in 1895, the totals of the tonnage for the years since then are about 20 per cent. less than under the old system of measurement.

In 1861–70 38·4 per cent. of the vessels which arrived by sea and 53·8 per cent. of the tonnage flew the British flag, 45·7 per cent. of the vessels and 33·6 per cent. of the tonnage the German flag (of which 32·9 per cent. of the vessels belonged to Hamburg and 72·2 per cent. of the tonnage), whereas in 1899 26·1 per cent. of the

[1] This is the largest steamship company in the world. At the end of 1901 it possessed a fleet of 117 steamboats, with an aggregate of 602,948 tons, 92 per cent. of which was built within the preceding twelve years. In addition it owns a fleet of 25,453 tons of river steamboats. The company in 1900 owned 80 per cent. of the total steam tonnage belonging to Hamburg, and 49 per cent. of the total steam tonnage of all Germany. In 1900 they launched the *Deutschland*, of 16,000 net tonnage and 35,000 horse-power, with estimated speed of 23 knots.

vessels which arrived by sea came under the British flag and 38·8 per cent. of the tonnage (29 and 30 respectively in 1900), as compared with 57·1 per cent. of vessels under the German flag and 50·2 per cent. tonnage.

Table IV. shows the average annual number of vessels, and their total tonnage, belonging to the mercantile fleet of Hamburg for the periods specified :—

	1881–90.	1891–95.	1900.	Increase per cent 1851–1901.
Sea-going vessels	504	626	792	178
Tonnage . .	359,697	621,482	998,854	836

Of the 792 vessels quoted for the year 1900, 486 were steamships and 307 sailing vessels. To the sea-going vessels must be added 4700 river boats, aggregating a total of 332,704 tons in 1898 ; also 157 fishing vessels of 4956 tons, of which only 8 of 264 tons were propelled by steam.

Emigration.—Hamburg is one of the principal Continental ports for the embarkation of emigrants. In 1881–90, on an average the number of emigrants was 90,889 a year (to the United States, 59,322). In 1900 the number was 87,153 (to the United States, 64,137). In the period 1891–1900 the total number of emigrants averaged 71,096 annually, of whom about 88 per cent. went to the United States. The emigrants are mostly Germans (30,514 in 1893, 11,582 in 1900), Russians (41,082 in 1900), and Austrian-Hungarians (28,862 in 1900).

Industries.—Of recent years Hamburg has also developed into an important industrial centre, more especially since the year 1882. The branches which are represented on the largest scale are shipbuilding (employing some 5000 men in 1897) ; iron and steel industries, *i.e.*, iron and copper foundries, iron works, rolling mills, machinery factories, tin works, lead works, zinc pipe factories, nail factories, tool factories, electrical plant works, &c. ; chemical factories and factories for explosives, employing about 4000 workpeople (1300 in 1887) ; jute mills, employing about 3000 hands ; a wool-carding factory, with over 1300 hands ; cotton and woollen spinning mills ; indiarubber goods factories (4000 hands) ; factories for finer leather goods, with about 2000 hands ; sawmills, joinery works, factories for furniture, boxes, &c , and cooperages ; tobacco and cigars (some 3000 hands) ; printing works, with over 2000 workpeople ; factories for ready-made clothing ; breweries and distilleries in great number ; flour mills, steam bakeries, chocolate, sugar, pork-packing, ice, margarine, and other factories connected with the supplying of provisions. Altogether more than 42,400 persons above 16 years of age were employed in industrial establishments in 1899.

Banking, as might be expected in a city of the commercial magnitude of Hamburg, is carried on on a very extensive scale. Table V. supplies particulars with regard to the five principal banks for the year 1898 :—

	Hamburg Branch of Imperial Bank.	N. German Bank.	Union Bank.	Commercial and Discount Bank.	German Bank—Hamburg Branch.
Capital . .	£7,500,000 (head bank in 1901)	£2,000,000	£1,500,000	£2,500,000	£7,500,000 (head bank)
Turnover for year	764,414,900	832,760,850	516,881,500	312,669,200	637,950,300
Reserve .	..	33,000	136,500	346,500	2,322,900 (head bank)
Advances upon security .	6,262,000	3,426,300	2,065,600	..	1,775,250
Discount and bill business	45,170,400	23,732,000	18,614,900	16,444,100	49,847,200

Population.—Including the suburbs (of which there are fifteen, and which were definitely incorporated with the city in 1894), the population of Hamburg amounted to 471,427 in 1885, to 569,260 in 1890, to 625,552 in 1895, and to 705,738 in 1900. The birth-rate was 34·3 per 1000 in 1899 and 24·1 per 1000 in 1897. The marriage-rate was 9·5 and 8·96 per 1000 in the same two years respectively. Since 1892, the year in which cholera visited Hamburg so fatally, great improvements have taken place in the sanitary arrangements of the city, as well as in the regulations for the water-supply. As a consequence the death-rate shows an excellent improvement, as the following table manifests :—

	1887–91. Average.	1892.	1893.	1894.	1895.	1896.	1897.	1898 and 1899.
Death-rate per 1000 inhabitants	23·8	39·3	20·1	17·9	18·9	17·5	16·89	17·3

In the year 1895 39 per cent. of the entire population were engaged in occupations on their own behalf, dependants and servants not being counted, or 243,929 persons (of whom 50,307 were women), out of a total of 606,788 employed, whilst the number of dependants was 307,985, and of domestic servants 27,434. The class first named, namely, those working on their own behalf, increased between 1882 and 1895 from 38·1 to 40·2 per cent. of the population engaged in all occupations, whereas the class of domestic servants decreased from 6 to 4·5 per cent. Of the first-named class, again, 38·2 per cent. were engaged in commerce and its ministrant branches in 1882 and 39·9 per cent. in 1895, whilst 44 per cent. in 1882 and 40·6 per cent. in 1895 were occupied in industrial pursuits. As some evidence of the general condition of prosperity which prevails, it may be mentioned that of those who were liable to pay income-tax in 1894, 26·6 per cent. enjoyed incomes ranging between £30 and £40 per annum, 49·8 per cent. incomes between £40 and £100, 19·6 per cent. incomes between £100 and £500, 3 6 per cent. incomes between £500 and £1000, and 0·4 per cent. incomes above £2500.

THE FREE STATE OF HAMBURG.—A modification of the constitution came into force in 1879, by which the House of Burgesses was reduced from 196 to 160 members, of whom one-half are elected by the direct votes of all tax-paying citizens, 40 by the owners of house property, and 40 by the members of the guilds, corporations, and courts of justice. A committee of this house, numbering 20 members, is charged with the duty of watching the action of the senate and preserving the integrity of the constitution. In 1900 the state revenue was £4,489,200 and the expenditure £4,373,650. The state contribution to the revenues of the empire was fixed in 1900 at £343,286, and in 1900 the state debt amounted to £18,776,300. The population increased from 453,869 in 1880 to 518,620 in 1885, to 622,530 in 1890, to 681,632 in 1895, and to 768,349 in 1900. The population of the country districts (exclusive of the city of Hamburg) was 62,611 in 1900. In 1895 633,949 of the inhabitants belonged to the Evangelical Lutheran Church, 24,518 were Roman Catholics, and 17,308 were Jews. Of the total population, about 16,200 were engaged in agricultural pursuits, the crops raised being principally vegetables and fruit, potatoes, hay, oats, rye, and wheat. The live stock in 1897 numbered 17,141 horses, 13,949 cattle, 16,602 pigs, and only 2727 sheep. The other industries of importance are sulphuric acid works (25,323 tons of sulphuric acid, valued at £42,540, in 1897), iron foundries (7345 tons, valued at £712,290), sugar refineries, breweries, and distilleries. Apart from the city of Hamburg, the chief centres of population are the town of Bergedorf and the commune of Cuxhaven (6208).

AUTHORITIES. — *Tabellarische Uebersichten des Hamburgischen Handels im Jahre* 1898, by the Commercial Statistical Office (Hamburg, 1899), a very useful compilation going back to the years 1851, 1845, and 1815.—KOPPMANN. *Aus Hamburg's Vergangenheit.* Hamburg, 1885.—ZERNIKO. *Hamburg in Wort und Bild.* Hamburg, 1896. —MELHOP. *Historische Topographie der Freien, und Hanse-stadt Hamburg 1880–95.* Hamburg. 1896.—WOHLWILL. *Aus drei Jahrhunderten der Hamburgischen Geschichte.* Hamburg, 1897.—HÜBBE. *Beiträge zur Geschichte der Stadt Hamburg.* Hamburg, 1897.—TRINIUS. *Hamburger Schlendertage,* 2 vols. Minden, 1891–96.

(J. T. BE)

Hameln, a town of Prussia, province of Hanover, 33 miles S.W. of Hanover by rail and on the river Weser. In 1875 a monument was erected to commemorate the legend of the "Pied Piper." Population (1885), 11,830 ; (1895), 16,508 ; (1900), 18,965.

Hamerling, Robert (1830–1889), Austrian poet, was born at Kirchberg am Walde in Upper Austria, on the 24th of March 1830, of humble parentage. He early displayed a genius for poetry, and his youthful attempts at drama, *Christopher Colombus* and *Märtyrer*, excited the interest and admiration of some influential persons. Owing to their assistance young Hamerling

was enabled to pass through a school course at the Gymnasium at Vienna. Proceeding to the university, he entered the Academic Legion, and took part in 1848 in the defence of Vienna, which was being besieged by Windischgratz; as a consequence of this action he was obliged to hide for a long time to escape arrest. He diligently pursued his studies in natural science and philosophy, and in 1855 was appointed teacher at the Gymnasium at Trieste. For many years he battled with ill-health, and in 1866 retired on a pension, which in acknowledgment of his literary labours was increased by the Government to a sum which enabled him to live without care until his death at Graz, where he had made his home, on the 13th of July 1889. Among his poetic productions, *Ahasver im Rom* (1866), his *chef d'œuvre*, shows the author's brilliant talent for description. Hamerling was one of the most remarkable of the poets of the modern German school; his imagination was rich and his poems full of natural grace. Among his other productions may be mentioned *Venus im Exil* (1858), *Der König von Sion* (1868), *Die Sieben Tod-Sünden*, *Blätter im Winde*, *Homunculus*, *Amor und Psyche*, and a novel, *Aspasia*, which gives a finely-drawn description of the Periclean age.

Hamerton, Philip Gilbert (1834–1894), English artist and author, was born at Laneside, near Shaw, close to Oldham, 10th September 1834. His mother died at his birth, and having lost his father ten years afterwards, he was educated privately under the direction of his guardians. His first literary attempt, a volume of poems, proving unsuccessful, he devoted himself for a time entirely to landscape painting, encamping out of doors in the Highlands, where he eventually rented the island of Innistrynych, upon which he settled with his wife, a French lady, in 1858. Discovering after a time that his qualifications were rather those of an art critic than of a painter he removed to the neighbourhood of his wife's relatives in France, where he produced his *Painter's Camp in the Highlands* (1863), which obtained a great success and prepared the way for his standard work on *Etching and Etchers* (1866). In the following year he published a book, entitled *Contemporary French Painters*, and in 1868 a continuation, *Painting in France after the Decline of Classicism.* He had meanwhile become art critic to the *Saturday Review*, a position which, from the burden it laid upon him of frequent visits to England, he did not long retain. He proceeded (1870) to establish an art journal of his own, *The Portfolio*, a monthly periodical, each number of which consisted of a monograph upon some artist or group of artists, frequently written and always edited by him. The discontinuance of his active work as a painter gave him time for more general literary composition, and he successively produced *The Intellectual Life* (1873), perhaps the best known and most valuable of his writings; *Round My House* (1876), notes on French society by a resident; and *Modern Frenchmen* (1879), admirable short biographies. He also wrote two novels, *Wenderholme* (1870) and *Marmorne* (1878). In 1884 *Human Intercourse*, another valuable volume of essays, was published, and shortly afterwards Hamerton began to write his autobiography, which he brought down to 1858. In 1882 he issued a finely illustrated work on the technique of the great masters of various arts, under the title of *The Graphic Arts*, and three years later another splendidly illustrated volume, *Landscape*, which traces the influence of landscape upon the mind of man. His last books were: *Portfolio Papers* (1889) and *French and English* (1889). In 1891 he removed to the neighbourhood of Paris, and died suddenly on 4th November 1894, occupied to the last with his labours on *The Portfolio* and other writings on art. In 1896 was published *Philip Gilbert Hamerton: an Autobiography*, 1834–58; and a *Memoir by his Wife*, 1858–94.

Hamilton, a police (extended 1878) and parliamentary burgh (Falkirk group) of Lanarkshire, Scotland, 10¾ miles south-east of Glasgow by road, with five stations on two railway systems. The surrounding coalfield is the richest in Scotland, and there is a considerable manufacture of cotton, lace, iron-work, and carriages. The park adjoining the seat of the dukes of Hamilton contains a racecourse, and the herd of aboriginal white cattle in Cadzow Chase was in 1901 the only one still extant in Scotland. The town is the depot of the 26th and 71st regimental districts. Various public halls have been erected, and there is a hospital and a fever hospital. A Free church was built in 1882 and a United Presbyterian in 1884 (both now United Free). The academy, with an average attendance in 1898–99 of 559, is the principal secondary school in the middle ward of the county. Population (1881), 18,517; (1901), 32,775.

Hamilton, a city of Ontario, Canada, at the western extremity of Lake Ontario. It is an important centre on the Grand Trunk, Canadian Pacific, and other railways, whilst an extensive system of electric railways connects the different parts of the city with one another and with the adjacent localities. It has three daily newspapers, an efficient police force and fire brigade, and is lighted by electricity and gas. As an industrial centre it has been called the Birmingham of Canada, containing iron-smelting works, rolling mills, cotton factories, stove, zinc-refining, agricultural implement, bridge, wire, screw and steel works, and pork-packing, tobacco, and canning factories. The extensive water-power at De Cew Falls, 32 miles distant, has been utilized for the generation of electricity, which is supplied for manufacturing purposes. Hamilton is represented in the Dominion Parliament by two members, and by the same number in the Ontario legislature; its local affairs are administered by a mayor and twenty-one aldermen. The total shipping for 1899–1900 was 1850 vessels, with a tonnage of 412,624; exports were valued at $1,808,200, imports at $6,891,149. Area of city in 1901, 3990 acres; total assessment, $29,163,050. Population (1881), 35,961; (1891), 48,980; (1901), 52,550.

Hamilton, capital of Butler county, Ohio, U.S.A., in 39° 23′ N. lat. and 84° 25′ W. long., on the Great Miami, 25 miles north of Cincinnati, at an altitude of 591 feet. It is on the Cincinnati, Hamilton, and Dayton, and the Pittsburg, Cincinnati, Chicago, and St Louis railways, and on the Miami and Erie canal. It has an abundant water-power in the river and canal, which is utilized in varied manufactures. Population (1880), 11,122; (1890), 17,565; (1900), 23,914, of whom 2949 were foreign-born and 347 were negroes.

Hamirpur, a town and district of British India, in the Allahabad division of the North-West Provinces. The town is on a tongue of land at the confluence of the Betwa and the Jumna, 110 miles N.W. of Allahabad. Population about 9000. The District has an area of 2289 square miles. It had a population in 1881 of 507,337, and in 1891 of 513,720, giving an average density of 224 persons per square mile. The land revenue and rates were Rs.8,85,367, the incidence of assessment being R.0–11–7 per acre; the cultivated area was 600,918 acres, of which 21,633 were irrigated; the number of police was 1688; the number of vernacular schools in 1896–97 was 72, with 2707 pupils; the registered death-rate was 65·18 per 1000. In 1901 the population was 458,645,

showing a decrease of 11 per cent., due to the famine of 1896–97. The south of the district is traversed by the line of the Indian Midland Railway from Banda to Jhansi. The largest place is Rath (13,000).

Hamley, Sir Edward Bruce (1824–1893), British soldier and military writer, youngest son of Vice-Admiral William Hamley, was born on 27th April 1824 at Bodmin, Cornwall, and entered the Royal Artillery as second lieutenant in 1843. He was promoted to be captain in 1850, and in 1851 went to Gibraltar, where he commenced his literary career by contributing articles to magazines. He served throughout the Crimean campaign as aide-de-camp to Sir Richard Dacres, commanding the artillery, taking part in all the operations (medal and four clasps, 5th class of Legion of Honour and Medjidie, Sardinian and Turkish medals, brevet-majority and lieutenant-colonelcy, and C.B.). During the war he contributed to *Blackwood's Magazine* an admirable account of the progress of the campaign, which was afterwards republished separately. The combination in Hamley of literary and military ability secured for him in 1859 the professorship of Military History at the New Staff College at Sandhurst, from which, in 1866, he went to the Council of Military Education, returning in 1870 to the Staff College as commandant. From 1879 to 1881 he was British Commissioner successively for the delimitation of the frontiers of Turkey and Bulgaria, Turkey in Asia and Russia, and Turkey and Greece (K.C.M.G., 2nd class of Medjidie). Promoted colonel in 1863, he became a lieutenant-general in 1882, when he commanded the 2nd division of the expedition to Egypt under Lord Wolseley, and led his troops to the successful storm of Tel-el-Kebir (medal and clasp and star, 2nd class of Osmanieh, thanks of Parliament, and K.C.B.). Hamley considered that his services in Egypt had been insufficiently recognized in Lord Wolseley's despatches, and expressed his indignation freely. As, however, both he and the other divisional commander, Sir George H. S. Willis, were mentioned in the final despatch and were suitably rewarded, it cannot be supposed that there was any intention to belittle their services. From 1885 until his death on 12th August 1893 he represented Birkenhead in Parliament in the Conservative interest. Hamley was a clever and versatile writer. His principal work, *The Operations of War*, published in 1867, became a text-book of military instruction. He published some pamphlets on national defence, was a frequent contributor to magazines, and the author of several novels, of which perhaps the best known is *Lady Lee's Widowhood*. (R. H. V.)

Hamlin, Hannibal (1809–1891), Vice-President of the United States (1861–65), was born in Paris, Maine, on the 27th of August 1809. He studied law, and was admitted to the bar in 1833. Entering politics as a Democrat, he was a member of the Maine legislature 1836–40. In 1843 he was elected to Congress, where he served in the House of Representatives till 1847, and then in the Senate, with a short interval, till 1861. He opposed the extension of slavery, was concerned in the origination of the Wilmot Proviso, and in 1856, because of the repeal of the Missouri Compromise, he formally abandoned his old party and joined the Republicans. Nominated and elected with Lincoln in 1861, he was set aside at the end of his term through the preference of the party leaders for a Southern Democrat. After two terms more in the Senate (1869–81) and a brief service as minister to Spain (1881–83), he retired from public life in 1883, and died at Bangor (Me.), 4th July 1891.

Hamm, a town of Prussia, province of Westphalia, on the Lippe, 19 miles by rail north-east of Dortmund. It has important iron industries, wire and machinery factories, production of chemicals, varnishes, &c., saw-mills, and distilleries. Population (1885), 22,520; (1900), 31,369.

Hamme, a town of Belgium, in the province of East Flanders, 5 miles north of Termonde by rail. Its manufactures include rope, lace, linen, and oil. There are also boat-building workshops. Population (communal) (1899), 13,593.

Hammerfest, a seaport town of Norway, county Finmarken, in 70° 39′ 15″ N., 23° 39′ E. The principal street was rebuilt after a fire in 1890, and the town is lighted by the electric light. As a rule the sun is visible from Hammerfest uninterruptedly from 13th May to 29th July, and is never seen from 20th November to 21st January. Population about 2200.

Hammersmith, a metropolitan borough in the county of London, on the north bank of the Thames, 3½ miles south-west of Hyde Park Corner. Hammersmith Bridge, designed by Tierney Clark (1824), was the earliest suspension bridge erected near London. The old bridge being found to be in an insecure condition, a new one from the designs of Sir Joseph Bazalgette was erected in 1884–87. The superstructure is carried by steel chains, which are passed over towers formed of a framing of wrought-iron enclosed in an ornamental cast-iron casing. Down to 1834 Hammersmith formed a portion of Fulham parish. The parish church of St Paul's was built as a chapel of ease to Fulham, and consecrated by Bishop Laud, 7th June 1631. In 1864 it was enlarged and restored. It was subsequently pulled down, and a new church on the old site was completed in 1890. The Godolphin School, founded in the 16th century under the will of William Godolphin, was remodelled as a grammar school, under the approval of the Court of Chancery in 1861. The new buildings were completed in 1862 from the designs of C. H. Cooke. St Paul's School was removed from St Paul's Churchyard to Hammersmith Road, West Kensington, near Addison Road station, in 1883. The Mercers' Company purchased 16 acres of land and erected new buildings from the designs of Mr Barnes Williams. The Mall facing the river still contains many fine houses, but the old mansions of other parts of Hammersmith have mostly been pulled down. The market gardens and farms have been built over, so that the population has largely increased at each decennial period. Population (1881), 71,939; (1901), 112,245.

Hammond, a city of Lake county, Indiana, U.S.A., 20 miles south-east of Chicago, at an altitude of 590 feet. It is traversed by no fewer than eight railways approaching Chicago from the east. It has a level site on Grand Calumet river, and contains iron and steel works, and slaughter and packing houses. Population (1880), 699; (1890), 5428; (1900), 12,376, of whom 3156 were foreign-born.

Hampshire, HANTS, or SOUTHAMPTON, a southern county of England, bounded (as regards its mainland portion) on the S. by the English Channel, on the W. by Dorset and Wilts, on the N. by Berks, and on the E. by Surrey and Sussex. The county also embraces the Isle of Wight in the English Channel.

Area and Population.—The area of the ancient and administrative county (including the Isle of Wight, with an area of 93,342 acres and a population in 1901 of 82,387), as given in the census returns of 1891, was 1,037,769 acres or 1622 square miles, with a population in 1881 of 593,465, and in 1891 of 690,097, of whom 337,546 were males and 352,551 females, the number of persons per square mile being 425, and of acres to a person 1·50. Excluding the Isle of Wight and the two county boroughs of Portsmouth and

Southampton, the area was 938,098 acres, with a population in 1891 of 386,849. In 1895 certain alterations were made in the area of the administrative county. The parish of Combe was transferred from Hampshire to Berkshire, and the parish of Dockenfield to Surrey, and to Hampshire were added from West Sussex the part of the parish of Bramshott in West Sussex, and from Wilts the parishes of Bramshaw, Martin, Melchet Park, Plaitford, South Damerham, Toyd Farm with Allenford, and the part of the parish of Whichbury in Wilts. The area of the registration county is 1,047,223 acres, with a population in 1891 of 666,250, of which 414,600 were urban and 251,650 rural. Within the registration area the increase of population between 1881 and 1891 was 16·08 per cent. The excess of births over deaths between 1881 and 1891 was 80,634, but this was exceeded by the increase in the resident population, which was 91,073. The population of the ancient county in 1901 was 798,756. The number of Scots in the county in 1891 was 7243, of Irish 11,848, and of foreigners 2954.

The following table gives the numbers of marriages, births, and deaths, with the number of illegitimate births:—

Year.	Marriages.	Births.	Deaths.	Illegitimate Births.	
				Males.	Females.
1880	4209	17,882	10,674	405	390
1890	4578	17,982	10,590	369	337
1898	5591	19,126	11,374	439	393

Marriages in 1899, 5792; births, 19,000; deaths, 13,207.

The following table gives the marriage-, birth-, and death-rate per 1000 of the population, with the percentage of illegitimate births, for a series of years:—

	1870-79.	1880.	1880-89.	1890.	1888-97.	1899.
Marriage-rate	15·3	14·7	14·6	13·9	14·6	15·1
Birth-rate	32·6	31·5	30·3	27·3	27·3	25·9
Death-rate	18·5	18·6	17·1	16·1	16·0	15·4
Percentage of Illegitimate Births	4·6	4·4	5·3	4·8	4·1	4·4

Constitution and Government.—The ancient county, including the Isle of Wight, is divided into six parliamentary divisions; and it also includes the parliamentary boroughs of Portsmouth and Southampton, each returning two members, and of Christ Church and Winchester, each returning one. The administrative county includes eleven municipal boroughs: Andover (6509), Basingstoke (9793), Bournemouth (47,003), Christ Church (4204), Lymington (4165), Newport (10,911), Portsmouth (189,160), Romsey (4365), Ryde (11,042), Southampton (104,911), and Winchester (20,919). Bournemouth, Portsmouth, and Southampton are county boroughs; the following are the urban districts: Aldershot (30,974), Alton (5479), Cowes (8654), East Cowes (3180), East Leigh (9317), Fareham (8246), Farnborough (11,499), Gosport and Alverstoke (28,879), Havant (3839), Itchin (13,097), Petersfield (3265), Pokesdown (4930), St Helens (4645), Sandown (5006), Shanklin (4533), Ventnor (5866), Warblington (3639), and Winton (6719). The administrative county is in the Western circuit, and assizes are held at Winchester. The boroughs of Andover, Basingstoke, Lymington, Newport, Portsmouth, Romsey, Ryde, Southampton, and Winchester have separate commissions of the peace, and the boroughs of Andover, Portsmouth, Southampton, and Winchester have in addition separate courts of quarter sessions. The ancient county, which is almost entirely in the diocese of Winchester, has 396 entire ecclesiastical parishes and part of one other.

Education.—There is a day training college (Hartley College) at Southampton for both masters and mistresses. At Portsmouth is the Hants and Isle of Wight school and home for the blind. On 31st August 1898 there were in the county 520 elementary schools, of which 119 were board and 401 voluntary schools, the latter including 358 National Church of England schools, 3 Wesleyan, 19 Roman Catholic, and 21 "British and other." The average attendance at board schools was 48,763, at voluntary schools 57,789. The total school board receipts for the year ending 29th September 1899 were over £146,180. The income under the Agricultural Rates Act was over £1520.

Agriculture.—About seven-tenths of the total area of the county is under cultivation, and of this area about two-fifths is in permanent pasture. There are also about 87,000 acres in hill pasture, and over 125,000 acres under woods, much of it ancient forest. The acreage under corn crops has been steadily diminishing, the diminution being chiefly in the acreage under wheat, which has now an average acreage of only about 60,000. Turnips are grown on more than one-half of the green crop acreage. Over 2000 acres are under small fruit, and about 2000 under orchards. The following table gives the larger main divisions of the cultivated area at intervals from 1880:—

Year.	Total area under Cultivation.	Corn Crops.	Green Crops.	Clover.	Permanent Pasture.	Fallow.
1880	708,144	238,720	129,610	114,689	192,855	29,228
1885	711,521	222,226	133,464	110,802	233,751	17,957
1890	775,023	213,314	118,742	109,621	247,882	21,716
1895	705,969	184,100	110,988	117,674	266,124	22,087
1900	712,969	188,208	108,483	113,120	284,103	14,482

Much attention is paid to the rearing of sheep and cattle, but while the numbers of sheep have diminished, cattle have increased, the increase being wholly in cows for dairy purposes, and chiefly for the supply of milk. The following table gives particulars regarding the principal live stock:—

Year.	Total Horses.	Total Cattle.	Cows or Heifers in Milk or in Calf.	Sheep.	Pigs.
1880	28,761	66,943	36,335	512,796	56,727
1885	28,189	82,561	42,030	524,715	68,591
1890	28,150	76,887	41,757	443,658	77,837
1895	29,101	76,402	44,465	366,004	82,434
1900	27,726	86,666	48,402	378,951	83,302

Industries and Trade.—According to the report for 1898 of the chief inspector of factories, the total number of persons employed in factories and workshops in 1897 was 44,660, as compared with 44,010 in 1896; 29,307 were employed in non-textile factories, there being an increase between 1895 and 1896 of 9·5 per cent., and between 1896 and 1897 of 3·8. Of these, 14,048 were employed in the manufacture of machines, appliances, conveyances, and tools, many in the Portsmouth dockyards and the carriage works at Southampton; 3302 in clothing industries, 2976 in the manufacture of paper, &c., and 1750 in that of drink. Workshops employed 15,154 persons, 6098 being employed in clothing industries, 2291 in the manufacture of machines, &c., 1879 in food industries, and 1055 in the manufacture of furniture, &c. While the naval establishments of Portsmouth have undergone great development, Southampton has become one of the principal ports of the kingdom for ocean steamers, and Aldershot is now the great military training centre of the empire. In 1899, 224,272 tons of chalk were raised, 64,079 tons of clay, and 13,349 tons of gravel and sand. The amount of fish landed in 1899 was 10,931 cwt., valued at £9683. The value of shell-fish, in addition, was £22,517.

Authorities.—Godwin. *Civil War in Hampshire.* London, 1882.—Townsend. *Flora of Hampshire.* London, 1883.—Gilbert and Godwin. *Bibliotheca Hantoniensis.* Southampton, 1891.—Shore. *History of Hampshire* (Popular County Series). London, 1892.—*History of Hampshire* (Victoria History Series). vol. i. 1900. See also *The Climate of Hampshire* in *Climates of Great Britain*, vol. i. London, 1895; and various papers in *Hampshire Notes and Queries.* (T. F. H.)

Hampstead, a metropolitan and parliamentary borough in the county of London, on the southern slope and the summit of Hampstead Hill, 4 miles north-west of the City. Owing to its position on the side of a hill, Hampstead largely retained its rural character till quite recently, and many of the houses still possess their old-world appearance, but great changes have been made of late years. Some of the old-fashioned houses in Church Row have been pulled down and replaced by flats. A large number of new houses has also been built in various parts. The hill is the highest in the vicinity of London, being 443 feet above the level of the Thames, or 36 feet higher than the cross of St Paul's. A chapel at Hampstead, dedicated to the Virgin Mary, is mentioned in a deed of 1461, and this seems to have stood until 1745, when it was taken down and a new church built from the designs of Henry Flitcroft, which was dedicated to St John, and consecrated in 1747. The church was enlarged in 1844. It is a plain brick structure in the Italian style, with the altar at the west end. The tower is the only picturesque portion of the building. Hampstead Heath is one of

the finest open spaces in the neighbourhood of London, and consists of 240 acres. At one time its permanence was in jeopardy, but attempts were made as early as 1829 to save the Heath from the builder. In 1871 the struggle for the preservation of the Heath was brought to a satisfactory conclusion by the agreement of Sir Thomas Maryon Wilson and his son, Mr Spencer Wilson, to give up all the rights in the Heath of the Lord of the Manor of Hampstead for the sum of £45,000. An Act of Parliament was passed transferring the ownership to the Metropolitan Board of Works, now represented by the London County Council. Golders Hill, to the north-westward of the West Heath, now under the control of the London County Council, was until 1898 in the occupation of the late Sir Spencer Wells, Bart. It consists of a house and 36 acres of land. The estate was purchased for £38,500, to which amount the County Council contributed £12,000. Hampstead has long been a favourite place of residence for lawyers, artists, poets and other men of letters, and the number of great names associated with the place is very large. It is also remarkable for its charitable institutions, one of the most important being the North London Consumptive Hospital. The sub-manor of Belsize and the hamlet of Kilburn are included in the borough of Hampstead. Population (1881), 45,452; (1901), 81,942.

See CAROLINE A. WHITE. *Sweet Hampstead, its Associations.* London, 1901.—*Records of the Manor, Parish, and Borough of Hampstead*, edited by T. E. BAINES. London, 1890.

Hampton, a parish and town of England, on the Thames, 12 miles W.S.W. of Hyde Park Corner, in the Uxbridge parliamentary division of Middlesex; station on a branch of the London and South-Western Railway. Included in the parish is Hampton Court, the Home Park of which was thrown open to the public in 1893. Garrick, Sir Christopher Wren, and Sir Richard Steele were residents of Hampton. The area of the civil parish and urban district is 2036 acres. Population (1881), 4776; (1891), 5822; (1901), 6812. HAMPTON WICK is a parish and urban district on the Thames, about a mile to the east of Hampton Court. Area, 1315 acres. Population (1881), 2164; (1901), 2606.

Hampton, Wade (1818–1902), American general, was born on the 28th of March 1818 at Columbia, South Carolina. He graduated at South Carolina University, and was trained for the law. Though national in early leanings, he threw himself with energy into the Southern cause in 1861, raising a mixed command known as "Hampton's Legion," which he led at Bull Run. He rose from brigadier to lieutenant-general in the course of the Civil War, serving chiefly in Stuart's cavalry. When General Sherman advanced northwards from Savannah, and Columbia, S.C., was burned, Hampton's command formed the rearguard of the Confederate retreat. He was chosen in 1876 governor of his state, and installed after a memorable contest; he served in the United States Senate 1879–91, and was United States commissioner of railways in 1893. He died 10th April 1902.

Hanau, a town of Prussia, province of Hesse-Nassau, on the right bank of the Main, 14 miles by rail east of Frankfort. In 1896 a monument to Jakob and Wilhelm Grimm was unveiled. There is a royal academy of industrial art design. Population (1885), 24,377; (1900), 29,846.

Hancock, Winfield Scott (1824–1886), American general, was born, 14th February 1824, in the village of Montgomery Square, Montgomery county, Pa. He was educated in the public schools and at West Point, his career at the latter being creditable but not distinguished. On the 1st of July 1844 he was breveted, and on the 18th of June 1846 commissioned second lieutenant. He took part in the later movements under Scott against the city of Mexico, and was breveted first lieutenant for "gallant and meritorious conduct." After the Mexican war he served at various places in the West, in Florida, and elsewhere; was married in 1850 to Miss Almira Russell of St Louis; became first lieutenant in 1853, and assistant-quartermaster with rank of captain in 1855. The outbreak of the Civil War found him in California. At his own request he was ordered East, and on 23rd September 1861 was made brigadier-general of volunteers and assigned to command a brigade in the army of the Potomac. He took part in the Peninsula campaign, and the handling of his troops in the engagement at Williamsburg, 5th May 1862, was so brilliant that McClellan reported "Hancock was superb," an epithet always afterwards applied to him. At the battle of Antietam he was placed in command of the first division of the second corps, and on 30th November of the same year was promoted from captain to major and assistant-quartermaster in the regular army. In the disastrous battle of Fredericksburg, Hancock's division was on the right among the troops that were ordered to storm Marye Heights. Out of the 5006 men in his division 2013 fell, among them not less than 156 commissioned officers. At Chancellorsville his division received both on the 2nd and the 3rd of May the brunt of the attack of Lee's main army. Soon after the battle he was appointed commander of the second corps. The battle of Gettysburg began 1st July in the defeat of the left wing of the army of the Potomac under General Reynolds. About the middle of the afternoon Hancock arrived on the field with orders from Meade to assume command and to decide whether to continue the fight there or to fall back. He decided to stay, rallied the retreating troops, and held Cemetery Hill and Ridge until the arrival of the main body of the Federal army. During the second day's battle he commanded the left centre of the Union army, and after the fall of Sickles the left wing. In the third day's battle he commanded the left centre, upon which fell the full brunt of Longstreet's attack, the most famous charge in the whole war. Hancock's superb presence and power over men never shone more clearly than when, as the 150 guns of the Confederate army opened upon the left centre, he calmly rode along the front of his line to show his soldiers that he shared the dangers of the cannonade with them. His corps lost in the battle 4350 out of less than 10,000 fighting men. But it had captured twenty-seven Confederate battle flags and as many prisoners as it had men when the fighting ceased. Just as the Confederate troops reached the Union line Hancock was struck in the groin by a bullet, but continued in command until the repulse of the attack. The wound proved a severe one, so that some six months passed before he resumed command. In the battles of the year 1864 Hancock's part was as important and striking as in those of 1863. At the Wilderness he commanded, during the second day's fighting, half of the Union army; at Spottsylvania he had charge of the fierce but successful attack on the "salient"; at Cold Harbor his corps formed the left wing in the unsuccessful assault on the Confederate lines. In August he was promoted to brigadier-general in the regular army. In November, his old wound troubling him, he obtained a short leave of absence, expecting to return to his corps in the near future. He was, however, detailed to raise a new corps, and later was placed in charge of the "Middle Division." It was expected that he would move towards Lynchburg, as part of a combined movement against Lee's communications. But before he

could take the field Richmond had fallen and Lee had surrendered. It thus happened that Hancock, who for three years had been the most conspicuous single figure in the army of the Potomac, did not take part in the final triumph.

After the assassination of Lincoln, Hancock was placed in charge of Washington, and it was under his command that Booth's accomplices were tried and executed. In July 1866 he was appointed major-general. A little later he was placed in command of the department of the Missouri, and the year following assumed command of the fifth military division, comprising Louisiana and Texas. His policy, however, of discountenancing military trials and conciliating the late rebellious states did not meet with approval at Washington, and he was at his own request transferred. Hancock had all his life been a Democrat. His splendid war record and his personal popularity caused his name to be considered as a candidate for the Presidency as early as 1868, and in 1880 he was nominated for that office by the Democrats; but he did not prove a strong candidate, and was defeated by General Garfield, though by the small popular plurality of a few thousand votes. He died at Governor's Island, near New York, on 9th February 1886. Hancock was in many respects the ideal soldier of the Northern armies. His large frame and majestic carriage helped him to look every inch the soldier that he was. He was quick, energetic, and resourceful, reckless of his own safety, a strict disciplinarian, a painstaking and hard-working officer. It was on the field of battle, and when the fighting was fiercest, that his best qualities came to the front. He was a born commander of men, and it is doubtful if any other officer in the Northern army could get more fighting and more marching out of his men. Grant said of him, "Hancock stands the most conspicuous figure of all the general officers who did not exercise a separate command. He commanded a corps longer than any other, and his name was never mentioned as having committed in battle a blunder for which he was responsible." A biography of him has been written by General Francis A. Walker.

(F. H. H.)

Hangchow, the capital city of the province of Chekiang, at the head of Hangchow Bay, China, 110 miles south-west of Shanghai. It was declared open to foreign trade in 1896, in pursuance of the Japanese treaty of Shimonoseki. It is connected with Shanghai by inland canal, which is navigable for boats drawing up to four feet of water, and which might be greatly improved by dredging. The cities of Shanghai, Hangchow, and Soochow form the three points of a triangle, each being connected with the other by canal, and trade is now open by steam between all three under the inland navigation rules. These canals pass through the richest and most populous districts of China, and in particular lead into the great silk-producing districts. They have for many centuries been the highway of commerce, and afford a cheap and economical means of transport. Hangchow lies at the head of the large estuary of that name, which is, however, too shallow for navigation by steamers. The estuary or bay is funnel-shaped, and its configuration produces at spring tides a "bore" or tidal wave, which is perhaps unequalled in any other part of the world. The inflowing tide becoming more and more concentrated as it advances, and being checked at its foot by the friction of the downrush of the river, gradually assumes the formation of a wall of water, the upper part being raised higher and higher by the augmenting flood from behind. At its maximum the wave reaches a height of 15 to 20 feet, and rushes past with a roar like thunder and the speed of a railway train. The population of Hangchow is estimated at 500,000. It is the great seat of the silk-weaving industry, and is celebrated for the production of fans, "joss paper," drugs, lacquer, &c. The volume of trade passing through the customs in 1899 was 11,501,000 H. (Haikwan, or customs) taels, equal to £1,729,000, which, however, was only a small part of the total trade.

Hankow, a treaty port on the north bank, and 700 miles from the mouth, of the Yangtse, China. Within recent years it has made rapid advance in wealth and importance. The opening up of the upper waters of the Yangtse to steam navigation has made it a commercial *entrepôt* second only to Shanghai. It is the terminus of the Belgian railway now in course of construction between Peking and the Yangtse, being the northern half of the grand trunk line from Peking to Canton. The southern half has been contracted for by an Anglo-American syndicate. There is daily communication by regular lines of steamers with Shanghai, and smaller steamers ply on the upper section of the river between Hankow and Ichang. The principal article of export continues to be black tea, of which staple Hankow has always been the central market. The bulk of the leaf tea, however, now goes to Russia by direct steamers to Odessa instead of to London as formerly, and a large quantity goes overland *viâ* Tientsin and Siberia in the form of brick tea. The quantity of brick tea thus exported in 1898 was upwards of 60 million lb. The exports which come next in value are opium, wood-oil, hides, beans, cotton yarn, and raw silk. The population of Hankow, together with the city of Wuchang on the opposite bank, is estimated at 800,000, and the number of foreign residents is about 500. Large iron-works have been erected by the Chinese authorities at Hanyang, a couple of miles higher up the river, and at Wuchang there are two official cotton mills. The British concession, on which the business part of the foreign settlement is built, was obtained in 1861 by a lease in perpetuity from the Chinese authorities in favour of the Crown. Subleases for a term of years are granted by the Crown to private individuals; local control, including the policing of the settlement, is managed by a municipal council elected under regulations promulgated by the British minister in China, acting by authority of the Sovereign's Orders in Council. Foreigners, *i.e.*, non-British, are admitted to become lease-holders on their submitting to be bound by the municipal regulations. The concession, however, gives no territorial jurisdiction. All foreigners, of whatever nationality, are justiciable only before their own consular authorities by virtue of the extra-territorial clauses of their treaties with China. In 1895 a concession on similar terms to that under which the British is held was obtained by Germany, and this was followed by concessions to France and Russia. These three concessions all lie on the north bank of the river and immediately below the British. An extension of the British concession backwards was granted in 1898. The total trade in 1900 was valued at £13,248,100 (£6,582,050 being exports and £6,666,050 imports), as compared with a total of £17,183,400 in 1900 and £11,628,000 in 1880.

Hanley, a municipal (1857), county (1888), and parliamentary (1885) borough and market town of Staffordshire, England, often styled "the metropolis of the Potteries," 150 miles by rail north-north-west of London. The adjoining municipal borough of Burslem is included in the parliamentary borough, which returns one member. The schools include a higher-grade elementary and science school, built in 1894, and a school of art. Other buildings include the free library (1887); a technical and art museum, transferred to the corporation in 1891; and a

theatre, reconstructed in 1894. Hanley Park, opened in 1894, covers 80 acres. In 1891 there were 5815 males and 4588 females employed in the manufacture of earthenware, china, and porcelain, and 2305 persons in coal-mining. There is a daily newspaper. Area of municipal borough, 1768 acres; population (1881), 48,361; (1901), 61,524.

Hannen, James Hannen, 1st Baron (1821–1894), English judge, son of a London merchant, was born in 1821. He was educated at St Paul's School, and then proceeded to Heidelberg University, which was famous as a school of law. Called to the bar at the Middle Temple in 1848, he joined the Home Circuit. At this time he also wrote for the press, and supplied special reports for the *Morning Chronicle*. Though not eloquent in speech, he was clear, accurate, and painstaking, and soon advanced in his profession, passing many more brilliant competitors. He appeared for the claimant in the Shrewsbury peerage case; was principal agent for Great Britain on the mixed British and American Commission for the settlement of outstanding claims, 1853–55; and assisted in the prosecution of the Fenian prisoners at Manchester. In 1868 Hannen was appointed a judge of the Court of Queen's Bench. In many cases he took a strong position of his own, notably in that of "Farrar *v.* Close," which materially affected the legal status of trade unions and was regarded by unionists as a severe blow to their interests. Hannen became judge of the Probate and Divorce Court in 1872, and in 1875 he was appointed President of the Probate and Admiralty Division of the High Court of Justice. Here he showed himself a worthy successor to Cresswell and Penzance. Many important causes came before him, but he will chiefly be remembered for the manner in which he presided over the Parnell Special Commission. His influence pervaded the whole proceedings, and it is understood that he personally penned a large part of the voluminous report. Hannen's last public service was in connexion with the Bering Sea inquiry at Paris, when he acted as one of the British arbitrators. In January 1891 he was created a life peer and appointed a Lord of Appeal, but in that capacity he had few opportunities for displaying his powers, and he retired at the close of the session of 1893. He died in London, after a prolonged illness, on 29th March 1894.
(G. B. S.)

Hannibal, a city of Marion county, Missouri, U.S.A., in 39° 44′ N. lat. and 91° 23′ W. long., on the west bank of the Mississippi, at an altitude of 473 feet. The business part is in the level bottom lands of the river, while the residence portion spreads up the banks, which afford fine building sites. It has four railways—the Chicago, Burlington, and Quincy; the Missouri, Kansas, and Texas; the Wabash; and the St Louis and Hannibal. It has a large lumber trade, and manufactures of railway cars, machinery, and other iron and steel goods. Population (1880), 11,074; (1890), 12,857; (1900), 12,780, of whom 925 were foreign-born and 1836 were negroes.

Hannington, James (1847–1885), bishop of Eastern Equatorial Africa, was born at Hurstpierpoint, in Sussex, on the 3rd of September 1847. From earliest childhood he displayed a love of fun, adventure, and natural history. At school he made little progress, and left at the age of fifteen for his father's counting-house at Brighton. He had no head for office work, and much of his time was occupied in commanding a battery of volunteers and in charge of a steam-launch. At twenty-one he resolved to prepare for the ministry, and in 1868 entered St Mary's Hall, Oxford, and soon exercised a remarkable influence over his fellow-students. His studies, however, did not make much progress, and in 1870 he was advised to repair to the little village of Martinhoe, in Devonshire, for quiet reading, but distinguished himself more by his daring climbs after sea-gulls' eggs and his engineering skill in cutting a pathway along precipitous cliffs to some caves. In 1872 the death of his mother, whom he dearly loved, made a deep impression upon him, and after studying hard he took his B.A. degree, and in the following year was ordained deacon and placed in charge of the small country parish of Trentishoe. Here his spiritual life underwent a great change. After ministering at Hurstpierpoint, his thoughts were turned by the murder of two missionaries on the shores of Victoria Nyanza to mission work. Accordingly he offered himself to the Church Missionary Society, and sailed on 17th May 1882 at the head of a party of six for Zanzibar, and thence set out for Uganda; but, prostrated by fever and dysentery, he was obliged to return to England in 1883. On his recovery he was consecrated bishop of Eastern Equatorial Africa, and in 1885 started again for the scene of his mission, and occupied himself on his arrival at Freretown in visiting many stations in the neighbourhood. Then, filled with the idea of opening a new route to Uganda, he set out and reached a spot near Victoria Nyanza in safety. His arrival, however, roused the suspicion of the natives, and under King Mwanga's orders he was lodged in a filthy hut swarming with rats and vermin. After eight days his men were murdered, and on the 29th of October 1885 he himself was speared in both sides, his last words to the soldiers appointed to kill him being, "Go, tell Mwanga I have purchased the road to Uganda with my blood."
(G. F. M*.)

Hanoi, capital of Tongking, French Indo-China, on the right bank of the Song-Koi or Red River, 60 miles in a direct line from the sea. It is the ancient *Ke-Sho* ("great market"), and few towns have undergone greater changes. Between 1892 and 1895 M. de Lanessan, the then Governor-General, completely altered its appearance. The old Annamese town has almost entirely disappeared, giving place to a magnificent city possessing all the improvements and comforts of European civilization. The Annamese citadel has been razed, and the town now covers over 2470 acres. The population, formerly not exceeding 50,000, now comprises more than 100,000 Annamese, besides 1700 Chinese and 1000 Europeans, almost exclusively French. For several years, especially from 1881 to 1895, Hanoi was regarded as the capital of Indo-China. Wide streets have been opened up, boulevards, squares, and promenades laid out, and a theatre and new Government offices built. A system of drains has been constructed and is being extended; the town is lighted by electricity, and there is a good water-supply. A fine botanical and zoological garden has been laid out, and the Lanessan Hospital was opened in 1894. Important works (embankments and quays) were undertaken in 1894 along the Red River for a distance of 2½ miles, and a commercial port to which the largest vessels can ascend is under construction. On the completion of the great bridge across the Red River three railway lines will cross at Hanoi—the lines from Hanoi to Haiphong, from Hanoi to Yenbai *viâ* Sontai (about to be extended to Laokai), and from Hanoi to Ninhbinh, which is ultimately to be prolonged to Thanh-hoa and Hué. The approaching connexion between Haiphong and Phu-Lang-Thuong will place Hanoi in communication with the Chinese frontier as far as the Canton river. River and sea communication are secured to Hanoi by the Messageries Maritimes, which run in conjunction with boats between

Haiphong, Hong Kong, and Saigon. The Messageries Fluviales ply regularly between Haiphong, Hong Kong, and Pakhoi, and also up the Red River to Laokai. Horse-racing is much enjoyed, and the town is at all times very animated. The course is 1420 yards long. Hanoi has a chamber of commerce, the president of which is entitled to a seat on the Superior Council of Indo-China. It has also a court of appeal, a tribunal of general commerce, and a civil tribunal of the first order. The great Indo-China Exhibition of 1902 was held in buildings specially erected on the race-course. (J. M. A. DE L.)

Hanotaux, Albert Auguste Gabriel (1853——), French statesman and historian, was born at Beaurevoir, in the department of Aisne, France, on the 19th November 1853. After successful studies at the École des Chartes, which made him an expert in historical research, he obtained a connexion with journalism. An article in the *République Française* procured him the notice of Gambetta, who brought him into the Ministry of Foreign Affairs, where, but for one brief excursion into parliamentary life, he continued until 1894, filling successively several important posts, and obtaining so much distinction that, with scarcely any political claim excepting his eminence as a civil servant, he was raised to the post of Minister on M. Dupuy's accession to power in May of that year. With one brief interruption, M. Hanotaux retained his position amid changing Ministries, until the resignation of the Méline Cabinet in June 1898. After his retirement M. Hanotaux devoted himself chiefly to literature. His *Histoire de Richelieu* (1893–96) made his reputation as a historian, and he was elected a member of the French Academy in 1897.

Hanover, a province of Prussia, with an area of 14,869 square miles and population of 2,590,939 (1900). The mines in 1898 gave an output of 529,925 tons of coal, valued at £221,000, and 90,643 tons of lignite, valued at £14,000; 730,045 tons of iron ore, valued at £138,700; 17,197 tons of zinc, valued at £87,800; 48,197 tons of lead, valued at £134,100; and 25,623 tons of copper, valued at £26,700: total value of minerals, £534,500. The output of the salt works and smelting furnaces consisted of 117,761 tons of salt, valued at £121,900; 7618 tons of Glauber salts, valued at £8500; 217,804 tons of iron, valued at £420,600; 11,008 tons of lead, valued at £139,350; 1,087,450 oz. of silver, valued at £163,500; and 27,954 tons of sulphuric acid, valued at £35,450: total value, £889,300. The produce of the iron-foundries amounted to 344,316 tons, estimated to be worth £2,331,000. In 1897 the live stock consisted of 1,314,762 pigs, 1,064,586 cattle, 971,669 sheep, and 234,604 horses. In 1899–1900 the sugar factories and refineries yielded 142,340 tons of sugar; the breweries, 36,630,000 gallons of beer; and the distilleries, 2,356,500 gallons (1897–98) of pure alcohol. In 1899 the mercantile marine numbered 843 sea-going vessels of 82,626 tons. The principal ports are Harburg, Emden, Papenburg, Leer, Geestemünde, Norderney, and Borkum. (See also GERMANY, PRUSSIA.)

Hanover, a town of Prussia, capital of the province of Hanover, 163 miles by rail west of Berlin, at the crossing of the Berlin–Cologne and Hamburg–Frankfort lines, and headquarters of the 10th German Army Corps. In the old town the more noteworthy recent buildings are the Kestner (archæological) Museum (1888), containing also the municipal library, the administrative offices (finished in 1878), the garrison church (1891–93), the new provincial museum (1900–1901), the Imperial Bank (1895–96) in the Italian Renaissance style, the industrial exhibition, industrial art school, large covered market (1890–92), and Gutenberg fountain (1890). The industrial art museum is now lodged in the house of Leibnitz. The new town hall was designed by Eggers. In the eastern quarters, which are half encircled by the Eilenriede woods and parks (1650 acres), there are the hall of the provincial estates, the Garden church (1887–91), a sandstone structure in the early Gothic style, with a tower 289 feet high and some good stained glass; the law courts (1880–82), the large convict prison (1865–75), Holy Trinity church (1881–83), a fine war monument (1884), and the veterinary high school. The old provincial museum (1853–54) in this part of the town now includes a variety of collections, such as natural history, ethnography. and modern paintings, besides the Cumberland gallery and the Guelph Museum. Here, too, is the zoological garden. On the north of the old town are the technical high school (1878–80), now in the Guelph Castle (1857–66); the riding and fencing school of the army; the Roman Catholic church of St Mary's, with a tower 302 feet high, and the grave of "His Little Excellency" Windthorst, for many years leader of the Ultramontane (Centre) party in the Imperial Diet; the Luther church (1898), the Apostles' church (1883), and Herrenhausen Castle, with its fine gardens, theatre, museum, orangery, &c., and the magnificent avenue (2200 yards long, 187 feet wide) which leads to it. Other public institutions comprise a high school for girls (1899), commercial school, blind asylum, cripples' home, military school, various seminaries for teachers, industrial art school, mint, &c. Hanover occupies a leading place amongst the industrial and commercial towns of the kingdom. Its staple industries are the manufacture of india-rubber and gutta-percha (1400 operatives), machinery (1100 men), iron-founding, and brewing. Besides these, hardware, linens, chemicals, tobacco, pianos, books, furniture, and various other articles are produced. The commerce is principally in the home manufactures, and in wine, chocolate, groceries, hides, horses, coal, wool, and cereals. In the industrial sister town of LINDEN (50,623), to the south-west, there are a new town hall, a church (1722), and the Alten Park. Population of Hanover (1885), 139,731; (1900), 235,666.

Hanover, a town of Grafton county, New Hampshire, U.S.A., on the east bank of the Connecticut, 55 miles north-west of Concord. It is connected by bridge with Norwich, and with the Boston and Maine Railway on the opposite bank of the river. It is the seat of Dartmouth College, a non-sectarian institution founded in 1796, and having in 1899, in all departments, 55 instructors and 694 students. Its endowment and the value of its plant amounted to two and a half million dollars, its library numbered 80,000 volumes, and its income for the year was $103,000. Population (1880), 2147; (1890), 1817; (1900), 1884.

Hanover, a borough of York county, Pennsylvania, U.S.A., at the intersection of a line of the Pennsylvania Railway with the Western Maryland Railway. Population (1890), 3746; (1900), 5302, of whom 133 were foreign-born.

Hansi, a town of British India, in the Hissar district of the Punjab, on a branch of the Western Jumna canal, with a station on the Rewari–Ferozepore Railway, 16 miles east of Hissar by rail. The population in 1881 was 12,656, in 1891 it was 15,190; the municipal income in 1897–98 was Rs.18,320. It is the ancient capital of the tract called Hariana, and was the headquarters of the Irish adventurer George Thomas at the end of the 18th century; from 1802 to 1857 it was a British cantonment, and the scene of a murderous outbreak during the Mutiny.

It is still surrounded by a high brick wall, with a dismantled fortress, and is the centre of local trade, with four factories for ginning and pressing cotton. There is an annual horse fair, and a municipal school.

Hanthawaddy, a district in the Pegu division of Lower Burma, the home district of Rangoon, from which the town was detached to make a separate district in 1880. It has an area of 3023 square miles, with a population in 1891 of 396,887, living in 1313 villages, and paying in 1898–99 a revenue of Rs.31,99,729. The population was made up of 371,308 Buddhists and Jains, 15,032 Hindus, 6236 Mahommedans, and 4311 Christians, many of whom were Karens. In 1901 the population was 484,847. The total area is 1,934,720 acres, of which, in 1898–99, 1,027,027 acres were cultivated, 167,723 were cultivable, 31,155 acres were lying current fallow, and 489,030 acres were not available for cultivation, while 219,785 acres were under forests. The rainfall in 1898–99, taken at Hmawbi, was 105·8 inches. The headquarters of the district are in Rangoon, which is also the sub-divisional headquarters. The second subdivision has its headquarters at Insein, where there are large railway works. There are nearly 200 schools in the district, with about 7000 pupils. Cultivation is almost wholly confined to rice, but there are many vegetable and fruit gardens.

Hanwell, a parish of England, on the Brent, 10 miles west of St Paul's, London, and in the Brentford parliamentary division of Middlesex; station on the Great Western Railway. St Mary's, the parish church, was built in 1841, and St Mark's in 1883. In the parish there are also a Catholic chapel (1864) and Baptist and Methodist chapels. In the neighbouring parish of Norwood is the Hanwell lunatic asylum of the county of London. Since its erection in 1831 it has been much extended, and can now accommodate over 2500 inmates. Its chapel was built in 1880. In Hanwell a Roman Catholic convalescent home was erected in 1865. Area of urban district, 1067 acres. Population (1881), 5178; (1901), 10,437.

Haparanda, a small town of Sweden, on the right bank of the Torneå, 1½ miles from its issue into the north extremity of the Gulf of Bothnia, immediately opposite to the Finnish town of Torneå, though, owing to the river having shifted its course, both towns stood in 1899 on the Swedish side of the stream. It has an important meteorological station; annual mean temperature, 32° Fahr.; February, 10·5°; July, 58·8°. Rainfall, 16·5 inches annually. Sea-going vessels load and unload at Salmis, 7 miles distant. Population (1880), 1039; (1900), 1568.

Harburg, a seaport town of Prussia, province of Hanover, 6 miles by rail south of Hamburg. A new bridge has been built (1899) across the south arm of the Elbe, on which Harburg stands, thus connecting it by means of the island of Wilhelmsburg with Hamburg on the north arm of the river. The port is accessible to vessels drawing 18 feet and measuring 4500 tons. Owing to its geographical position and cheap storage, Harburg is a distributing centre of not a little importance, despite its proximity to Hamburg. It is the chief mart in the empire for palm oil and resin; and in 1901 the Prussian Government contemplated converting it into a free port, and enlarging it relatively on the lines of Hamburg. The shipping entering has decreased from 636 vessels of 77,676 tons in 1888 to 428 vessels of 75,746 tons in 1899; in addition to which there are inland (river) entries of approximately 13,090 vessels of nearly three-quarters of a million tons. The leading industries are the crushing of palm kernels and linseed, and the manufacture of india-rubber, phosphates, starch, nitrate, and jute. Population (1885), 26,320; (1900), 49,155, the area of the town having been increased since 1895.

Harcourt, Sir William George Granville Venables Vernon (1827– ——), English statesman, second son of William Vernon Harcourt, of Nuneham Park, Oxford, was born 14th October 1827. He was educated at Trinity College, Cambridge, graduating with first-class honours in the classical tripos in 1851. He was called to the bar at the Inner Temple in 1854, became a Q.C. in 1866, and was appointed Whewell professor of international law, Cambridge, 1869. It was in these years that he contributed largely to journalism and wrote letters to *The Times* over the signature of "Historicus," which were published in book form in 1863. He entered Parliament as Liberal member for Oxford, and sat from 1868 to 1880, when, upon seeking re-election after acceptance of office, he was defeated by Mr Hall. A seat was, however, found for him at Derby, by the voluntary retirement of Mr Plimsoll, and he continued to represent that constituency until 1895, when, having been defeated at the general election, he found a seat in West Monmouthshire. He was appointed Solicitor-General and knighted in 1873; and, although he had not shown himself a very strenuous supporter of Mr Gladstone during that statesman's exclusion from power, he became Secretary of State for the Home Department on the return of the Liberals to office in 1880. His name was connected at that time with the passing of the Ground Game Act (1880), the Arms (Ireland) Act (1881), and the Explosives Act (1883). As Home Secretary at the time of the dynamite outrages he had to take up a firm attitude, and the Explosives Act was passed through all its stages in the shortest time on record. Moreover, as champion of law and order against the attacks of the Parnellites, his vigorous speeches brought him constantly into conflict with the Irish members. In 1884 he introduced an abortive Bill for unifying the municipal administration of London. He was indeed at that time recognized as one of the ablest and most effective leaders of the Liberal party; and when, after a brief interval in 1885, Mr Gladstone returned to office in 1886, he was made Chancellor of the Exchequer, an office which he again filled from 1892 to 1895. Between 1880 and 1892 Sir William Harcourt acted as Mr Gladstone's loyal and indefatigable lieutenant in political life. A first-rate party fighter, his services were of inestimable value; but in spite of his great success as a platform speaker, he did not impress the country as possessing much depth of conviction. It was he who coined the phrase about "stewing in Parnellite juice," and, when the split came in the Liberal party on the Irish question, even those who gave Mr Gladstone and Mr Morley the credit of being convinced Home Rulers could not be persuaded that Sir William had followed anything but the line of party expediency. In 1894 he introduced and carried a memorable Budget, which equalized the Death Duties on real and personal property. After Mr Gladstone's retirement in 1894 and Lord Rosebery's selection as Prime Minister Sir William became the leader of the Liberal party in the House of Commons, but it was never probable that he would work comfortably in the new conditions. His title to be regarded as Mr Gladstone's successor had been too lightly ignored, and from the first it was evident that Lord Rosebery's ideas of Liberalism and of the policy of the Liberal party were not those of Sir William Harcourt. Their differences were patched up from time to time, but the combination could not last. At the

general election of 1895 it was clear that there were divisions as to what issue the Liberals were fighting for, and the effect of Sir William Harcourt's Local Veto Bill on the election was seen not only in his defeat at Derby, which gave the signal for the Liberal rout, but in the set-back it gave to temperance legislation. Though returned for West Monmouthshire (1895, 1900), his speeches in debate only occasionally showed his characteristic spirit, and it was evident that for the hard work of Opposition he no longer had the same motive as of old. In 1898 the crisis arrived, and with Mr John Morley he definitely retired from the counsels of the party and resigned his leadership of the Opposition, alleging as his reason, in letters exchanged between Mr Morley and himself, the cross-currents of opinion among his old supporters and former colleagues. The split excited considerable comment, and resulted in much heart-burning and a more or less open division between the section of the Liberal party following Lord Rosebery and those who disliked that statesman's Imperialistic views. Though now a private member, Sir William Harcourt still continued to vindicate his opinions in his independent position, and his attacks on the Government were no longer restrained by even the semblance of deference to Liberal Imperialism. He actively intervened in 1899 and 1900, strongly condemning the Government's financial policy and their attitude towards the Transvaal; and throughout the Boer war he lost no opportunity of criticizing the South African developments in a pessimistic vein. One of the readiest parliamentary debaters, he savoured his speeches with humour of that broad and familiar order which appeals particularly to political audiences. In 1898–1900 he was conspicuous, both on the platform and in letters written to *The Times*, in demanding active measures against the Ritualistic party in the Church of England; but his attitude on that subject could not be dissociated from his political advocacy of Disestablishment. Sir William Harcourt married, first, in 1859, Thérèse, daughter of Mr T. H. Lister; and secondly, in 1876, Elizabeth, widow of Mr T. Ives and daughter of Mr J. L. Motley, the historian.

Harderwyk, a small town in the province of Gelderland, Netherlands, on the coast of the Zuider Zee, 28 miles north-east of and on the railway to Utrecht from Zwolle (Central Railway). It has a colonial recruiting office. As a seaport its trade is exclusively confined to the Zuider Zee. Population (1900), 7327.

Hardingstone, a parish in the Mid division of Northamptonshire, England, 2 miles south-south-east of Northampton. In it stands one of the original Eleanor Crosses, of which only three out of twelve remain, erected by King Edward I. to mark the resting-places of his queen's body on its way from Harby (Nottinghamshire) to burial at Westminster. Population about 3000.

Hardoi, a town and district of British India, in the Lucknow division of Oudh. The town is 63 miles north-east of Lucknow by rail. The population in 1881 was 10,026, in 1891 it was 11,152; the municipal income in 1897–98 was Rs.10,797; the registered death-rate in 1897 was 108 per 1000. The DISTRICT OF HARDOI has an area of 2324 square miles; the population in 1881 was 987,630, in 1891 it was 1,113,211, giving an average density of 479 persons per square mile. In 1901 the population was 1,093,201, showing a decrease of 2 per cent. The land revenue and rates were Rs.9,79,534, the incidence of assessment being a little over R.1 per acre; the cultivated area in 1896–97 was 905,405 acres, of which 209,042 were irrigated from tanks, wells, &c.; the number of police was 2273; the number of vernacular schools in 1896–97 was 92, with 4219 pupils; the registered death-rate in 1897 was 50·57 per 1000. There are three printing-presses, one of which issues a vernacular periodical. The district contains a larger urban population than any other in Oudh, the biggest town being Shahabad, with in 1891 a population of 20,153. It is traversed by the Oudh and Rohilkhand Railway from Lucknow to Shahjahanpur, with six stations; 62 miles in all.

Hardwar, a town of British India, in the Saharanpur district of the North-West Provinces, on the right bank of the Ganges, 17 miles north-east of Roorkee, with a railway station. The population of the municipal union in 1891 was 29,125; the municipal income in 1897–98 was Rs.39,246. It has an annual religious fair. The Ganges canal here takes off from the river. A branch railway to Dehra was opened in 1900.

Hardy, Thomas (1840–——), English novelist, was born in Dorsetshire, 2nd June 1840. His family was one of the branches of the Dorset Hardys, formerly of influence in and near the valley of the Frome, claiming descent from John Le Hardy of Jersey (son of Clement Le Hardy, lieutenant-governor of that island in 1488), who settled in the west of England. His maternal

THOMAS HARDY.
(*From a photograph by Elliott and Fry, London.*)

ancestors were the Swetman, Childs or Child, and kindred families, who before and after 1635 were small landed proprietors in Melbury Osmond, Dorset, and adjoining parishes. He was educated at local schools, 1848–54, and afterwards privately, and in 1856 was articled to Mr John Hicks, an ecclesiastical architect of Dorchester. In 1859 he began writing verse and essays, but in 1861 was compelled to apply himself more strictly to architecture, sketching and measuring many old Dorset churches with a view to their restoration. In 1862 he went to London (which he had first visited at the age of nine) and became assistant to the late Sir Arthur Blomfield, R.A. In 1863 he won the medal of the Royal Institute of British Architects for an essay on *Coloured Brick and Terra-cotta Architecture*, and in

the same year won the prize of the Architectural Association for design. In March 1865 his first short story was published in *Chambers's Journal*, and during the next two or three years he wrote a good deal of verse, being somewhat uncertain whether to take to architecture or to literature as a profession. In 1867 he left London for Weymouth, and during that and the following year wrote a "purpose" story, which in 1869 was accepted by Messrs Chapman and Hall. The manuscript had been read by Mr George Meredith, who asked the writer to call on him, and advised him not to print it, but to try another, with more plot. The manuscript was withdrawn and re-written, but never published. In 1870 Mr Hardy took Mr Meredith's advice too literally, and constructed a novel that was all plot, which was published in 1871 under the title *Desperate Remedies*. In 1872 appeared *Under the Greenwood Tree*, a "rural painting of the Dutch school," in which Mr Hardy had already "found himself," and which he has never surpassed in happy and delicate perfection of art. *A Pair of Blue Eyes*, in which tragedy and irony come into his work together, was published in 1873. In 1874 Mr Hardy married Emma Lavinia, daughter of the late T. Attersoll Gifford of Plymouth. His first popular success was made by *Far from the Madding Crowd* (1874), which, on its appearance anonymously in the *Cornhill Magazine*, was attributed by many to George Eliot. Then came *The Hand of Ethelberta* (1876), described, not inaptly, as "a comedy in chapters"; *The Return of the Native* (1878), the most sombre and, in some ways, the most powerful and characteristic of Mr Hardy's novels; *The Trumpet-Major* (1880); *A Laodicean* (1881); *Two on a Tower* (1882), a long excursion in constructive irony; *The Mayor of Casterbridge* (1886); *The Woodlanders* (1887); *Wessex Tales* (1888); *A Group of Noble Dames* (1891); *Tess of the D'Urbervilles* (1891), Mr Hardy's most famous novel; *Life's Little Ironies* (1894); *Jude the Obscure* (1895), his most thoughtful and least popular book; *The Well-Beloved*, a reprint, with some revision, of a story originally published in the *Illustrated London News* in 1892 (1897); *Wessex Poems*, written during the previous thirty years, with illustrations by the author (1898). In 1894 Mr Hardy was appointed a magistrate for Dorsetshire. In all his work Mr Hardy is concerned with one thing, seen under two aspects; not civilization, nor manners, but the principle of life itself, invisibly realized in humanity as sex, seen visibly in the world as what we call nature. He is a fatalist, perhaps rather a determinist, and he studies the workings of fate, or law (ruling through inexorable moods or humours), in the chief vivifying and disturbing influence in life, women. His view of women is more French than English; it is subtle, a little cruel, not as tolerant as it seems, thoroughly a man's point of view, and not, as with Mr Meredith, man's and woman's at once. He sees all that is irresponsible for good and evil in a woman's character, all that is untrustworthy in her brain and will, all that is alluring in her variability. He is her apologist, but always with a reserve of private judgment. No one has created more attractive women of a certain class, women whom a man would have been more likely to love or to regret loving. In his earlier books he is somewhat careful over the reputation of his heroines; gradually he allows them more liberty, with a franker treatment of instinct and its consequences. *Jude the Obscure* is perhaps the most unbiassed consideration in English fiction of the more complicated questions of sex. There is almost no passion in his work, neither the author nor his characters ever seeming able to pass beyond the state of curiosity, the most intellectually interesting of limitations, under the influence of any emotion. In his feeling for nature, curiosity sometimes seems to broaden into a more intimate communion. The heath, the village with its peasants, the change of every hour among the fields and on the roads of that English countryside which he has made his own—the Dorsetshire and Wiltshire "Wessex"—mean more to him, in a sense, than even the spectacle of man and woman in their blind, and painful, and absorbing struggle for existence. His knowledge of woman confirms him in a suspension of judgment; his knowledge of nature brings him nearer to the unchanging and consoling element in the world. All the entertainment which he gets out of life comes to him from his contemplation of the peasant, as himself a rooted part of the earth, translating the dumbness of the fields into humour. His peasants have been compared with Shakespeare's; he has the Shakespearean sense of their placid vegetation by the side of hurrying animal life, to which they act the part of chorus, with an unconscious wisdom in their close, narrow, and undistracted view of things.

See ANNIE MACDONELL. *Thomas Hardy*. London, 1894.—LIONEL P. JOHNSON. *The Art of Thomas Hardy*. London, 1894.

Harfleur, a town in the arrondissement of Havre, department of Seine-Inférieure, France, 42 miles, in direct line, west by north of Rouen, on the railway from Paris to Havre. Principal industries are the founding of various metals, oil-refining, and the manufacture of soap. The port, which had been rendered almost inaccessible owing to the deposits of the Lézarde, has again become available since the opening, in 1887, of the Tancarville canal, connecting it with the Seine. The new port is half a mile from the old, and vessels drawing 18 feet can moor alongside its quays. Population (1901), 2686.

Harlingen, important trading town and seaport in the province of Friesland, Netherlands, 17 miles west of Leeuwarden by rail. Owing to the improvement of the port (Willemsport), and the railway and steamship connexion with Amsterdam, Bremen, and the southern provinces, trade with Great Britain (imports—coal, cotton, and jute for the manufacturing district of Twenthe; exports—cattle, butter, cheese, fish, potatoes, and wood) has much increased. Among the industries is the manufacture of margarine. A steam tramway has been opened to Sneek. Population (1900), 10,267.

Harmonic Functions. See SPHERICAL HARMONICS.

Harnack, Adolf (1851– ——), German theologian, was born on 7th May 1851 at Dorpat, in Russia, where his father held a professorship of pastoral theology. The son pursued his studies at this university and at Leipzig, where he took his degree; and immediately afterwards began lecturing as a *privat-docent*. These lectures, which dealt with such special subjects as gnosticism, the Apocalypse, &c., attracted considerable attention, and in 1876 he was appointed "extraordinary" professor. Three years later he was called to Giessen, where he became professor of Church history. There he collaborated with Von Gebhardt in *Texte und Untersuchungen zur Geschichte der altchristlichen Litteratur*, an irregular periodical, containing only essays in New Testament and patristic fields. In 1885 he published the first volume of his great work, the *History of Dogma*. In it Harnack traces the rise of dogma, by which he understands the authoritative doctrinal system of the 4th century and its development down to the Reformation. He considers that in its earliest origins Christian faith and the methods of Greek thought were so closely intermingled that much that is not essential to Christianity found its way into the resultant system. Therefore Protestants are not only free, but bound to

criticize it; indeed, for a Protestant Christian dogma cannot be said to exist. In 1886 Harnack was called to Marburg; and in 1889, in spite of violent opposition from the conservative section of the Church authorities, to Berlin. Here, somewhat against his will, he was drawn into a controversy on the Apostles' Creed, in which the party antagonisms within the Prussian Church had found expression. Harnack's view is that the creed contains both too much and too little to be a satisfactory test for candidates for ordination, and he would prefer a briefer symbol which could be rigorously exacted from all. At Berlin Harnack continued his literary labours. He undertook an edition of the Greek Fathers down to Eusebius, and a history of early Christian literature. He is one of the most prolific and most stimulating of modern Church historians, and has trained up in his "Seminar" a whole generation of teachers, who are carrying his ideas and methods throughout the whole of Germany and even beyond its borders. Harnack's own point of view is the historico-critical. His distinctive characteristics are: his claim for absolute freedom in the study of Church history and the New Testament; his distrust of speculative theology, whether orthodox or liberal; his interest in practical Christianity as a religious life and not a system of theology. His writings are remarkable for their clearness combined with picturesque grace of style.

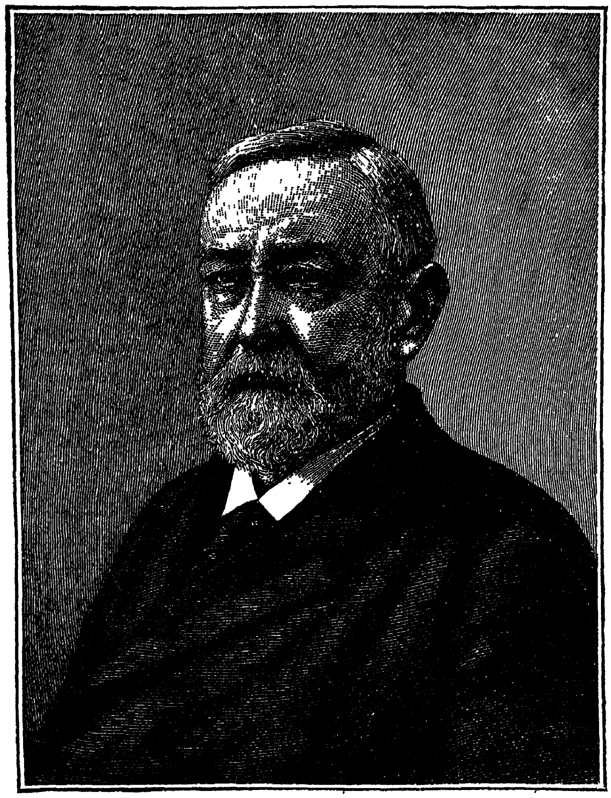
Haro, a town of Northern Spain, in the province of Logroño. It has increased in importance with the development of viticulture in its neighbourhood, and become the centre of a large export trade in wine. It has also manufactures of soap, liqueurs, brandy, preserves, candles, chalk, hats, and leather. Several casinos, a theatre, and various promenades have been constructed by the local authorities since 1880. Population (1897), 7976.

Harpenden, a village and urban district, Hertfordshire, England, in the Mid or St Albans division of the county, 5 miles south by east of Luton by rail, with stations on the Midland and Great Northern railways. In the Lawes Testimonial Laboratory there is a collection of over 50,000 bottles of samples of experimentally-grown produce, annual products, ashes, and soils. The late Sir John Bennet Lawes provided an endowment of £100,000 for the perpetuation of the agricultural experiments which he inaugurated here. The success of his association of chemistry with botany is shown by the fact that one field has grown wheat without intermission for 55 years without manure. Area of urban and rural districts combined, 5111 acres. Population (1891), 3603; (1901), 4725.

Harrisburg, capital of Dauphin county and of the state, Pennsylvania, U.S.A., in 40° 16′ N. and 76° 53′ W., on the east bank of the Susquehanna, at an altitude of 317 feet. Its site is level and the street plan regular. It derives an excellent water-supply from the river, and is well paved and sewered. It is on four railways—the Pennsylvania, the Northern Central, the Philadelphia and Reading, and the Cumberland Valley. The state capitol was destroyed by fire in 1897, and has since been rebuilt, greatly enlarged and improved. The manufacturing establishments in 1890 numbered 475, with $6,716,074 capital, and employed 6898 hands. Their products were valued at $10,538,444; of these nearly one-third in value were of iron and steel goods, the only prominent single item. The assessed valuation of real and personal property in 1890, on a basis of about two-thirds of the full value, was $26,631,875; the net debt was $1,183,234, and the rate of taxation was $17 per $1000. Population (1880), 30,762; (1890), 39,385; (1900), 50,167, of whom 2493 were foreign-born and 4107 were negroes. The death-rate in 1900 was 17·8.

Harrison, a town of Hudson county, New Jersey, U.S.A., on the Delaware, Lackawanna, and Western, the Erie and the Pennsylvania railways, at an altitude of 32 feet. Population (1880), 6898; (1890), 8338; (1900), 10,596, of whom 3633 were foreign-born.

Harrison, Benjamin (1833–1901), the twenty-third President of the United States, was born at North Bend, Ohio, 20th August 1833. His great-grandfather, Benjamin Harrison of Virginia, was a signatory of the Declaration of Independence. His grandfather, William Henry Harrison, who emigrated to Ohio, was in 1840 elected President of the United States. His father, John Scott Harrison, represented his district in the



Benjamin Harrison.

Congress of the United States. Benjamin's youth was passed upon the ancestral farm, and as opportunity afforded he attended the log school-house near his home. He was prepared for college by a private tutor at his father's house, and at the age of eighteen he graduated from Miami University, at that time the leading educational institution in the state of Ohio. From his youth he was diligent in his attention to his studies, and showed an avidity for the writings of Scott, Gibbon, and other classic English authors; and during his college life he showed a marked talent for extemporaneous speaking. He pursued the study of law, partly in the office of Bellamy Storer, a leading lawyer and judge of Cincinnati, and partly at his father's farm. At the age of twenty-one, having previously married, he went to Indianapolis. He had but one acquaintance in the place, the clerk of the Federal Court, who permitted him to occupy a desk in his office and place at the door his sign as a lawyer. Waiting for professional business, he was content to act as court crier for two dollars and a half a day; but he soon gave indications of his talent, and his studious

habits and attention to his cases rapidly brought him clients. Within a few years he took rank among the leading members of the profession at a bar which included some of the ablest lawyers of the country. His legal career was early interrupted by the Civil War. His whole heart was enlisted in the anti-slavery cause, and during the second year of the war he accepted a commission from the governor of the state as second lieutenant, and speedily raised a regiment. He was appointed its colonel, and as such continued in the Union army until near the close of the war, when he was breveted a brigadier-general for gallantry in the field. He participated with his regiment in various engagements during Buell's campaigns in Kentucky and Tennessee in 1862 and 1863; in Sherman's march on Atlanta in 1864; in the Nashville campaign; and was transferred early in 1865 to Sherman's army in its march through the Carolinas.

Allowing for this interval of military service, he applied himself exclusively for twenty-four years to his legal work, and became recognized as among the first lawyers of his state. The only office he held was that of reporter of the Supreme Court for two terms, which was strictly in the line of his profession. He was a devoted member of the Republican party, but not a politician in the strict sense. Once he became a candidate for Governor, in 1876, but his candidature was a forlorn hope, undertaken from a sense of duty, after the regular nominee had been forced to withdraw. He took a deep interest in the campaign which resulted in the election of Garfield as President, and was offered by him a place in his cabinet; but this he declined, having been elected a member of the United States Senate. He was chairman of the Committee on Territories, and took an active part in the admission of the new states of the north-west, especially of North and South Dakota. He served also on the Committee of Military and Indian Affairs, on Foreign Relations and others, was prominent in the discussion of matters brought before the Senate from these committees, advocated the restoration or enlargement of the navy, the reform of the civil service, and opposed the pension veto messages of President Cleveland. Mr Harrison was nominated by the Republican party for the Presidency in 1888, and successfully opposed Mr Cleveland, the candidate of the Democratic party. Among the measures and events distinguishing his term as President were the following:—The meeting of the Pan-American Congress at Washington; the passage of the McKinley Tariff Bill; the law suppressing the Louisiana lottery; the enlargement of the navy; further advance in civil service reform; the convocation by the United States of an international monetary conference; the establishment of commercial reciprocity with many countries of America and Europe; the peaceful settlement of the controversy with Chile; the Hawaiian annexation treaty; and the adjustment by arbitration with Great Britain of the Bering Sea fur-seal question. His administration was marked by a revival of American industries and a reduction of the public debt, and at its conclusion the country was left in an unexampled condition of prosperity and on friendly terms with foreign nations. He was nominated by his party in 1892 for re-election, but was defeated by Mr Cleveland, this result being due to the labour strikes which occurred during the Presidential campaign and arrayed the labour unions against the tariff party.

In 1898 Mr Harrison was retained by the government of Venezuela as its leading counsel in the arbitration of its boundary dispute with Great Britain. In charge of this duty he appeared before the international tribunal of arbitration at Paris in 1899, worthily maintaining the reputation of the American bar. He occupied a portion of his leisure after leaving public life in writing a book, entitled *This Country of Ours*, treating of the organization and administration of the government of the United States. He died at Indianapolis, Ind., on the 13th of March 1901. Mr Harrison's distinguishing trait of character, to which his success is to be most largely attributed, was his thoroughness. He was somewhat reserved in manner, and this led to the charge in political circles that he was cold and unsympathetic; but no one gathered around him more devoted and loyal friends, and his dignified bearing in and out of office commanded the hearty respect of his countrymen. (J. W. Fo.)

Harrison, Frederic (1831- ——), English jurist and author, was born in London, 18th October 1831. He was educated at King's College School and at Wadham College, Oxford, where, after taking a first-class in *Literæ Humaniores* in 1853, he became fellow and tutor. He was called to the bar in 1858, and, in addition to his practice in Equity cases, soon began to distinguish himself as an effective contributor to the higher-class reviews. Two articles in the *Westminster Review*, one on the Italian question, which procured him the special thanks of Cavour, the other on *Essays and Reviews*, which had the probably undesigned effect of stimulating the attack on the book, attracted especial notice. A few years later Mr Harrison worked at the codification of the law with Lord Westbury, of whom he contributed an interesting notice to Nash's biography of the chancellor. His special interest in legislation for the working classes led him to be placed upon the Trades Union Commission of 1867–69; he was secretary to the Commission for the Digest of the Law, 1869–70; and was from 1877 to 1889 professor of Jurisprudence and International Law under the Council of Legal Education. A follower of the Positive philosophy, he was one of the founders of Newton Hall in 1881; and he was editor and part author of the Positivist *New Calendar of Great Men* (1892). Of his separate publications, the most important are his lives of Cromwell (1888) and of William the Silent (1897), his *Historical Pieces* (1894), and *Meaning of History* (1862); his essays on *Early Victorian Literature* (1896), and *The Choice of Books* (1886) evince a rare faculty for generous admiration tempered by sound common-sense. An advanced Radical in politics and Progressive in municipal affairs, Mr Harrison in 1886 stood unsuccessfully for Parliament against Sir John Lubbock for London University. In 1889 he was elected an alderman of the London County Council, but resigned in 1893. In 1870 he married Ethel Berta, daughter of Mr William Harrison.

Harrogate, a municipal borough (incorporated 1884, extended 1900) and inland watering-place in the Ripon parliamentary division of Yorkshire, England, 16 miles north of Leeds by rail. Recent erections are Royal Baths, seven Established churches, Wesleyan and Baptist chapels; new buildings of the Harrogate Cottage Hospital, the Royal Bath Hospital, and the Rawson Convalescent Home; a Jubilee memorial statue of Queen Victoria (1887), Primitive Methodist chapel, Home for Incurables, Grand Opera House, and new Kursaal in course (1901) of erection. Public gardens were opened in 1888, and 36 acres of open ground, apart from the common (200 acres) are the property of the corporation, which also owns the Spa Concert Rooms and grounds, Harlow Moor, Crescent Gardens, Royal Bath Gardens, and other large open spaces, as well as Royal Baths, Victoria Baths, and Starbeck Baths. The mineral springs are vested in the corporation. Area (1891), 1287 acres; (1900, after extension), 3297 acres. Population (1881), 9482; (1891), 13,917; (1901), 28,414.

Harrow-on-the-Hill, a parish and town of England, 11 miles W.N.W. of St Paul's, London, in the Harrow parliamentary division of Middlesex, with stations on the London and North-Western and the Metropolitan Extension railways. Besides the church of St Mary's, which contains ancient brasses and other memorials, there are Roman Catholic (1894), Baptist, and Wesleyan places of worship. Harrow is celebrated for its School, founded in 1571 by John Lyon, and during the latter half of the 19th century frequently enlarged. Of recent additions the most important are the building which contains, besides schoolrooms, the Butler Museum (1886), the music school (1891), and a new drawing school (1897). The Harrow Technical School is under the control of the Middlesex County Council. The civil parish has an area of 10,027 acres, with a population of 13,000. The urban district population is (1901) 10,220.

Hart, Sir Robert, Bart. (1835- ——), Inspector-General of Chinese Customs, was born at Portadown, in Ulster, on 20th February 1835. He was educated at Taunton, Dublin, and Belfast, and graduated at Queen's College, Belfast, in 1853. In the following

Sir Robert Hart.
(From a photograph by the London Stereoscopic Company.)

year he received an appointment as student-interpreter in the China consular service, and after serving for a short time at the Ningpo vice-consulate, he was transferred to Canton, where after acting as secretary to the allied commissioners governing the city, he was appointed the local inspector of customs. There he first gained an insight into custom-house work. One effect of the Taiping rebellion was to close the native custom-house at Shanghai; and as the corrupt alternatives proposed by the Chinese were worse than useless, it was arranged by Sir Rutherford Alcock, the British consul, with his French and American colleagues, that they should undertake to collect the duties on goods owned by foreigners entering and leaving the port. Sir T. Wade was appointed to the post of collector in the first instance, and after a short tenure of office was succeeded by Mr H. N. Lay, who held the post until 1863, when he resigned owing to a disagreement with the Chinese Government in connexion with the Lay-Osborn fleet. During his tenancy of office the system adopted at Shanghai was applied to the other treaty ports, so that when on Mr Lay's resignation Mr Hart was appointed inspector-general of foreign customs, he found himself at the head of an organization which collected a revenue of upwards of eight million taels per annum at fourteen treaty ports. From the date when Mr Hart took up his duties at Peking, in 1863, he unceasingly devoted the whole of his energies to the work of the department, with the result that the revenue grew from upwards of eight million taels to nearly twenty-seven million, collected at the thirty-two treaty ports, and the customs staff, which in 1864 numbered 200, reached in 1901 a total of 5704. From the first Mr Hart gained the entire confidence of the members of the Chinese Government, who were wise enough to recognize his loyal and able assistance. Of all their numerous sources of revenue, the money furnished by Mr Hart was the only certain asset which could be offered as security for Chinese loans. For many years, moreover, it was customary for the British minister, as well as the ministers of other Powers, to consult him in every difficulty; and such complete confidence had Lord Granville in his ability and loyalty, that on the retirement of Sir T. Wade he appointed him minister plenipotentiary at Peking (1885). Sir Robert Hart, however—who was made a K.C.M.G. in 1882—recognized the anomalous position in which he would have been placed had he accepted the proposal, and declined the proffered honour. On all disputed points, whether commercial, religious, or political, his advice was invariably sought by the foreign ministers and the Chinese alike. Thrice only did he visit Europe between 1863 and 1902, the result of this long comparative isolation, and of his constant intercourse with the Peking officials, being that he learnt to look at events through Chinese spectacles; and his work, *These from the Land of Sinim*, shows how far this affected his outlook. The faith which he put in the Chinese made him turn a deaf ear to the warnings which he received of the threatening Boxer movement in 1900. To the last he believed that the attacking force would at least have spared his house, which contained official records of priceless value, but he was doomed to see his faith falsified. The building was burnt to the ground with all that it contained, including his private diary for forty years. When the stress came, and he retreated to the British Legation, he took an active part in the defence, and spared neither risk nor toil in his exertions. In addition to the administration of the foreign customs service, the establishment of a postal service in the provinces devolved upon him, and after the signing of the protocol of 1901 he was called upon to organize a native customs service at the treaty ports. Both the Chinese and the British Governments from time to time conferred honours upon him. By giving him a Red Button, or button of the highest rank, a Peacock's Feather, the Order of the Double Dragon, a patent of nobility to his ancestors for three generations, and the title of Junior Guardian of the Heir Apparent, the Chinese showed their appreciation of his manifold and great services; while under the seal of the British Government there were bestowed upon him the Orders of C.M.G. (1880), K.C.M.G. (1882), G.C.M.G. (1889), and a baronetcy (1893). He has also been the recipient of many foreign orders. Sir Robert Hart married in 1886 Hester, the daughter of Alexander Bredon, Esq., M.D., of Portadown, his family consisting of one son and two daughters.

Harte, Francis Bret (1839–1902), an American author, was born at Albany, New York, 25th August His father, a teacher in the Albany Female Academy, died during his boyhood. After a common-school education he went with his mother to California at the age of seventeen, afterwards working in that state as a teacher, miner, printer, express-messenger, secretary of the San Francisco mint, and editor. His first literary venture was a series of *Condensed Novels* (travesties of well-known works of fiction, somewhat in the style of Thackeray), published weekly in *The Californian*, of which he was editor, and reissued in book form in 1870. *The Overland Monthly*, the earliest considerable literary magazine on the Pacific coast, was established in 1868, with Harte as editor. His sketches and poems, which appeared in its pages during the next few years, attracted wide attention in the eastern states and in Europe. "The Luck of Roaring Camp" (1868), "The Outcasts of Poker Flat" (1869), the later sketch "How Santa Claus came to Simpson's Bar," and the verses entitled "Plain Language from Truthful James," combined humour, pathos, and power of character portrayal in a manner that indicated that the new land of mining-gulches, gamblers, unassimilated Asiatics, and picturesque and varied landscape had found its best delineator; so that Harte became, in his pioneer pictures, a sort of later Fenimore Cooper. Forty-four volumes were published by him between 1867 and 1898. After a year as professor in the University of California, Harte lived in New York, 1871–78; was United States consul at Crefeld, Germany, 1878–80; consul at Glasgow, 1880–85; and after 1885 resided in London, engaged in literary work. He died at Camberley, England, 5th May 1902.

Hartford, capital of Hartford county and of the state, Connecticut, U.S.A., on the western bank of the Connecticut river. It is well laid out, is divided into ten wards, has an excellent system of water-works, constructed by the city at a cost of $2,800,000, is well sewered, and is paved mainly with macadam. Its death-rate was 17·91 per 1000 in 1900. The New York, New Haven, and Hartford, and the Central of New England railways enter the city, and, with steamboats on the river, which is navigable to this point, give it a large commerce. In 1900 there were 888 manufacturing establishments, having a total capital of $30,500,047, and employing an average number of 13,363 wage-earners. The total products were valued at $31,145,715, among which the most important were bicycles and tricycles ($2,472,446) and foundry and machine shop products ($3,718,608). Hartford has also a large business in the printing and publishing of books. Among its newspapers should be mentioned the *Hartford Courant*, one of the oldest and best-known papers of New England. The chief business is in life and fire insurance. In 1890 the offices of six stock and five mutual-aid life insurance companies were situated here. The former had a capital exceeding $12,000,000 and assets exceeding $111,000,000. There were seven fire insurance companies, with a capital of over $10,000,000. Hartford is the seat of Trinity College, a Protestant Episcopal institution, founded in 1824, which in 1900 had 25 instructors and 128 students. The assessed valuation of real and personal property in 1900 was $69,760,630. The net debt was $3,641,971, and the rate of taxation was $17·50 per $1000. Population (1880), 42,015; (1890), 53,230; (1900), 79,850, of whom 23,758 were foreign-born and 1887 were negroes. The death-rate in 1890 was 24·4; in 1900 it was 19·4.

Hartford City, capital of Blackford county, Indiana, U.S.A., at the intersection of the Lake Erie and Western and the Pittsburg, Cincinnati, Chicago, and St Louis railways. Population (1890), 2287; (1900), 5912, of whom 572 were foreign-born.

Hartlepool (sometimes called EAST HARTLEPOOL) and **West Hartlepool,** twin seaports on the coast of Durham, England, the latter 12 miles, the former 15 miles, north-east from Stockton-on-Tees. The harbour, which embraces two tidal basins and six docks aggregating 83½ acres, in addition to timber docks of 57 acres, covers altogether 350 acres, and stretches between the two Hartlepools. The depth of water on the dock sills varies from 17½ feet at neap tides to 25 feet at spring tides. A breakwater three-quarters of a mile long protects the entrance to the harbour. Officially the two Hartlepools are considered as one port. They carry on an important trade in the export of coal, ships, machinery, iron and other metallic ores, woollens and cottons, and in the import of timber, sugar, iron and copper ores, and eggs. The exports increased from a total value of £624,531 in 1896 to £1,491,346 in 1900, and the imports from £1,630,486 to £2,004,481 in the same two years. Timber makes up 59 per cent. of the imports, and coal and ships each about 30 per cent. of the exports. The foreign trade employs about 800 vessels of 411,600 tons cleared annually, and the coasting trade some 1550 vessels of 530,700 tons. The port owns about 260 vessels of 380,000 tons, and a small fishing fleet. The principal industries are shipbuilding (iron), boiler and engineering works, iron and brass foundries, steam saw and planing mills, flour-mills, paper and paint factories, and soapworks. There are five graving docks, admitting vessels of 550 feet length and 10 to 21 feet draught. In 1889 a promenade, ¾ mile long, was made from the Heugh lighthouse to Throston. In East Hartlepool there are a new chapel of ease (St Andrew's) to the parish church, and a new United Presbyterian church; and in addition a Roman Catholic church and half-a-dozen Nonconformist chapels. The area of the municipal borough is 552 acres, and its population (1891) 21,288, and (1901) 22,737.

WEST HARTLEPOOL, which is of quite modern growth, but now the larger, was only incorporated in 1887. Its municipal area is 2454 acres, and its population (1891) 42,815, and (1901) 62,614. The municipal area embraces the three townships of Seaton Carew, Stranton, and Throston. There are several new churches, *e.g.*, St Aidan's and St Paul's, both in the Early English style, the Roman Catholic church (1893–94), the Swedish church, and the Presbyterian church; and conspicuous amongst the older sacred edifices are Christ Church, in the Gothic style, and St James's, Early Decorated. There are, further, several Nonconformist chapels. Stranton parish church dates from the middle of the 14th century, but was restored in 1889. The more important of the recent secular buildings are the municipal offices (1889), the free public library (1895), the technical institute and public hall (1896), and the market hall (rebuilt). The town possesses three clubs, three theatres, and the Ward-Jackson Memorial Park, opened in 1883.

Hartley, Sir Charles Augustus (1825–——), English engineer, was born in 1825 at Heworth, in Durham. Like most engineers of his generation he was engaged in railway work in the early part of his career, but subsequently he devoted himself to hydraulic engineering and the improvement of estuaries and harbours for the purposes of navigation. His services were employed in connexion with some of the largest and most important waterways of the world. After serving in the Crimea as a captain of engineers in the Anglo-Turkish

contingent, he was in 1856 appointed engineer-in-chief for the works carried out by the European Commission of the Danube for improving the navigation at the mouths of that river, and that position he retained till 1872, when he became consulting engineer to the Commission. In 1875 he was one of the committee appointed by the authority of the U.S.A. Congress to report on the works necessary to form and maintain a deep channel through the south pass of the Mississippi delta; and in 1884 the British Government nominated him a member of the International Technical Commission for widening the Suez Canal. In addition he was consulted by the British and other Governments in connexion with many other river and harbour works, including the improvement of the navigation of the Scheldt, Hugli, Don, and Dnieper, and of the ports of Odessa, Trieste, Kustendjie, Burgas, Varna, &c. He was knighted in 1862, and became K.C.M.G. in 1884.

Hartmann, Karl Robert Eduard von (1842-——), German philosopher, son of a general officer in the Prussian army, was born in Berlin on 23rd February 1842. He was educated for the army, and entered the artillery of the Guards as an officer in 1860, but a malady of the knee, which crippled him, forced him to quit the service in 1865. After some hesitation between music and philosophy he decided to make the latter the serious work of his life, and in 1867 the University of Rostock conferred on him the degree of doctor of philosophy without requiring residence. His reputation as a philosopher was established by his first book, *The Philosophy of the Unconscious*, which was published in 1869 and had by 1890 reached its tenth edition (in three volumes). This success, which was not rivalled by any of his subsequent writings, was largely due to the originality of its title, the diversity of its contents (von Hartmann professing to obtain his speculative results by the methods of inductive science, and making plentiful use of concrete illustrations), the fashionableness of its pessimism, the vigour and lucidity of its style; and these qualities will probably continue to give it the preponderance over its author's later and maturer works, in spite of all his protests. The conception of the Unconscious, by which von Hartmann describes his ultimate metaphysical principle, is not at bottom as paradoxical as it sounds: it is merely a new and mysterious designation for the Absolute of German metaphysicians, which lends itself to much manipulation by reason of its manifold ambiguities. This fact von Hartmann tardily recognized in an article in the *Archiv für systematische Philosophie* (August 1900), in which he distinguished nineteen different senses of the "unconscious," and confessed to great imperfections in his earlier treatment, but nevertheless maintained the validity of his metaphysical principle. Shorn in this way of the illusory empirical illustrations which rendered it interesting, the Unconscious appears as a combination of the metaphysic of Hegel with that of Schopenhauer. The Unconscious is both Will and Reason and the absolute all-embracing ground of all existence. Von Hartmann thus combines "pantheism" with "panlogism" in a manner adumbrated by Schelling in his "positive philosophy." Nevertheless Will and not Reason is the primary aspect of the Unconscious, whose melancholy career is determined by the primacy of the Will and the subservience of the Reason. Precosmically the Will is potential and the Reason latent, and the Will is void of reason when it passes from potentiality to actual willing. This latter is absolute misery, and to cure it the Unconscious evokes its Reason and with its aid creates the best of all possible worlds, which contains the promise of its redemption from actual existence by the emancipation of the Reason from its subjugation to the Will in the conscious reason of the enlightened pessimist. When the greater part of the Will in existence is so far enlightened by reason as to perceive the inevitable misery of existence, a collective effort to will non-existence will be made, and the world will relapse into nothingness, the Unconscious into quiescence. It is apparent from the above that although von Hartmann is a pessimist, and ably continues the tradition of Schopenhauer, his pessimism is by no means unmitigated. The individual's happiness is indeed unattainable either here and now or hereafter and in the future, but von Hartmann does not despair of ultimately releasing the Unconscious from its sufferings. He differs from Schopenhauer in making salvation by the "negation of the Will-to-live" depend on a collective social effort and not on individualistic asceticism. The conception of a redemption of the Unconscious also supplies the ultimate basis of von Hartmann's ethics. We must provisionally affirm life and devote ourselves to social evolution, instead of striving after a happiness which is impossible; in so doing we shall find that morality renders life less unhappy than it would otherwise be. Suicide, and all other forms of selfishness, are highly reprehensible. Epistemologically von Hartmann is a transcendental realist, who ably defends his views and acutely criticizes those of his opponents. His realism enables him to maintain the reality of Time, and so of the process of the world's redemption.

Von Hartmann is a very voluminous writer, his collected works extending to more than 12,000 pages. They may be classified into—A. Systematical, including * *Grundprobleme der Erkenntnisstheorie*; * *Kategorienlehre*; * *Das sittliche Bewusstsein*; * *Die Philosophie des Schönen*; * *Die Religion des Geistes*; * *Die Philosophie des Unbewussten* (3 vols., which now include his, originally anonymous, self-criticism, *Das Unbewusste vom Standpunkte der Physiologie und Descendenztheorie*, and its refutation). B. Historical and critical—* *Das religiöse Bewusstsein der Menschheit*; * *Geschichte der Metaphysik* (2 vols.); *Kant's Erkenntnisstheorie*; * *Kritische Grundlegung des transcendentalen Realismus*; *Über die dialektische Methode*; studies of *Schelling, Lotze, von Kirchmann*; *Zur Geschichte des Pessimismus*; *Neukantianismus, Schopenhauerismus, Hegelianismus*; * *Geschichte der deutschen Aesthetik seit Kant*; *Die Krisis des Christentums in der modernen Theologie*; *Philosophische Fragen der Gegenwart*; *Ethische Studien*; * *Moderne Psychologie*. C. Popular—*Soziale Kernfragen*; *Moderne Probleme*; *Tagesfragen*; *Zwei Jahrzehnte deutscher Politik*; *Das Judentum in Gegenwart und Zukunft*; † *Die Selbstzersetzung des Christentums*; *Gesammelte Studien*; *Der Spiritismus* and *Die Geisterhypothese des Spiritismus*. Of these, those marked * have been included among his selected works, while those marked † have been translated into English.

Harvard College, founded in 1636 at Cambridge, Massachusetts. It is the oldest and largest university in the United States. Since the election of Charles William Eliot as President in 1869 the standard both in the college and professional schools has been raised to the university level, and there have been founded the Graduate School, the Veterinary School, the Bussey Institution for Agriculture, and the School of Comparative Medicine. The Dental School (founded in 1867) has been organized on a sound basis, and the Lawrence Scientific School (founded in 1847) has been quickened into vigorous activity. In administration and in the life of its students Harvard has developed the characteristics of the older American colleges under the guiding principle of liberty: the free election of studies has been extended to the freshman class; compulsory attendance at religious exercises has been abolished (1885); the general government, and even the Divinity School, have been purged of sectarianism, and freedom is accorded to instructors. In scholarship, Germany has furnished the model. The range of studies has been widened to keep pace with the immense extension of

knowledge, and the scientific method, which exacts of the student a large share of observation and research, prevails in all departments. With Johns Hopkins University, Harvard led the movement that has transformed higher education in the United States. In the college proper the requirements for entrance and for graduation have been raised, although many candidates complete in three years the number of courses requisite for the degree. The professional schools have systematized and lengthened their work, most of which is prescribed. The Law School, where instruction by the "case" method was introduced by Professor C. C. Langdell, Dean from 1870 to 1895, and the Divinity School, already require of their matriculants the degree of A.B. or its equivalent; and the Medical School now does the same; the Dental School likewise looks forward to becoming a graduate school. At the Law School and Dental School the course is three years; at the Medical School, four years. Each school has a separate faculty for internal administration, but in 1890 the College, Graduate School, and Scientific School were placed under the general control of the Faculty of Arts and Sciences, and in 1899 the Faculty of Medicine was created for the Medical, Dental, and Veterinary Schools.

Connected with the university are the Botanic Garden (founded 1807) and Gray Herbarium (1864); the university museum of natural history (founded, 1859, by Louis Agassiz, and largely supported by his son, Alexander Agassiz); the Peabody Museum (founded, 1866, by George Peabody), devoted to American archæology; the Fogg Art Museum (erected 1895); the Semitic Museum; chemical, physical, and metallurgical laboratories; the astronomical observatory (founded in 1843), which has maintained since 1891 a station at Arequipa, Peru; the Arnold Arboretum, for the study of arboriculture, forestry, and dendrology. The college and departmental libraries contain 577,000 bound volumes and as many pamphlets. The college has twelve large dormitories, two dining halls, a theatre for public ceremonies, a chapel, Phillips Brooks House for religious societies, an infirmary, a gymnasium, and large playgrounds and boathouses. On 31st July 1900 the invested capital was $12,614,448; the lands and buildings were worth about $12,250,000 more; the receipts for the year were $2,071,306, and the payments $1,584,123; the gifts and bequests of the preceding twelve months amounted to $835,101. In 1901 there were 496 teachers and 4297 students, the latter being distributed as follows: College, 1992; Scientific School, 507; Graduate School, 341; Divinity School, 28; Law School, 647; Medical School, 605; Dental School, 126; Veterinary School, 18; Bussey Institution, 33. In addition, the Summer School of 1900 had 987 students; Radcliffe College for women had in 1901, 449. The alumni of the university number 27,477 (15,763 A.B.'s, 4085 M.D.'s, 3291 LL.B.'s). (See also UNIVERSITIES and EDUCATION.)

AUTHORITIES.—BENJAMIN PEIRCE. *A History of Harvard University, 1636–1775.* Boston, 1833.—JOSIAH QUINCY. *A History of Harvard University,* 2 vols. Boston, 1840.—SAMUEL A. ELIOT. *Harvard College and its Benefactors.* Boston, 1848. *The Harvard Book,* 2 vols. Cambridge, 1874.—G. BIRKBECK HILL. *Harvard College, by an Oxonian.* New York, 1894.—WILLIAM R. THAYER. *History and Customs of Harvard University* (in *Universities and their Sons,* vol. i.). Boston, 1898.—*Official Guide to Harvard.* Cambridge, 1899. (W. R. T.)

Harvesting Machines. See AGRICULTURAL MACHINERY.

Harvey, a city of Cook county, Illinois, U.S.A. It is a manufacturing town of growing importance, south of and close to Chicago. Population (1900), 5395, of whom 982 were foreign-born.

Harwich, a municipal borough and seaport in the Harwich parliamentary division (since 1885) of Essex, England, on the Stour, 7 miles north-east of London by rail. A quay was opened by the Great Eastern Railway Company at Parkeston, 1 mile up the river, in 1883. The port is also the headquarters of the Royal Harwich Yacht Club. The registered shipping in 1899 consisted of 121 vessels of 14,096 tons. In 1888, 3170 vessels of 686,775 tons entered and 2952 of 670,924 tons cleared; in 1899, 3860 vessels of 916,371 tons entered and 3639 of 893,281 tons cleared. Area, 1526 acres. Population (1881), 7842; (1901), 10,019.

Harz Mountains, one of the systems which border the great North German plain on the south, between the Saale and Leine. Owing to its position, as the first range of altitudes which the northerly winds strike after crossing the North German plain, the climate on the summit of the Harz is generally raw and damp, even, relatively speaking, in summer. In 1895 an observatory was opened on the top of the Brocken, and the results of the first five years (1896–1900) showed a July mean of 50° Fahr., a February mean of 24·7°, and a yearly mean of 36·6° (an admittedly imperfect series of older records between 1836 and 1867 gave a yearly mean of 34·5°). During the same five years the rainfall averaged 64½ inches annually. But whilst the summer is thus relatively ungenial on the top of the Harz, the usual summer heat of the lower-lying valleys is greatly tempered and cooled; so that, superadding this to the natural attractions of the scenery, the deep, dark forests, and the crowd of legendary and romantic associations which cling to every fantastic rock and ruined castle, the Harz is a favourite summer resort of the German people. Amongst the more popular places of resort are Harzburg, with the Canossa obelisk (50 feet high), dedicated to Bismarck and put up in 1877; Thale and the Bodethal, with the rock scenery of the Rosstrappe and the Hexentanzplatz; Blankenburg, with the Teufelsmauer and the Hermannshöhle; Wernigerode, Ilsenburg, Grund, Lauterberg, Hubertusbad, Alexisbad, and Suderode. Some of these, and other places not named, add to their natural attractions the advantage of mineral springs and baths, pine-needle baths, whey cures, &c. In spite of the mountainous nature of the region, the Harz is penetrated by some half-a-dozen railways, amongst them being a rack-railway up the Brocken, opened in 1898. The Harz is one of the richest mineral storehouses in Germany. Here silver and lead, to say nothing of other ores, have been mined for several hundred years, principally at Klausthal and St Andreasberg in the Upper Harz. Near the latter town is one of the deepest mining shafts in Europe, namely, the Samson, which goes down 2790 feet, or 720 feet below the level of the sea. For the purpose of getting rid of the water, and obviating the flooding of such deep workings, it has been found necessary to construct drainage works of some magnitude. As far back as 1777–99 the Georgsstollen was cut through the mountains from the east of Klausthal westwards to Grund, a distance of 4 miles or so; but this proving insufficient, another sewer, the Ernst-Auguststollen, no less than 14 miles in length, was made from the same neighbourhood to Gittelde, at the west side of the Harz in 1851–64.

See *Der Harz,* by various writers, edited by HANS HOFFMANN (Leipzig, 1899); VON GRODDECK, *Abriss der Geognosie des Harzes* (2nd edition, Klausthal, 1883); GÜNTHER, *Der Harz in Geschichts-Kultur- und Landschafts-bildern* (Hanover, 1885); PROHLE, *Harzsagen* (2nd edition, Leipzig, 1886); *Zeitschrift des Harzvereins* (annual since 1868, Wernigerode).

Haslemere, a town of England, in the south-west corner of Surrey, with a station 12 miles south-west from Guildford. It stands at an altitude of over 500 feet, between the bold hills (900 feet) of Hindhead and Blackdown. The invigorating air and fine scenery of the place, with its copses and abundance of heather and gorse, have made the district round Haslemere a favourite place of residence in recent years, particularly for literary and artistic society. Lord Tennyson spent most of his time at Aldworth, his property on Blackdown; Professor Tyndall

built a house on Hindhead, and thereby set an example which was followed by many others; George Eliot stayed for some time at Shottermill, 2 miles from Haslemere; and since about 1880 the number of new houses has gone on increasing, till the aspect of the neighbourhood has been completely changed. The town too has been modernized. The principal mansion in the district is Lythe Hill, built by the late Mr J. Stewart Hodgson. The population of Haslemere itself is 2613, and of Hindhead 666, but the number of people for whom Haslemere station is the railway centre is very much larger.

Haslingden, a municipal borough (1891) and market-town in the Rossendale and Heywood parliamentary divisions of Lancashire, England, 4 miles south-south-east of Accrington by rail. Two Established churches have been recently erected. The town, steadily increasing in importance, has cotton, woollen, and engineering works; quarrying and brickmaking are carried on in the neighbourhood. Area, 8196 acres. Population (1881), 16,298; (1901), 18,543. The borough, as incorporated, comprised several townships and parts of townships, but under the Local Government Act of 1894 these were united into one civil parish.

Haspe, a town of Prussia, province of Westphalia, 10 miles north-east of Barmen by rail. It has various iron-works, boiler-works, chemical factories, &c. Population (1885), 8903; (1900), 16,040.

Hasselt, a town of Belgium, capital of the province of Limburg, 47 miles east of Brussels, at an important junction of railway lines connecting it with towns in Holland and with the other principal places of Belgium. Its gin is reputed the finest distilled in the country. Its manufactures include oil, tobacco, and chemical and non-chemical manures. Population (communal, 1899), 15,002.

Hastings, one of the Cinque Ports, a municipal, county (1888), and parliamentary borough, and market-town of Sussex, England, 60 miles south-south-east of London by rail. The limits of the municipal and county borough were in 1897 extended, and now exceed those of the parliamentary borough. In 1885 the parliamentary representation was reduced to one member. Among the churches may be noted Christ Church (1875), costing over £23,000, and the church of St John the Evangelist (1881), All Souls' (1890), and a Catholic church (1882). Educational institutions include the grammar school (1883), school of science and art (1878), technical schools, and numerous board schools. The town hall, costing £20,000, dates from 1880. Other buildings are a theatre (1882), a music hall (1899), baths (1897), costing £60,000; convalescent home (1886), and hospital (1887). A second pier, that of St Leonards, 950 feet long, with a large pavilion, was opened in 1891. Alexandra Park, 75 acres, laid out at a cost of about £35,000, was opened in 1882. Population of municipal and county borough on unextended area (2194 acres) (1881), 42,258; (1891), 52,223. Extended area, 4769 acres; population (1891), 63,072; (1901), 65,528.

Hastings, capital of Adams county, Nebraska, U.S.A., at an altitude of 1933 feet. It has a regular plan, the water-supply and sewerage systems are excellent, and four railways enter it—the Burlington and Missouri River, the Fremont, Elkhorn, and Missouri Valley, the Missouri Pacific, and St Joseph and Grand Island. It is the seat of Hastings College, a Presbyterian institution, founded in 1882, which in 1899 had 10 instructors and 149 students, 68 of whom were women. Population (1880), 2817; (1890), 13,584; (1900), 7188, of whom 1253 were foreign-born.

Hatch, Edwin (1835–1889), English theologian, was born at Derby, 4th September 1835. He was educated at King Edward's School, Birmingham, under Dr James Prince Lee, afterwards Bishop of Manchester, the preceptor of Archbishop Benson and Bishops Lightfoot and Westcott. Hatch became scholar of Pembroke College, Oxford, took a second-class in Classics in 1857, and was Pusey and Ellerton Scholar in 1858. For some time he was professor of Classics in Trinity College, Toronto, but returned to Oxford in 1867, and was made Principal of St Mary's Hall, a post which he held until 1885. In 1883 he was presented to the living of Purleigh in Essex, and in 1884 was appointed University reader in ecclesiastical history. He had many struggles to pass through in early life, which tended to discipline his character and to form the habits of severe study and the mental independence of view for which he was afterwards distinguished. He was the first editor of the University official *Gazette*, and of the *Student's Handbook to the University*. He took a principal part in the preparation of a concordance to the Septuagint, published after his death. But he established his reputation chiefly by his treatises *On the Organization of the Early Christian Churches* (the Bampton Lectures for 1880), and on the *Influence of Greek Ideas and Usages on the Christian Church* (the Hibbert Lectures for 1888). These works attracted much attention, and provoked no little criticism on account of the challenge they appeared to throw down to the traditional views in vogue at the time of their appearance. But the research and fairness displayed were admitted on all hands. Hatch died, worn out with labour and greatly regretted, on 10th November 1889. He was a contributor of some important articles to the ninth edition of the *Encyclopædia Britannica*. (J. J. L*.)

Hatfield, or Bishop's Hatfield, a market-town and railway station in the St Albans parliamentary division of Hertfordshire, England, 7 miles W. by S. of Hertford. Hatfield forms part of a rural district. Partly in consequence of the increased importance of Hatfield House in recent years, as the residence of the Marquis of Salisbury, the station has become a more important one for purposes of the Great Northern system, and the town has spread out. Area of the parish, 12,884 acres. Population (1891), 4330; of the rural district (1891), 6963; (1901), 7551.

Hatherley, William Page Wood, Baron (1801–1881), Lord Chancellor of Great Britain, son of Sir Matthew Wood, a London alderman and lord mayor who became famous for befriending Queen Caroline and braving George IV., was born 29th November 1801. He was educated at Winchester, Geneva University, and Trinity College, Cambridge, where he became a fellow after being 24th wrangler in 1824. He entered Lincoln's Inn, and was called to the bar in 1824, studying conveyancing in Mr John Tyrrell's chambers. He soon obtained a good practice as an Equity draughtsman and before parliamentary committees, and in 1830 married Miss Charlotte Moor. In 1845 he became Q.C., and in 1847 was elected to Parliament for the city of Oxford as a Liberal. In 1849 he was appointed Vice-Chancellor of the County Palatine of Lancaster, and in 1851 was made Solicitor-General and knighted, vacating that position in 1852. When his party returned to power in 1853, he was raised to the bench as a Vice-Chancellor. In 1868 he was made a lord justice of appeal, but before the end of the year was selected by Mr Gladstone to be Lord Chancellor, and was raised to the peerage as Lord Hatherley of Down Hatherley. He retired in 1872 owing to failing eyesight, but sat occasionally as a law lord. His wife's death in

1878 was a great blow, from which he never recovered, and he died 10th July 1881. Dean Hook said that Lord Hatherley—who was a sound and benevolent supporter of the Church of England—was the best man he had ever known. He was a particularly clear-headed lawyer, conscientious and industrious, and his judgments—always delivered extempore—commanded the greatest confidence both with the public and the legal profession.

Hathras, a town of British India, in the Aligarh district of the North-West Provinces, 29 miles north of Agra. Population (1881), 25,656; (1901), 41,849. The municipal income in 1897–98 was Rs.32,670. It is an important centre of local trade in sugar and grain, and is connected by a light railway with Muttra, and by a branch (6 miles, opened in 1898) with Hathras junction, on the East Indian main line.

Hatton, John Liptrot (1809–1886), English musical composer, was born at Liverpool, 12th October 1809. He was virtually a self-taught musician, and besides holding several appointments as organist in Liverpool, appeared as an actor on the Liverpool stage, subsequently finding his way to London as a member of Macready's company at Drury Lane in 1832. Ten years after this he was appointed conductor at the same theatre for a series of English operas, and in 1843 his own first operetta, *Queen of the Thames*, was given with success. Staudigl, the eminent German bass, was a member of the company, and at his suggestion Hatton wrote a more ambitious work, *Pascal Bruno*, which, in a German translation, was presented at Vienna, with Staudigl in the principal part; the opera contained a song, "Revenge," which the basso made very popular in England, though the piece as a whole was not successful enough to be produced here. Hatton's excellent pianoforte playing attracted much attention in Vienna; he took the opportunity of studying counterpoint under Sechter, and wrote a number of songs, obviously modelled on the style of German classics. In 1846 he appeared at the Hereford Festival as a singer, and also played a pianoforte concerto of Mozart. He undertook concert tours about this time with Sivori, Vieuxtemps, and others. From 1848 to 1850 he was in America; on his return he became conductor of the Glee and Madrigal Union, and from about 1853 was engaged at the Princess's Theatre to provide and conduct the music for Charles Kean's Shakespearean revivals. He seems to have kept this appointment for about five years. In 1856 a cantata, *Robin Hood*, was given at the Bradford Festival, and a third opera, *Rose, or Love's Ransom*, at Covent Garden in 1864, without much success. In 1866 he went again to America, and from this year Hatton held the post of accompanist at the Ballad Concerts, St James's Hall, for nine seasons. In 1875 he went to Stuttgart, and wrote an oratorio, *Hezekiah*, given at the Crystal Palace in 1877; like all his larger works, it met with very moderate success. Hatton excelled in the lyrical forms of music, and, in spite of his distinct skill in the severer styles of the madrigal, &c., he won popularity by such songs as "To Anthea," "Good-Night, Beloved," and "Simon the Cellarer," the first of which may be called a classic in its own way. His glees and part-songs, such as "When Evening's Twilight," are still reckoned among the best of their class; and he might have gained a place of higher distinction among English composers had it not been for his irresistible animal spirits and a want of artistic reverence, which made it uncertain in his younger days whether, when he appeared at a concert, he would play a fugue of Bach or sing a comic song. He died at Margate, 20th September 1886. (J. A. F. M.)

Hatvan, a market-town of Hungary, in the county of Heves. Being situated at the junction of the railway lines leading from Budapest to the northern and north-eastern parts of the country, it carries on a very lively trade. Its industry is considerable, its sugar factory affording employment to about 500 workmen, and producing 60,000 metric centners of refined sugar a year. Population (1900), 9707.

Haubourdin, a town in the arrondissement of Lille, department of Nord, France, 4 miles south-west of Lille by rail, situated on the canalized Haute Deûle, and commanded by a fort and a battery. Public buildings of interest include the fine castle of Beaupré, built by the Spaniards in the 16th century; a hospital of the 15th century, and the chapel of the Crépins, built in 1347. The principal industries are starch and glucose, textile fabrics, oil and oil-cake, distilling, potash-refining, and dyeing. Port traffic (1900), 70,835 tons. Population (1876), 5115; (1901), 8485.

Haugesund, a seaport town of Norway, county of Stavanger, on the west coast, 34 miles north by west of Stavanger, an important fishing centre. Herrings are exported to the annual value of £100,000 to £200,000, also mackerel and lobsters. The total trade was valued at £460,250 in 1900. The Vigsnäs iron-mines were closed in 1896. The principal imports are coal and salt. There are factories for woollen goods and a margarine factory. Haugesund is the reputed death-place of Harold Haarfager, to whom an obelisk of red granite (45 feet high) was erected in 1872, 1¼ miles north of the town. Population (1875), 4102; (1900), 7935.

Hausa, sometimes incorrectly written Haussa, Houssa, or Haoussa, a numerous and important people inhabiting about half a million square miles in the western and central Sudan. Their country, roughly speaking, extends from 8° N. to 14° N., and from 4° E. to 11° E. By the terms of a proclamation dated 1st January 1901 a British protectorate was declared over the whole of this immense territory, including also the province of Bornu, which borders on Lake Chad. Since then British officers in charge of Hausa troops have had frequent fights with the slave-raiders of the interior. A considerable time must, however, elapse before slave-raiding can be extinguished and the protectorate be rendered effective. The Hausa people are believed to number altogether fifteen millions. They are quite distinct from all the tribes by whom they are surrounded, and in physical development far superior. Though their skin is as black as that of any African native, their lips are not so thick nor their hair so curly as those of the ordinary negro. They excel in physical strength. The average Hausa will carry on his head a load of ninety or a hundred pounds without showing the slightest signs of fatigue during a long day's march. When carrying their own goods it is by no means uncommon for them to take double this weight. Their general look of intelligence cannot but strike the traveller as he meets with them in their capacity of traders in all the surrounding districts. Their food consists chiefly of guinea corn (*sorghum vulgare*), which is ground up and eaten as a sort of porridge mixed with large quantities of red pepper. The Hausas attribute their superiority in strength to the fact that they live on guinea corn instead of yams and bananas, which form the staple food of the tribes on the river Niger. The Hausas carry on agriculture chiefly by slave labour; they are themselves born traders, and as such are to be met with in almost every part of Africa north of the equator. Small colonies of them are to be found in towns as far distant from one another as Lagos, Tunis, Tripoli, Alexandria, and Suakin.

The chief articles of trade are cloth, salt, kola nuts, ivory, leather, and spices. The centre of the cloth manufacture is the town of Kano, which has a population of at least 100,000, and the market-place of which has an average daily attendance of from 20,000 to 25,000. The cloth is made of cotton grown in the country, woven on small handlooms, and dyed either with indigo or with a scarlet dye obtained from the bark of a tree. If the Hausa history, which now exists in written form, be correct, the manufacture of this cloth has been carried on in Kano for 950 years. Kano and the district around it clothes half the population of the Sudan. The kola nut, which is chewed by almost every native of Hausaland, is brought from the country which lies at the back of the Gold Coast Colony. In taste it is almost as bitter as quinine. It takes the place of any other stimulant, and by keeping off the pangs of hunger enables the Hausas to work for a long time without food. The Hausas, though not a military race at all, nevertheless make exceedingly good soldiers when drilled and led by European officers. Their value was discovered in the first Ashanti war, and by the year 1902 there were over 5000 employed either as soldiers or police on the west coast or on the river Niger. They have been employed by the French as far away as in Madagascar.

Government.—Hausaland consists of a large number of nearly independent states owing a nominal allegiance to the sultan of Sokoto. The various kings are for the most part uncontrolled despots. The tribute which is paid by the smaller towns to the larger, and by the larger to Sokoto, consists almost entirely of slaves. In order to obtain the required number, which in the case of a large town comes to several thousands, the more powerful kings are constantly engaged in raiding the less powerful. In the Kano market there are usually not less than 500 slaves on sale. Most of the kings and of the ruling class are not Hausas, but belong to a tribe variously called Fulah, Fulani, Fulbe, or Fullatah. Whilst the Hausas are a quiet commercial people, the Fulahs are a race of soldiers and rulers. They have been the ruling class in Hausaland for about two centuries. They were in former time a race of herdsmen, and practically all the cattle in the country round belong to them. They are responsible for most of the slave raiding. At least a third of the inhabitants of the country are in a state of slavery.

The *language* is the lingua franca over practically all Africa north of the equator and west of the valley of the Nile. It is a rich sonorous language, with a vocabulary containing perhaps 10,000 words. About a third of the words which the language contains are connected with Arabic roots, nor are these words which the Hausas could well have borrowed in anything like recent times from the Arabs. Many words representing ideas or things with which the Hausas must have been familiar from the very earliest time are obviously connected with Arabic or Semitic roots. There is a certain amount of resemblance between the Hausa language and that spoken by the Berbers to the south of Tripoli and Tunis. This language, again, has several striking points of resemblance with Coptic. If, as seems likely, it should prove possible in the future to demonstrate the connexion between these three languages, such connexion would serve to corroborate the Hausa tradition that their ancestors came from the very far east away beyond Mecca. The Hausa language has been reduced to writing for at least a century, possibly for very much longer. It is the only language in tropical Africa which has been reduced to writing by the natives themselves, the character used being a modified form of Arabic. Some fragments of literature exist, consisting of political and religious poems, together with a limited amount of native history. A volume, consisting of history and poems reproduced in facsimile, with translations, has been published by the Cambridge University Press.

Religion.—About one-third of the people are professed Mahommedans, one-third are heathen, and the remainder have apparently no definite form of religion. Mahommedanism as a dominant power only dates from the beginning of the 19th century. In 1802 the Mahommedan Fulah sheik Othman proclaimed a sort of religious war, and after suffering many defeats, at length succeeded in establishing himself at Sokoto as ruler over the greater part of the Hausa states. Ever since then the ruler of Sokoto has been acknowledged as the religious head of the whole country, and tribute has been paid to him as such. The Hausas who profess Mahommedanism are extremely ignorant of their own faith, and what little religious fanaticism exists is chiefly confined to the Fulahs. Large numbers of the Hausas start every year on the pilgrimage to Mecca, travelling sometimes across the Sahara desert and by way of Tripoli and Alexandria, sometimes by way of Wadai, Darfur, Khartum, and Suakin. The journey often occupies five or six years, and is undertaken quite as much from trading as from religious motives. Mahommedanism is making very slow, if any, progress amongst the Hausa people. The greatest obstacle to its general acceptance is the institution of the Ramadan fast. In a climate so hot as that of Hausaland, the obligation to abstain from food and drink from sunrise to sunset during one month in the year is a serious difficulty. No important attempt had, up to 1902, been made to introduce Christianity, but the fact that the Hausas are fond of reading, and that native schools exist in all parts of the country, should greatly facilitate the work of Christian missionaries.

The greater part of Hausaland consists of thinly wooded country, with towns and villages scattered at frequent intervals. Every village is fortified in order to resist sudden attack from slave raiders. The largest towns are Kano, Yakoba (often called Garim Bauchi), Zaria, Katsena, Zinder, Gando, and Sokoto. The last two are of no great size, but are regarded as the centres of the whole country from a religious and political point of view. The country rises very slowly from the coast. Three hundred miles inland, at Lokoja, it is about 280 feet above the sea. The level of Kano, which is about 750 miles inland, is 1425 feet. One of the highest towns is Kachia, which is 2440 feet above the sea. It lies on a range of hills which attain an altitude of about 3800 feet, running from east to west at about 10° N. The rivers are small, and many of them cease running during the dry season, which lasts from December to June or July. During the wet season the grass, except in the densest parts of the forest land, grows to a height of about ten feet, but dies down entirely when the dry season begins. In the southern part of the country baggage animals are not available, except to a limited extent during the dry season. In the northern part horses, donkeys, and mules are used, and in the extreme north camels. There are no roads other than narrow paths about a foot wide. Hills similar in shape to the Table Mountain at Cape Town are a feature of the country. On the hilly country round Kachia are found several pagan tribes who wear no clothes and whose bodies are covered with hair. These were probably the original inhabitants of the Hausa country, and were driven by the Hausa people into the hills on their advance from the north, which, according to their tradition, occurred 950 years ago. The climate is very trying to the European, though it is perhaps slightly better than that of the river Niger and the West Coast. The natives do not suffer to any extent from fever unless they move from one part of the country to another at some distance from their own home. Leprosy is very common, especially in the inland towns. The chief currency of the country, except when slaves are used, consists of cowry shells, the average value of which is about the two-hundredth part of a penny.

Authorities.—Barth. *Travels in North and Central Africa*, 2 vols. London, 1857; *Central-Africanische Vokabularien*. Gotha, 1867.—Robinson. *Hausaland, or Fifteen Hundred Miles through the Central Soudan*, 1896; *Specimens of Hausa Literature*, 1896; *Hausa Grammar*, 1897; *Hausa Dictionary*. 1899.—Monteuil, *St Louis à Tripoli par le Tchad*, 1895. (C. H. R.)

Haussmann, Georges Eugène, Baron (1809–1891), the famous aedile of modern Paris, was the son of Nicolas Valentin Haussmann, a publicist and statistician, who rose in the public service under Louis Philippe. This Nicolas Valentin was the son of Nicolas Haussmann (1761–1846), an Alsatian who established himself at Versailles as a linen-draper and became one of the commissaries of the Convention in 1793, and the nephew of Jean Michel Haussmann (1749–1824), a distinguished chemist of Colmar who inaugurated an important chintz manufactory at Rouen and did much to advance the colour printing of textiles in Normandy. Born in Paris 27th March 1809, Georges Eugène first studied for the profession of a vocalist at the Conservatoire, but then entered a notary's office and qualified for the bar with a view to some administrative office. His advancement was accelerated by that of Louis Napoleon, and by 1851 he had risen to be Prefect of the Gironde. In 1852 Louis Napoleon visited Bordeaux, and was greatly struck by the adroitness with which the prefect had organized the demonstrations in his honour. In intercourse with Haussmann he was still further impressed by his grandiose

schemes for municipal improvements. In the following year he sent for him to Paris and made him Prefect of the Seine. With the aid of a very able engineer named Alphand, Haussmann in the course of the next twelve years completely transformed the ground plan of intramural Paris. It is not possible to do more than barely indicate a few of his most daring conceptions. In the forefront of these stand the design of the Place du Carrousel, the junction of the Louvre and the Tuileries by means of two monumental galleries, the building of the Halles Centrales, of a number of pretentious churches, and of a group of theatres, including the Nouvel Opéra. Passing by the external boulevards, which were almost entirely of his planning, he designed the Boulevards Strasbourg, Sébastopol, Malesherbes, and St Michel, besides improving and greatly enlarging the Boulevard St Germain. Even more striking still, perhaps, is the series of arterial streets which he cut through the tortuous thoroughfares of central Paris. Such were the Rue de Rivoli, the Rue La Fayette, the Rue de Rennes, the Rue Bonaparte, and the Rue des Écoles, in the construction of which the Donjon de St Jean de Latran was destroyed. The present Hôtel Dieu is merely one of the structures which he entirely rebuilt. His reforming zeal was directed with equal energy to the drainage, the water supply, the cemeteries, and the plantations of Paris. Among the metropolitan parks, for the present arrangement and dimensions of which he was mainly responsible, are the Bois de Vincennes, the Parc Monceau, the Parc Montsouris, the Buttes Chaumont, and the Bois de Boulogne, which he extended to the Seine in 1854. The Champs Élysées in its present form, and the avenues which radiate from the Arc de Triomphe, owe much to the hand of the same master designer; and the present Hôtel Carnavalet with its collections is due primarily to his initiative. To finance these stupendous schemes the municipality of Paris effected loans of between one and two million francs annually. Haussmann carried matters with a high hand, and assured the Parisians that the investment was a profitable one—nor has his prediction been altogether falsified. On the other hand, speculation in land was stimulated to an unwholesome degree, rents were enormously inflated, and malpractices of various kinds are said to have been prevalent. Great bitterness was caused by the transplantation of poor families and by encroachments upon certain outlying portions of the Luxembourg gardens, while no little political capital was made out of the multiplication of wide avenues, unsuitable for the erection of barricades, but admirably fitted for the operations of artillery.

Under the effective burlesque title of *Contes Fantastiques de Haussmann* a scathing attack was made upon Haussmann's methods in 1868 in a mordant pamphlet by Jules Ferry. Similar attacks were made in other quarters, and received semi-official sanction from the Cour des Comptes (Board of Audit), which in a special report described some of Haussmann's expedients as ingenious rather than strictly legal. He retained the confidence of the Emperor, but this availed less in 1869 than in 1853. He had to bend to the storm by submitting the Paris budget to the Chamber. Ollivier's attempt to liberalize the Government involved his fall on 2nd January 1870. He had been made a Senator (1857), Grand Cross of the Legion of Honour (1862), and Member of the Academy of Fine Arts (1867). Napoleon wished to retain his services, and offered him, it was rumoured, the title of Duc de Paris. He preferred a complete retirement at Nice on a small annual pension of 6000 francs. Subsequently he made several attempts to re-enter politics, and managed to secure a seat in the Chamber as Bonapartist deputy for Ajaccio from 1877 to 1881. He died at Paris on 11th January 1891, surviving by only a few weeks his wife, and leaving issue one daughter, wife of M. Camille Dollfus. He is commemorated in Paris street terminology by the Boulevard Haussmann, a name which the Municipal Council very nearly succeeded in altering in 1879; but Haussmann's real monument is modern Paris, of which he inaugurated, as was said, a new Stone Age. Old landmarks disappeared as if by magic under the stroke of his crayon, and new structures sprang up like the palaces of an Arabian tale. As Louis XIV. set the fashion to palace-builders with Versailles, so Haussmann, by the creation of a new Paris, excited to emulation the shapers of cities, and "to Haussmannize" has come to mean the substitution of monotonous avenues and rectilinear spaces for the crooked ways and irregular boundaries dear to the archæologist and the historian. To form any adequate conception of the extent of Haussmann's activities in these directions it is necessary to go through his somewhat dull *Mémoires* (1893), the third (and posthumous) volume of which bears the well-deserved sub-title, *Grands Travaux de Paris*. (T. SE)

Hautmont, a town in the arrondissement of Avesnes, department of Nord, France, 44 miles in direct line south-east of Lille; a junction on the railway from Paris to Brussels, and on the Sambre. There are very important forges, foundries, and iron-rolling mills, and various kinds of iron goods are extensively produced. Population, 10,000.

Havana, the capital of Cuba, the largest city of the West Indies, situated on the north coast of the island. The bay is capacious and land-locked, and on the town side is sea-walled and lined by handsome parks. At the southern end of the bay, at the old fort of Atares, the American Crittenden and others of the insurrectionary expedition of 1851 were shot. Regla, on the east side of the bay, contains the sugar-shipping wharves and the terminus of the railways leading to the eastern end of the island; it is connected with Havana by large ferry-boats. The older main portion of the city is on a low plain, once enclosed by a mediæval wall. It occupies a septagonal peninsula lying between the river Almendaris on the west, the sea on the north, and Havana harbour on the east. On the south and west it is backed by an amphitheatre of hills, 150 feet high, crowned by the conspicuous fortifications of Castillo de Principe. The principal business streets, Calle Obispo and Calle O'Reilly, are narrow and closely built. Elsewhere wider avenues are found. There are many beautiful parks and drives, including the fine avenue known as the Prado. There are also many suburban pleasure resorts, and pretty villages such as Guines, Guanabacoa, Marianao, and Puentes Grandes. Throughout the city, and especially the more modern portion, there are many elaborate structures. The Havanese boast that the Teatro Taçon is the largest theatre in the world. Other notable buildings are the markets, the opera-house, the captain-general's palace, the hospitals, the university, the city prison, several churches (including the cathedral), and many club-houses. The many immense cigar factories are by no means unattractive features. Some of the houses of the wealthy, scattered throughout the city, are very handsome. They have always an inner courtyard, or *patio*, surrounded by tall stuccoed columns and ornamented with plants around a central fountain. The large industrial population lives mostly in densely crowded houses. The principal institutions of learning are the University of Havana and the large Jesuit College de Belen for boys. The latter has a museum and an observatory, where most

of the important astronomical and climatological data concerning Cuba have been collected; its library is especially rich in old volumes pertaining to Cuban life from the 16th century to the present. Among the numerous benevolent institutions are the Casa de Beneficencia, founded by Las Casas as an asylum for infants and the aged; hospitals for the sick of all classes, and an immense lazaretto for lepers in the western part of the city. A hospital for the insane is maintained a few miles south of Havana. Until recently the city was badly supplied with water, and its sewerage is still abominable. In 1895 a modern system of waterworks was installed by New York engineers, who also prepared plans for the solution of the sewerage problem. The city is well policed. Street railways radiate in several directions from the Paseo. The tramcars are worked by electricity. An extensive system of railways radiates from Havana, extending east to Santa Clara, west to Pinar del Rio, and south to Batabano and Cienfuegos. Coasting vessels from Havana ply round the island, and lines of steamers afford close connexion with the United States. Many European lines also sail to the city. The chief industry is the manufacture of tobacco. There are also manufactories of sweetmeats, candles, carriages, soap, perfumery, and glycerine, and breweries, rum distilleries, tanneries, and gas works. Havana commands the wholesale trade of all the western half of Cuba, including the provinces of Matanzas, Havana, and Pinar del Rio, and is the headquarters of all the commercial and banking interests of the island. The foreign and coastal shipping trade is extensive, the American tonnage alone amounting to 1,000,000 per annum. About 1200 ocean vessels, steam and sail, annually clear from Havana, while the sugar crop finds an outlet at all the principal ports. Population (1899), 235,981. (See CUBA.)

(R. T. H.)

Havel, a river of Prussia, having its origin in Lake Dambeck (223 feet) on the Mecklenburg high grounds, a few miles north-west of Neu-Strelitz, and after threading several lakes flowing south as far as Spandau. Thence it curves south-west, west, and north-west past Potsdam and Brandenburg, traversing another chain of lakes, and finally continues north-west until it joins the Elbe from the right some miles above Wittenberge after a total course of 221 miles and a total fall of only 158 feet. Its banks are mostly marshy or sandy, and the stream is navigable from the Mecklenburg lakes downwards. Several canals connect it with these lakes, as well as with other rivers—*e.g.*, the Finow canal with the Oder, the Ruppin canal with the Rhin, the Berlin–Spandau navigable canal (5½ miles) with the Spree, and the Plaue–Ihle canal with the Elbe. The Sakrow–Paretz canal, 11 miles long, cuts off the deep bend at Potsdam. The most notable of the tributaries is the Spree (227 miles long), which bisects Berlin and joins the Havel at Spandau. Area of river basin, 10,159 square miles.

Haverfordwest, a municipal and county borough (with its own lord-lieutenant), market-town, and railway station, Pembrokeshire, Wales, 63 miles west by north of Swansea. Since 1885 it has united with Pembroke, Fishguard, Milford, Narberth, Tenby, and Wiston to return one member to Parliament. The old grammar-school has been provided with new buildings, a temperance hall erected, and a high-class school for girls established. There are a shire hall, Masonic hall, two market buildings, a reading-room, and an infirmary. The charities belonging to the borough are considerable. Area, 1382 acres. Population (1881), 6398; (1901), 6007.

Haverhill, a city of Essex county, Massachusetts, U.S.A., in 42° 47′ N., 71° 40′ W., on the Merrimack at the head of tide, and on the Boston and Maine Railway. Its area of 28 square miles is divided into seven wards; its plan is irregular; it has a good water-supply, pumped from neighbouring lakes; it is sewered, and the streets are paved, mainly with macadam. It is essentially a manufacturing city. In 1890 its manufacturing establishments numbered 734, with an invested capital of $8,084,272; 15,200 hands were employed, and the product was valued at $25,394,535. Of this not less than four-fifths consisted of boots and shoes. The assessed valuation of real and personal property in 1900 was $26,443,933, the net debt was $1,486,522, and the rate of taxation was $17·40 per $1000. Population (1880), 18,472; (1890), 27,412; (1900), 37,175, of whom 8530 were foreign-born, and 373 were negroes. The death-rate in 1900 was 15·1.

Haverstraw, a village of Rockland county, New York, U.S.A., in 41° 03′ N. and 73° 58′ W., on the west shore of Haverstraw Bay, an enlargement of the Hudson. It is on three railways—the New York, Ontario, and Western, the New Jersey and New York, and the West Shore. Its chief industry is brickmaking. Population (1880), 3506; (1890), 5070; (1900), 5935.

Havre, Le, a town and seaport of France, on the English Channel at the mouth of the Seine, department of Seine-Inférieure, 142 miles from Paris by rail, with a population in 1886 of 109,199, in 1896 of 117,009, and in 1901 of 129,044. Its trade has been estimated at one-fifth or one-sixth of that of all France. The annual movement of the port amounts to nearly 13,000 ships, approaching 6,000,000 tons, and producing more than £3,200,000 duty at the custom-house. In 1899, 6348 vessels entered the port and 6414 cleared, with a total of 5,837,997 tons; the value of exports reached £37,024,000, that of imports, £39,208,000. Fifty-one yachts, eleven of over 100 tons, belong to the port.

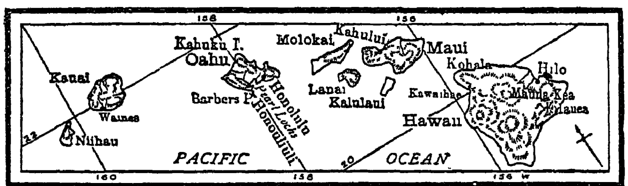
Le Havre owes its prosperity mainly to its advantageous situation. At each tide the water level does not vary more than 1 foot for three hours, thus permitting vessels to enter and clear freely during that interval. The appliances and resources of the port are constantly being improved. It now includes 9 wet docks, with an area of nearly 200 acres, and more than 8 miles of quays. The great transatlantic packet-boats berth in the Eure basin, into which the Tancarville canal (15½ miles long) enters, permitting river boats which could not attempt the estuary of the Seine to make the port direct. It is also between the same basin and the canal that the three dry docks (460, 500, and 600 feet long respectively, and from 65 to 130 feet wide) for the accommodation of large vessels are situated. There is a petroleum dock for the sole use of vessels carrying this dangerous commodity. The fortifications on the southern sea-front will be done away with, and on the west of the present jetties an area of about 120 acres will be surrounded by new piers and added to the present outer port. The channel directed towards the west will be equally accessible from the south-west and west-north-west. It will be excavated 15 feet below the zero level of the charts. The direction adopted will, as far as possible, remove the entrance to the port from the sand deposits in the bay of the Seine. The lock leading from the outer port into the Eure basin will have its flood-gate 13 feet below the zero level of the charts, and will allow large vessels to pass for six hours every tide. In the outer port itself the depth alongside the quay accessible to railway trains is to be deepened for a length of 1300 feet, so that the great transatlantic liners can regularly lie under conditions which will permit of their leaving at fixed hours.

The embellishment of the town corresponds with these improvements to the port. The boulevards which have replaced the ancient ramparts are lined with fine buildings. To the Hôtel de Ville and Palais de Justice, of comparatively recent date, is now added the Bourse. Among the large manufactories those producing war material have increased greatly in importance—founding cannon, and building gun-carriages and warships as well as merchant vessels. To these may be added a refinery

of argentiferous lead, a sugar refinery, petroleum, oil, soap, rice, and nickel works, a copper wire-drawing mill, and a manufactory of dye-stuffs. Important electrical works furnish the town with light and its trams with motive power. Le Havre also builds electric motors. Its *entrepôt* for tobacco leaf is the most important in France. England, Germany, and the United States of America are the countries with which the city holds most intercourse. There is weekly communication between Le Havre and New York by the magnificent steamships of the Compagnie Transatlantique Française.

Hawaiian or Sandwich Islands.—The treaty of commercial reciprocity with the United States, which took effect in 1876, has been justly called the most important event in Hawaiian history since 1843. It ushered in an era of unexampled prosperity, and set in motion a series of momentous changes. In the early part of Kalakaua's reign (1874–91) a political struggle began which culminated in the overthrow of the monarchy. It had been the aim of Kamehameha III. and his advisers to combine the native and the foreign elements under one government; to make the king the sovereign not of one race or class, but of all; and to extend equal and impartial laws over all inhabitants of the country. Kalakaua, however, seemed to regard himself as merely sovereign of the aboriginal Hawaiians, and residents of European or American descent as alien invaders. It appeared to be his chief aim to restore, to a great extent, the ancient system of personal government, under which he should have control of the public treasury. Thus he took it upon himself, on the 2nd of July

History.



G. V Darbishire & O J R Howarth *Engl Miles* 0 50 100 *Oxford, 1901.*

SKETCH MAP OF THE HAWAIIAN ISLANDS.

1878, and again on the 14th of August 1880, to dismiss a ministry without assigning any reason, after it had been triumphantly sustained by a test vote of the legislature. On the latter occasion he appointed Mr C. C. Moreno, who had come to Honolulu in the interest of a Chinese steamship company, as Premier and Minister of Foreign Affairs. This called forth the protest of the representatives of Great Britain, France, and the United States, and aroused such opposition on the part of both the foreigners and the better class of natives, that the king was obliged, after four days of popular excitement, to remove the obnoxious minister. On the 20th of January 1881 the king set out upon a tour around the world. He was received with royal honours in Japan, Siam, and Johore, and he then crossed British India by rail and visited the Khedive of Egypt. The royal party visited nearly all the capitals of Europe, and returned by way of Washington, arriving in Honolulu on the 29th of October 1881. During his absence his sister, Mrs Lydia Dominis, also styled Liliuokalani, acted as regent.

After the king's return the contest was renewed between the so-called National party, which favoured absolutism, and the Reform party, which sought to establish parliamentary government. The king took an active part in the elections, and also used his patronage to the utmost to influence legislation. For three successive sessions a majority of the legislature was composed of office-holders, dependent on the favour of the executive. Among the measures urged by the king and opposed by the Reform party were the project of a ten million dollar loan, chiefly for military purposes; the removal of the prohibition of the sale of alcoholic liquor to Hawaiians, which was carried in 1882; the licensing of the sale of opium; the chartering of a lottery company; the licensing of *kahunas*, or medicine men, &c. Systematic efforts were made to turn the constitutional question into a race issue, and the party cry was raised of "Hawaii for Hawaiians." Adroit politicians were not wanting to flatter the king's vanity, defend his follies, and teach him how to violate the spirit of the constitution while keeping the letter of the law. From 1882 till 1887 his prime minister was Walter Murray Gibson, a singular and romantic genius, at once a visionary adventurer and a shrewd politician, who had been imprisoned by the Dutch Government in Batavia in 1852 on a charge of inciting insurrection in Sumatra, and who had arrived at Honolulu in 1861 with the intention of leading a Mormon colony to the East Indies. To exalt his royal dignity, which was lowered by the fact that he was only an elected king, Kalakaua caused himself to be crowned with imposing ceremonies on the ninth anniversary of his election (12th February 1883). He was now no longer satisfied with being merely king of Hawaii, but aspired to what was termed the "Primacy of the Pacific." Accordingly Mr Gibson addressed a protest to the Great Powers, deprecating any further annexation of the islands of the Pacific Ocean, and claiming for Hawaii the exclusive right "to assist them in improving their political and social condition." In pursuance of this policy, two commissioners were sent to the Gilbert Islands in 1883 to prepare the way for a Hawaiian protectorate. On the 23rd of December 1886 Mr J. E. Bush was commissioned as minister plenipotentiary to the king of Samoa, the king of Tonga, and the other independent chiefs of Polynesia. He arrived in Samoa on 3rd January 1887, and remained there six months, during which time he concluded a treaty of alliance with Malietoa, which was ratified by his Government. The *Explorer*, a steamer of 170 tons, which had been employed in the copra trade, was purchased for \$20,000, and refitted as a man-of-war, to form the "nest-egg" of the future Hawaiian navy. She was re-named the *Kaimiloa*, and despatched to Samoa on 17th May 1887 to strengthen the hands of the embassy. As R. L. Stevenson wrote, "The history of the *Kaimiloa* is a story of debauchery, mutiny, and waste of Government property." At length the intrigues of the Hawaiian embassy gave umbrage to the German Government, and it was deemed prudent to recall it to Honolulu in July 1887. Meanwhile a reform league had been formed for the purpose of putting an end to the prevailing misrule and extravagance, and had the support of the volunteer military force known as the "Honolulu Rifles." The king had succeeded in carrying through the legislature of 1886 a Bill providing for an opium licence, as well as a Loan Act, under which a million dollars was borrowed in London. After this he went from one folly to another until his acceptance of two bribes—one of \$75,000 and another of \$80,000 for the assignment of an opium licence—precipitated the revolution of 1887. An immense mass meeting was held on 30th June, from which a committee was sent to the king with specific demands for radical reforms in the methods of administering the government. Overawed by the unanimity of the movement, and finding himself without support, he yielded without a struggle, dismissed his ministry, and signed a new constitution on the 7th of July 1887, revising that of 1864, which was intended to put an end to personal government and to make the cabinet responsible only to the legislature. By its terms office-holders were made ineligible for seats in the

legislature, and no member of the legislature could be appointed to any civil office under the Government during the term for which he had been elected. The members of the Upper House, instead of being appointed by the king for life, were henceforth to be elected for terms of six years by electors possessing a moderate property qualification. The remainder of Kalakaua's reign teemed with intrigues and conspiracies to restore autocratic rule. One of these came to a head on the 30th of July 1889, but the insurrection was promptly suppressed. Seven of the insurgents were killed and a larger number wounded. There can be little doubt that the late king and his sister, who succeeded him, were accessory to this ill-advised outbreak. In order to recruit his failing health, the king visited California in the U.S. cruiser *Charleston* in November 1890. In spite of the best medical attendance he continued to fail, and breathed his last on the 20th of January 1891 in San Francisco. His remains were brought to Honolulu in the *Charleston*, arriving there on the 29th of January, when the decorations for his welcome were suddenly changed into the emblems of mourning. On the same day at noon his sister, the regent, took the oath to maintain the constitution of 1887, and was proclaimed queen, under the title of Liliuokalani.

The history of her short and troubled reign shows that it was her constant purpose to restore autocratic government, and to govern as well as to reign. Passing over minor events, the legislative session of 1892, during which four changes of ministry took place, was protracted to eight months chiefly by her determination to carry through the opium and lottery Bills and to have a cabinet in sympathy with her views in regard to the constitution. Meanwhile she had caused a new constitution to be secretly drawn up, which would practically have transformed the Government from a limited to an absolute monarchy, besides disfranchising a large class of citizens who had voted since 1887. This constitution she undertook to spring upon the country by a *coup d'état*, immediately after proroguing the legislature on the 14th of January 1893. At the critical moment, when her preparations were complete, her ministers shrank from the responsibility of so revolutionary an act, and with difficulty prevailed upon her to postpone the execution of her design. In such undertakings to hesitate is fatal. Again there was an uprising of the conservative part of the community similar to that of 1887. But this time the prevailing opinion condemned all half-way measures, and declared the monarchy to be forfeited by its own act. A third party proposed a regency during the minority of the heir-apparent, Princess Kaiulani, but in her absence this scheme found few supporters. A Committee of Safety was appointed at a public meeting, which proceeded to form a Provisional Government and to reorganize the volunteer military companies, which had been disbanded in 1890. It also called a mass meeting of citizens, which met on the afternoon of the 16th and ratified its action. The U.S. steamer *Boston*, which had unexpectedly arrived from Hilo on the 14th, landed a small force on the evening of the 16th, at the request of the U.S. minister, Mr J. L. Stevens, and a committee of residents, to protect the lives and property of American citizens in case of riot or incendiarism. The next day, the 17th, the Committee of Safety took possession of the Government Building, and issued a proclamation declaring the monarchy to be abrogated, and establishing a Provisional Government, to exist "until terms of union with the United States of America shall have been negotiated and agreed upon." Meanwhile two companies of volunteer troops arrived and occupied the grounds. By the advice of her ministers, and to avoid bloodshed, the queen surrendered under protest, in view of the landing of United States troops, appealing to the Government of the United States to reinstate her in authority. A treaty of annexation was negotiated with the United States during the next month, but it was withdrawn on 9th March 1893 by President Cleveland, who then despatched Mr J. H. Blount of Macon, Georgia, as his special commissioner, to investigate the situation in the Hawaiian Islands. On receiving Mr Blount's report to the effect that the revolution had been accomplished by the aid of the U.S. minister and by the landing of troops from the *Boston*, President Cleveland sent the Hon. A. S. Willis of Kentucky to Honolulu with secret instructions as U.S. minister. Accordingly, Mr Willis, having with much difficulty and delay obtained the queen's promise to grant an amnesty, made a formal demand on the Provisional Government for her reinstatement on the 19th of December 1893. On the 23rd President S. B. Dole, of the Provisional Government, sent a reply to Minister Willis, declining to surrender its authority to the deposed queen. The U.S. Congress declared against any further intervention. On the 30th of May 1894 a convention was held to frame a constitution for the republic of Hawaii, which was proclaimed on the 4th of July following, with S. B. Dole as its first President. Towards the end of the same year a plot was formed to overthrow the republic and to restore the monarchy. A cargo of arms and ammunition from San Francisco was secretly landed at a point near Honolulu, where a company of native royalists were collected 6th January 1895, intending to capture the Government Buildings by surprise that night, with the aid of their allies in the city. A premature encounter with a squad of police alarmed the town and broke up their plans. There were several other skirmishes during the following week, resulting in the capture of the leading conspirators, with most of their followers. The ex-queen, on whose premises a large quantity of arms and ammunition, together with a number of incriminating documents, were found, was arrested and imprisoned for nine months in the former palace. On the 24th of January she formally renounced all claim to the throne and took the oath of allegiance to the republic. The ex-queen and forty-eight others were granted conditional pardons on the 7th of September, and on the following New Year's Day the remaining prisoners were set at liberty.

On the inauguration of President McKinley, in March 1897, negotiations with the United States were resumed, and on the 16th of June a new treaty of annexation was signed at Washington. As its ratification appeared to be uncertain, a joint resolution to the same effect was introduced, which passed the Senate by a vote of 42 to 21 and the House of Representatives by a vote of 209 to 91, and was signed by the President on the 7th of July 1898. The formal transfer of sovereignty took place on 12th August 1898, when the flag of the United States was raised over the Executive Building with impressive ceremonies. The public debt of the republic of Hawaii was assumed by the United States, with a limit of four million dollars. The existing laws of Hawaii were to continue in force until Congress should pass laws organizing the future government of the islands. In 1900 Congress passed an Act, approved by the President 30th April, by which the Territory of Hawaii was organized and a territorial government was established, with its capital at Honolulu. This Act declared all persons who were citizens of the Republic of Hawaii on 12th August 1898 to be citizens of the United States and of the Territory of Hawaii, and provided that the constitution and, except as specially provided, all the laws of the United States not locally

inapplicable should have the same force and effect within the Territory as elsewhere in the United States.

Government. Under this Act the legislature meets biennially, and consists of a Senate of 15 members holding office for four years, and a House of Representatives of 30 members holding office for two years. In order to vote for representatives or senators, the elector must be a male citizen of the United States who has attained the age of twenty-one years, has resided in the Territory not less than one year preceding, and is able to speak, read, and write the English or Hawaiian language. No person is allowed to vote who is in the Territory by reason of being in or attached to the army or navy. The executive power is vested in a governor, appointed by the President and holding office for four years. He must be not less than thirty-five years of age and a citizen of the Territory. The secretary of the Territory is appointed in like manner for the same length of term. The governor appoints, by and with the consent of the Senate of the Territory, an attorney-general, treasurer, commissioner of public lands, commissioner of agriculture and forestry, superintendent of public works, superintendent of public instruction, auditor and deputy auditor, surveyor, high sheriff, members of the board of health, commissioners of public instruction, board of prison inspectors, board of registration, and inspectors of election, &c. All such officers are appointed for four years except the commissioners of public instruction and the members of the said boards, whose terms are as provided by the laws of the Territory; all must be citizens of the Territory. The judicial power of the Territory is vested in one supreme court, circuit courts, and such inferior courts as the legislature may establish. One delegate is elected to the United States House of Representatives, and there is also established a United States district court. The Territory is also constituted an internal-revenue district and a customs district. The Act further provides that no Chinese labourer shall be allowed to enter any state, territory, or district of the United States from the Hawaiian Islands; and the Act of Congress of 26th February 1885, "To prohibit the importation and migration of foreigners and aliens under contract or agreement to perform labour in the United States, its territories, and the District of Columbia," and the amending and supplementing Acts, are extended to Hawaii.

The President appointed Sanford B. Dole Governor of the Territory, and on 14th June 1900 the new territorial government was formally instituted. The first elected legislature met on the 20th February 1901. The majority proved hostile to the Governor, passed a resolution asking the President to remove him, and adjourned without making appropriations. An extra session in May was no more harmonious. Matters went so far that the Governor was brought before a grand jury; but no indictment was found, and the President declined to remove him.

Immigration and Population.—The pressing demand for labour created by the Reciprocity Treaty has led to great changes in the population of the Hawaiian Islands. It has been the policy of the Government to assist immigrants from widely different countries, not only as labourers but also as prospective citizens. In the year 1877 arrangements were made for the importation of Portuguese families from the Azores and Madeira, and during the next ten years about 7000 of these people were brought to the islands. Others have since been added to their number, and their natural increase has been very rapid. In 1900 the total number of Portuguese in the islands, including those born there, was not far from 16,000, about 2400 of whom were employed in sugar plantations. They have shown themselves to be industrious, thrifty, and law-abiding. Persistent efforts have also been made to introduce Polynesian islanders, as being of a cognate race with the Hawaiians, but the results have been wholly unsatisfactory. About 2000 of these people, mainly from the Gilbert Islands, were brought in at the expense of the Government between 1878 and 1884; but they did not give satisfaction either as labourers or as citizens, and most of them have been returned to their homes. There has never existed any treaty or labour convention between the Government of Hawaii and the empire of China. In early days a limited number of Chinese settled in the islands, intermarried with the natives, and by their industry and economy were generally prosperous. About 750 of them were naturalized under the monarchy. The first importation of Chinese labourers into the country took place in 1852. In 1878 the number of Chinese had risen to 5916. During the next few years there was a steady influx of Chinese free immigrants, which finally reached alarming proportions. In the spring of 1881 the Hawaiian Government was obliged to send a dispatch to the Governor of Hong Kong to stop this invasion. Again, in April 1883, it was suddenly renewed, and within twenty days five steamers arrived from Hong Kong bringing 2253 Chinese passengers, followed the next month by 1100 more, with the news that several thousand more were ready to embark. Accordingly the Hawaiian Government sent another dispatch to the Governor of Hong Kong, refusing to admit any further immigration of male Chinese from that port. Various regulations restricting Chinese immigration were enacted from time to time, until in 1886 the landing of any Chinese passenger without a passport was prohibited. The number of Chinese in the islands had then risen to 21,000, and in 1900 they were estimated to be 27,000, of whom 6000 were employed on sugar plantations. The consent of the Japanese Government to the emigration of its subjects to Hawaii was obtained with difficulty in 1884, and in 1886 a labour convention was ratified. Since then the increase of the Japanese element in the population has been constant and rapid. It rose from 116 in 1884 to 12,360 in 1890, and 24,400 in 1896. In 1900 it was 61,111, of whom 26,000 were employed in sugar plantations. They have for the most part been recruited from the lowest classes in Japan. Unlike the Chinese, they show no inclination to intermarry with the Hawaiians. The effect of making Hawaii a territory of the United States was to put an end to all assisted immigration, of whatever race, and to exclude all Chinese labourers. But under the recent treaty between the United States and Japan there is nothing to limit the free immigration of Japanese, and several companies have been formed to promote it. The system of contract labour, which was abolished by Act of Congress in 1900, concerned but a small minority of the labourers other than Japanese. Various methods of co-operation or profit-sharing are in successful operation on some plantations.

The excessive preponderance of males over females in Asiatic immigration constitutes a serious menace to the morals and health of the commonwealth. The decrease of the aboriginal population has still continued, from 44,088 in 1878 to 40,014 in 1884, 34,436 in 1890, and 31,019 in 1896, the rate of decrease being about $1\frac{5}{10}$ per cent. a year. At the same time the part-Hawaiians, the offspring of intermarriage between Hawaiian women and men of other races, have been constantly increasing from 3420 in 1878 to 4218 in 1884, 6186 in 1890, and 8485 in 1896. All these facts point to the gradual extinction of the full-blooded Hawaiians, and the absorption of the remnant of the race by the European and Asiatic population. The scourge of leprosy, which is almost confined to the native Hawaiians, is being gradually extinguished by segregation. The number of cases at the Molokai settlement has been reduced from 1200 to about 900.

The population in 1900 was 154,001, distributed as follows:—Hawaii, 46,843; Kauai and Niihau, 20,734; Maui, 25,416; Molokai and Lanai, 2504; Oahu, 58,504.

Of the total population, 106,369 (69·1 per cent.) were males and 47,632 (30·9 per cent.) females; 63,221 (41·1 per cent.) were native-born and 90,780 (58·9 per cent.) foreign-born; 66,890 (43·4 per cent.) were white and 87,111 (56·6 per cent.) were coloured. Under the heading white are classed 37,656 Hawaiians or part-Hawaiians, 28,819 Caucasians, and 415 South Sea Islanders. The class coloured included 25,767 Chinese, 61,111 Japanese, and 233 persons of negro descent. Of the white population, 54,141 were native-born and 12,749 (8·3 per cent. of total population) foreign-born, largely Portuguese. The number of males of voting age (21 years and over) was 79,607, of whom 13,064 were native-born and 66,543 (83·6 per cent.) were foreign-born, principally Chinese and Japanese; and 60,031 (75·4 per cent.) were coloured, of whom 93 were persons of negro descent and the remainder Chinese and Japanese. Of the total number of males of voting age, 27,363 were illiterate (unable to write), of whom 26,641 were foreign-born and 24,028 were coloured (including 16,723 Japanese, 7276 Chinese, and 29 negroes). The urban population in 1900, classing as such all persons in cities of 8000 inhabitants or over (*i.e.*, in Honolulu), was 39,306, or 25·5 per cent. of the total population—which was exactly the same percentage as in 1890.

Land.—The total area of the inhabited islands slightly exceeds four million acres. The tenure by which these lands were held before 1840 was strictly feudal, having probably been evolved out of a prehistoric communal system. In the great division which took place in 1848, and which forms the foundation of land titles, about one million acres were set apart for the king and his successors, a million and a half acres for the Government, and an equal amount for the several chiefs, while the common people were granted fee simple titles for their house lots and the pieces of land which they had cultivated for themselves. As the chiefs generally ran into debt, and died in many cases without heirs, their lands have largely passed into the hands of foreigners. About half of the original Government land has been sold. The census of 1896 showed that there were at that time 3995 landowners of pure Hawaiian blood out of 31,019 men, women, and children.

At the abolition of the monarchy in 1893 the crown domains were declared to be public lands, and, together with the other Government lands, were turned over to the United States. Taken together, these lands now comprise a million and three-quarter acres, valued at seven and a half million dollars. A carefully-drawn Land Act, embodying many of the provisions of the New Zealand system, was passed in 1895, and was to be continued in force by the Cullom Bill. It was intended to promote the subdivision of the Government land into small holdings for actual settlers, and to discourage mere speculators. The crown lands, which were made by law inalienable in 1865, have hitherto been held for the most part under long leases. As these leases expire from time to time, it is the policy of the Government to break up gradually the large holdings into homesteads, and thus to encourage the growth of an agricultural population.

Commercial Progress.—Under the stimulus of the Reciprocity Treaty, the production of sugar, the principal staple of the islands, had increased twenty-fold in 1897, and in 1900 the value was $19,254,773. In 1900 there were 395 manufacturing establishments, with a total capital of $11,541,655, employing 4587 hands, and producing goods valued at $24,992,068. The total value of the domestic exports of the islands rose from $1,835,382 in 1875 to $22,628,741 in 1899; and the total value of the imports rose from $1,682,471 to $19,059,605·79, including $2,990,000 in specie. The number of vessels employed in the foreign carrying trade in 1898 was 481.

During 1899, 655 merchant vessels (of which 447 were American), with a tonnage of 786,842, entered at the ports of Hawaii. During the same year, 32,725 passengers (of whom 4705 were from San Francisco and 27,073 from China and Japan) arrived at Honolulu, and 9065 passengers departed (of whom 4011 sailed for San Francisco and 4398 to China and Japan). From 1843 to 1900 (14th June) inclusive the imports of Hawaii amounted to $184,278,309 and the exports to $286,483,219. During the year ending 30th June 1901 the imports of Hawaii amounted to $2,835,278 and the exports to $120,211—of course exclusive of commerce with the United States. During the same period the merchandise shipped from Hawaii to the United States amounted to $27,903,058, of which a part, valued at $4,293,009, was carried in American steam vessels, and the balance, valued at $23,610,049, in American sailing vessels.

Public Revenue.—The total revenue for the biennial period rose from $877,791 in 1874–75 to $5,913,720 in 1898–99. This latter amount was derived from the following sources:—Customs, $2,192,604; direct taxation, $1,879,935; postal bureau, $206,563; public lands, $315,256; licences, $333,994; besides sums received from fines and penalties, fees, waterworks, &c. The total expenditure for 1898–99 was, from current receipts, $4,740,005, and from loan fund for public improvements, $756,504. The total national debt, January 1900, was $4,890,351.

Material Improvements.—Under the monarchy much was done for the improvement of the city of Honolulu, but the outlying districts were neglected and the country roads were mere bridle-paths. Among the public improvements executed since 1878 may be mentioned the palace, now styled the Executive Building, erected in 1878–81 at a cost of $350,000; the marine railway, completed in 1882, at a cost of $90,000; and the police station, built in 1885, at a cost of $91,000. Lighthouses were placed at Barber's Point and at the south-west point of Molokai in the same year. Under the republic great attention has been paid to roads, and more has been accomplished in this direction since 1890 than during the entire previous history of the country. The entrance to the harbour of Honolulu was deepened to 30 feet in 1892, and a complete system of sewerage for the city was begun. The United States Congress has set aside $100,000 for deepening the entrance of Pearl Lochs, 7 miles west of Honolulu, which will open for commerce one of the finest harbours in the Pacific Ocean. Private enterprise has done still more to develop the resources of the islands and to improve the communications. The number of inter-island steamers has increased from two to twenty-two, besides twenty inter-island sailing vessels. The first railway built in the islands was the Kahului railway on Maui, which was begun in 1879, and is 15 miles long. The Kohala railway, which was built two years later, is 20 miles long. The Oahu railway, begun in 1888, has been completed from Honolulu around the western and northern sides of the island to Kahuku, a distance of 70 miles. Street tramways run in Honolulu. Each of the four principal islands is now encircled by telephone lines.

Agricultural Progress.—The immense increase in the production of sugar is due not only to the increase of the area planted with cane, but also to the scientific use of fertilizers, to more extensive irrigation, to improved machinery in mills, and to improved processes for the treatment of the juice. In several localities extensive irrigation canals have been constructed, which have brought into cultivation large tracts of land which had formerly lain barren. The first artesian well in the islands was bored at Honouliuli in July 1879, and met with unexpected success. Since then more than two hundred artesian wells have been sunk around the island of Oahu. Many of the plantations are now supplied with water for irrigation by pumping works, drawing their supply from wells. The crop of sugar has risen in some plantations to 10 and even 14 tons per acre, two crops being taken off in about three years. The average annual production for all the islands is about 5 tons per acre. The total number of labourers employed in the sugar plantations is about 40,000. The cultivation of rice, which was begun in 1860 with Carolina seed, has passed entirely into the hands of the Chinese.

The annual production is estimated to be about ten million pounds, most of which is consumed in the islands. The Kona coffee has established a reputation for quality equal to that of any in the world, and readily brings twice the price of the Brazilian product. Its culture is particularly adapted to farmers of moderate means, and tends to promote the multiplication of homesteads and the employment of a better class of labour. In 1898, 733,285 pounds of coffee were exported, valued at $132,347. The bananas exported in 1899 were valued at $84,268. There are many other kinds of fruits, as well as of fibre plants, such as sisal, ramie, &c., which can be successfully cultivated in the islands.

Educational Progress.—Education is universal, compulsory, and free. Every child between the ages of six and fifteen must attend either a public school or a duly authorized private school. Consequently the percentage of illiteracy is extremely low. English is by law the medium of instruction in all schools, both public and private, although other languages may be taught in addition. The schools are in session forty weeks during the year. The school system is essentially American in its text-books and its methods. A normal school has been established at Honolulu, with a practice school attached to it. The Honolulu High School is justly the pride of the department, both for the beauty of its buildings and grounds and the excellence of its work. Industrial training is as yet in its infancy. The Lahainaluna Seminary, founded in 1831, furnishes instruction to Hawaiian boys in agriculture, carpentry, printing, and mechanical drawing. The boys in the Reformatory School are taught useful trades. The teaching of sewing in the public schools has met with great success, and a simple form of the Swedish Sloyd has been introduced into many of the schools. But the best instruction of this kind is furnished by the independent schools, among which the Kamehameha Schools take the first place. They were founded by the late Mrs Bernice Pauahi Bishop, the last lineal descendant of Kamehameha I., who left her extensive landed estate in the hands of trustees for their support. They furnish a good manual and technical training to Hawaiian boys and girls, in addition to a primary and grammar school course of study, and exert a strong religious influence. There are six boarding schools for Hawaiian girls, supported by private resources. The most advanced courses of study are offered by Oahu College, which occupies a beautiful site east of Honolulu. It is well equipped with buildings and apparatus, and has an endowment of about $300,000.

During the biennial period ending 31st December 1899 the expenditure of the Hawaiian Government for the support of public schools was $569,188, of which sum $428,862 was paid for teachers' salaries. The average salary paid to public school teachers is $645 per annum. In 1899 there were 142 Government schools, with 344 teachers and 11,436 pupils; 55 independent schools, with 200 teachers and 4054 pupils, giving a total of 197 schools, with 544 teachers and 15,490 pupils. Of these pupils 5043 were Hawaiian, 2721 part-Hawaiian, 1314 Chinese, 1141 Japanese, 2767 Portuguese, and 2504 other foreigners. In 1900 the number of persons of school age (5 to 20 years inclusive) was 33,774, of whom 8489 (25·1 per cent.) were foreign-born.

Religion.—There are Protestant, Roman Catholic, and Mormon teachers, and recently Buddhist priests have been sent from Japan. The Roman Catholics comprise the bulk of the Portuguese population and about one-third of the natives. Perhaps three-fifths of the Hawaiians, and nearly all of British, American, or Northern European race, are Protestants. There are flourishing Protestant missions among the Portuguese, Chinese, and Japanese. The Mormons claim over 4000 adherents, nearly all native Hawaiians.

AUTHORITIES.—W. ELLIS. *Tour around Hawaii.* London, 1829.—J. J. JARVES. *History of the Sandwich Islands.* Honolulu, 1847.—H. BINGHAM. *A Residence of Twenty-one Years in the Sandwich Islands.* Hartford, 1848.—ISABELLA BIRD. *Six Months in the Sandwich Islands.* New York, 1881.—W. D. ALEXANDER. *A Brief History of the Hawaiian People.* New York, 1899.—W. F. BLACKMAN. *The Making of Hawaii.* New York, 1899.—T. G. THRUM. *Hawaiian Almanac and Annual to Date.*—Hawaiian Historical Society, *Papers and Annual Reports*, 1893–99.

(W. D. A.)

Haweis, Hugh Reginald (1838–1901), English preacher and writer, was born at Egham, Surrey, 3rd April 1838, his father and grandfather having both been clergymen. On leaving Trinity College, Cambridge, he took orders in the Church of England and held various curacies in London, becoming in 1866 incumbent of St James's, Marylebone. His unconventional methods of conducting the service, combined with his dwarfish figure and lively manner, soon attracted crowded congregations, particularly of people who liked a little "sensation." He married Miss M. E. Joy in 1866, and both he and Mrs Haweis (died 1898) contributed largely to periodical literature and travelled a good deal abroad. Mr Haweis was much interested in music, and wrote books on violins and on church bells, besides contributing an article to the 9th edition of the *Encyclopædia Britannica* on bell-ringing. As a lecturer also he was very successful, in America as well as in England. His best-known book was *Music and Morals;* and for a time he was editor of *Cassell's Magazine.* He died on 29th January 1901.

Hawick, a parliamentary burgh (Border group) of Roxburghshire, Scotland, on the Teviot, 53 miles south-south-east of Edinburgh by rail. There are now 20 hosiery factories and 7 tweed merchants, owning several spinning mills. Twelve of the hosiery factories and 9 of the tweed factories each employ several hundred women. About 200 hand-frames for knitting are still in use; iron-founding, engineering, and dyeing are carried on. There are five large nursery gardens. Great lamb, sheep, and cattle sales are held periodically. Recent erections are a cottage hospital, municipal buildings (including a free library), and a new post office; there is also a science and art institute. The academy furnishes both secondary and technical education. Population (1881), 16,184; (1901), 17,303.

Hawkins, Cæsar Henry (1798–1884), British surgeon, son of the Rev. E. Hawkins and grandson of the Sir Cæsar Hawkins who was serjeant-surgeon to Kings George II. and George III., was born 19th September 1798, educated at Christ's Hospital, and entered St George's Hospital, London, in 1818 (M.R.C.S. 1821, F.R.C.S. 1843). He was surgeon to the hospital from 1829 to 1861, and in 1862 was made serjeant-surgeon to Queen Victoria. He was president of the College of Surgeons in 1852, and again in 1861; and he delivered the Hunterian oration in 1849. His success in complex surgical cases gave him a great reputation. For long he was noted as the only surgeon who had succeeded in the operation of ovariotomy in a London hospital. This occurred in 1846, when anæsthetics were unknown. He did much to popularize colotomy. A successful operator, he nevertheless was attached to conservative surgery, and was always more anxious to teach his pupils how to save a limb than how to remove it. He reprinted his contributions to the medical journals in two volumes, 1874, the more valuable papers being on *Tumours, Excision of the Ovum, Hydrophobia and Snake-bites, Stricture of the Colon,* and *The Relative Claims of Sir Charles Bell and Majendie to the Discovery of the Functions of the Spinal Nerves.* He died 20th July 1884. His brother, Edward Hawkins (1789–1882), was the well-known Provost of Oriel, Oxford, who played so great a part in the Tractarian movement.

Hawkshaw, Sir John (1811–1891), English engineer, was born in Yorkshire in 1811. What scholastic education he received was imparted to him at Leeds

Grammar School, but his real education was gained in the school of practical experience. Before he was twenty-one he had been engaged for six or seven years in railway engineering and the construction of roads in his native county, and in the year of his majority he obtained an appointment as engineer to the Bolivar Mining Association in Venezuela. But the climate there was more than his health could stand, and in 1834 he was obliged to return to England. He soon obtained employment under Jesse Hartley at the Liverpool docks, and subsequently was made engineer in charge of the railway and navigation works of the Manchester, Bury, and Bolton Canal Company. In 1845 he became chief engineer to the Manchester and Leeds Railway, and in 1847 to its successor, the Lancashire and Yorkshire Railway, for which he constructed a large number of branch lines. In 1850 he removed to London and began to practise as a consulting engineer, at first alone, but subsequently in partnership with Harrison Hayter. In that capacity his work was of an extremely varied nature, embracing almost every branch of engineering. He retained his connexion with the Lancashire and Yorkshire Company until his retirement from professional work in 1888, and was consulted on all the important engineering points that affected it in that long period. In London he was responsible for the Charing Cross and Cannon Street railways, together with the two bridges which carried them over the Thames; he was engineer of the East London Railway, which passes under the Thames through Brunel's well-known tunnel; and jointly with Sir J. Wolfe Barry he constructed the section of the Underground Railway which completes the "inner circle" between the Aldgate and Mansion House stations. In addition, many railway works claimed his attention in all parts of the world—Germany, Russia, India, Mauritius, &c. One noteworthy point in his railway practice was his advocacy, in opposition to Robert Stephenson, of steeper gradients than had previously been thought desirable or possible, and so far back as 1838 he expressed decided disapproval of the maintenance of the broad gauge on the Great Western, because of the troubles he foresaw it would lead to in connexion with future railway extension, and because he objected in general to breaks of gauge in the lines of a country. The construction of canals was another branch of engineering in which he was actively engaged. In 1862 he became engineer of the Amsterdam ship-canal, and in the succeeding year he may fairly be said to have been the saviour of the Suez Canal. About that time the scheme was in very bad odour, and the Khedive determined to get the opinion of an English engineer as to its practicability, having made up his mind to stop the works if that opinion was unfavourable. Hawkshaw was chosen to make the inquiry, and it was because his report was entirely favourable that M. de Lesseps was able to say at the opening ceremony that to him he owed the canal. As a member of the International Congress which considered the construction of an interoceanic canal across Central America, he thought best of the Nicaraguan route, and privately he regarded the Panama scheme as impracticable at a reasonable cost, although publicly he expressed no opinion on the matter and left the Congress without voting. Sir John Hawkshaw also had a wide experience in constructing harbours (*e.g.*, Holyhead) and docks (*e.g.*, Penarth, the Albert Dock at Hull, and the south dock of the East and West India Docks in London), in river-engineering, in drainage and sewerage, in water-supply, &c. He was engineer, with Sir James Brunlees, of the original Channel Tunnel Company from 1872, but many years previously he had investigated for himself the question of a tunnel under the Strait of Dover from an engineering point of view, and had come to a belief in its feasibility, so far as that could be determined from borings and surveys. Subsequently, however, he became convinced that through railway communication with the Continent would not be to the advantage of Great Britain, and thereafter would have nothing to do with the project. He was also engineer of the Severn Tunnel, which, from its magnitude and the difficulties encountered in its construction, must rank as one of the most notable engineering undertakings of the 19th century. He died at his London residence on 2nd June 1891. (H. M. R.)

Hawksley, Thomas (1807–1893), English engineer, was born on 12th July 1807, at Arnold, near Nottingham. He was at Nottingham Grammar School till the age of fifteen, but was indebted to his private studies for his knowledge of mathematics, chemistry, and geology. In 1822 he was articled to an architect in Nottingham, subsequently becoming a partner in the firm, which also undertook engineering work; and in 1852 he removed to London, where he continued in active practice till he was well past eighty. His work was chiefly concerned with water and gas supply and with main-drainage. Of water-works he used to say that he had constructed 150, and a long list might be drawn up of important towns that owe their water to his skill, including Liverpool, Sheffield, Leicester, Leeds, Derby, Darlington, Oxford, Cambridge, and Northampton in England, and Stockholm, Altona, and Bridgetown (Barbados) in other countries. To his native town of Nottingham he was water engineer for fifty years, and the system he designed for it was noteworthy from the fact that the principle of constant supply was adopted for the first time. The gas-works at Nottingham, and at many other towns for which he provided water supplies, were also constructed by him. He designed main-drainage systems for Birmingham, Worcester, and Windsor, among other places, and in 1857 he was called in, together with Bidder and Bazalgette, to report on the best solution of the vexed question of a main-drainage scheme for London. In 1872 he was president of the Institution of Civil Engineers—an office in which his son succeeded him, in 1901. He died at his residence on Campden Hill, Kensington, on 23rd September 1893.

Haworth, parish and village, in the Keighley division of the West Riding of Yorkshire, England, 10 miles north-west of Bradford, with a station on a branch of the Midland Railway. Since 1894 it has been governed by an urban district council. The Reverend Patrick Brontë was incumbent here for forty-one years, and a memorial near the west window of St Michael's Church bears his name and the names of his gifted daughters upon it. The grave of Charlotte and Emily Brontë is also marked by a brass. In 1895 a museum was opened by the Brontë Society. A cemetery was formed in 1891. Population of the parish and urban district (1901), 7492.

Hay, John (1838– ——), American statesman and author, was born at Salem, Indiana, on the 8th of October 1838. He graduated from Brown University in 1858. Admitted to the bar in Springfield, Illinois, in 1861, he was at once selected by President Lincoln as assistant private secretary, in which capacity he served till the President's death. From 1865 to 1870 Mr Hay filled various posts in the U.S. legations at Paris, Vienna, and Madrid, and later, under President Hayes, he was first assistant Secretary of State (1879–81). In the interval he was for a time an editorial writer on the New York *Tribune*, and he also produced his *Pike County Ballads* (1871) and *Castilian Days* (1871). His most important

literary work was a monumental biography of Lincoln in collaboration with Mr Nicolay, which was published in book form in 1890. Upon the inauguration of President McKinley in 1897, Mr Hay was appointed ambassador to Great Britain, from which post he was transferred in 1898 to that of Secretary of State. Thus it fell to him to direct the peace negotiations with Spain after the war of 1898, and to secure American interests in the imbroglio caused by the Boxers in China. When President McKinley was murdered, and President Roosevelt succeeded, Mr Hay remained in office. It was largely due to his tact and good management, in concert with Lord Pauncefote, the British Ambassador, that negotiations for abrogating the Clayton-Bulwer Treaty and making a new treaty with Great Britain regarding the Isthmian Canal were successfully concluded at the end of 1901.

Haydock, parish and township, in the Newton division of Lancashire, England, 7 miles north-west of Warrington, 3 miles from Newton-in-Makerfield, station on the London and North-Western Railway. Since 1894 it has been governed by an urban district council. The church of St James's was rebuilt in 1891, a handsome Congregational chapel has been erected, and there are a cottage hospital and a large private lunatic asylum. There are extensive coal mines in the district. Population of the urban district (1901), 8575.

Hayes, Rutherford Birchard (1822–1893), nineteenth President of the United States, was born in Delaware, Ohio, 4th October 1822. He received his first education in the common schools, then passed through the ordinary academic course at Kenyon College, and was a student at the law school of Harvard University from 1843 to 1845. He practised law, first at Upper Sandusky and then at Cincinnati, Ohio, where he won a very respectable standing. As a politician he supported the Whig party, but, having always cherished anti-slavery sentiments, he joined the Republican party in 1854. After the breaking out of the Civil War the governor of Ohio, on 7th June 1861, appointed him a major of a volunteer regiment, and in July he was ordered to West Virginia for active service. His military career was uncommonly creditable, and he attained by his meritorious conduct the rank of brevet major-general. While still in the field he was elected a member of Congress, and took his seat in December 1865. He was re-elected in 1866, and supported the reconstruction measures advocated by his party. In 1867 he was elected governor of Ohio, and was re-elected in 1869. In 1873 he transferred his residence from Cincinnati to Fremont, a small town in the northern part of Ohio, his intention being to withdraw from public life; but in 1875 the Republican party in Ohio once more selected him as its candidate for the governorship. He accepted the charge with great reluctance. The opposition party, the Democrats, adopted a platform declaring in favour of indefinitely enlarging the volume of the irredeemable paper currency which the Civil War had left behind it. Hayes stoutly advocated the speediest practicable resumption of specie payments, and carried the election. The "sound-money campaign" in Ohio having attracted the attention of the whole country, Hayes was marked out as a candidate for the Presidency, and he obtained the nomination of the Republican National Convention of 1876. The candidate of the Democratic opposition, Samuel J. Tilden, by his reputation as a statesman and a reformer of uncommon ability drew many Republican votes. An excited controversy having arisen about the result of the balloting in the States of South Carolina, Florida, and Louisiana, to allay a crisis dangerous to public peace the two parties in Congress agreed to pass an Act referring all contested election returns to an extraordinary commission. This commission decided each contest by eight against seven votes in favour of the Republican candidates, and Mr Hayes was accordingly declared duly elected.

During his administration President Hayes devoted his efforts mainly to civil service reform, resumption of specie payments, and the pacification of the States recently in rebellion. In order to win the co-operation of the white people in the South in maintaining peace and order, he put himself in communication with their leaders. He then withdrew the Federal troops which since the Civil War had been stationed at the southern State capitals. An end was thus made of the so-called "carpet-bag governments" conducted by Republican politicians from the North, some of which were very corrupt, and had been upheld mainly by the Federal forces. This policy found much favour with the people generally, but displeased many of the Republican politicians, because it loosened the hold of the Republican party upon the Southern States. Though it did not secure to the negroes sufficient protection in the exercise of their political rights, it did much to extinguish the animosities still existing between the two sections of the Union, and to promote the material prosperity of the South. President Hayes endeavoured in vain to induce Congress to appropriate money for a Civil Service Commission; and whenever he made an effort to restrict the operation of the traditional "spoils system," he met the strenuous opposition of a majority of the most powerful politicians of his party. Nevertheless the system of competitive examinations for appointments was introduced in some of the great executive departments in Washington, and in the custom-house and the post-office in New York. Moreover, he ordered that "no officer should be required or permitted to take part in the management of political organizations, caucuses, conventions, or election campaigns," and that "no assessment for political purposes on officers or subordinates should be allowed"; and he removed from their offices the heads of the post-office in St Louis and of the custom-house in New York—influential party managers—on the ground that they had misused their official positions for partisan ends. While these measures were of limited scope and effect, they served greatly to facilitate the more extensive reform of the civil service which subsequently took place. Although the resumption of specie payments had been provided for to begin at a given time by the Resumption Act of January 1875, opposition to it did not cease. A Bill went through both Houses of Congress providing that a silver dollar should be coined of the weight of 412½ grains, to be full legal tender for all debts and dues, public and private, except where otherwise expressly stipulated in the contract. President Hayes returned this Bill with his veto, but the veto was overruled in both Houses of Congress. Meanwhile, however, the preparations for the return to specie payments were continued by the Administration with unflinching constancy, and on 1st January 1879 specie payments were resumed without difficulty. None of the evils predicted appeared. A marked revival of business and a period of general prosperity ensued. In his annual message of 1st December 1879 President Hayes urged the suspension of the silver coinage and also the withdrawal of United States legal tender notes, but Congress failed to act upon the recommendation. His Administration also did much to ameliorate the condition of the Indian tribes and to arrest the spoliation of the public forest lands.

Although President Hayes was not popular with the professional politicians of his own party, and was exposed to bitter attacks on the part of the Democratic opposition

on account of the cloud which hung over his election, his conduct of public affairs gave much satisfaction to the people generally. In the Presidential election of 1880 the Republican party carried the day after an unusually quiet canvass, a result largely due to popular contentment with the then existing state of public affairs. On 4th March 1881 President Hayes retired to his home at Fremont, Ohio. Various universities and colleges conferred honorary degrees upon him. His remaining years he devoted to active participation in philanthropic enterprises. He died after a short illness, 17th January 1893.

See *Life, Public Services, and Select Speeches of Rutherford B. Hayes*, by JAMES GRAY HOWARD, Cincinnati, 1876. *Life of R. B. Hayes*, by WILLIAM D. HOWELLS, New York, 1876; and by RUSSELL H. CONWELL, Boston, 1876. (C. S.)

Hayti, or SANTO DOMINGO, a West Indian island, comprising the two republics of Hayti and Santo Domingo, or the Dominican Republic. I. THE HAYTI REPUBLIC has an area of about 10,000 square miles, with a population of about 800,000. There are a President and two Chambers, the members of which hold office according to a Constitution dating from 1889. The army numbers about 7000 men, nominally, and the republic owns six third-class cruisers. Owing to the excessive customs duties, caused by the financial difficulties of the republic, coupled with the lack of capital and enterprise, trade has for some years been in a very depressed condition. At the end of 1899 the liabilities of the republic amounted to 19,075,733 dollars gold and 9,372,183 dollars paper (*gourdes*), as compared with a total (gold and paper) of 15,261,557 dollars in 1892. The amount of duties received from exports in 1899 was 2,815,902 dollars gold, as compared with 3,442,114 dollars in 1895; the import duties in the same years amounting in Haytian currency to 2,618,869 dollars and 4,107,989 dollars respectively. Imports were valued at 6,232,335 dollars in 1895, and exports at 13,788,562 dollars. Though showing a decided tendency to decline in 1896, they were about the same in 1897. Owing to the fall of prices in Europe and America, small coffee planters find it almost impossible, with the heavy export duties, to earn a living by this industry, and are beginning instead to raise plantains, yams, bananas, &c. The other chief products are logwood, mahogany, honey, wax, hides, and goatskins. Owing to the depression of trade, imports are confined to bare necessaries — the cheapest sort of dry goods and fancy goods, empty bags, lumber, matches, &c. Flour, salt pork, salt beef, codfish, lard, butter, and similar provisions continue to be imported, but in reduced quantities. Unable to purchase foreign rice, the natives now grow their own supplies. Considerable attention is devoted to the cultivation of tobacco, for which, as well as for sugar-cane, soil and climate are both admirably adapted. Indeed, the country is one of the most fertile in the world, and it is supposed to possess, in addition, valuable deposits of coal, copper, mercury, and other minerals. A railway from Cap-Haïtien to La Grande Rivière (15 miles) was completed in 1900, and a concession has been granted for branch lines to Quanaminte (35 miles) and Limbé (19 miles). In 1900 a further concession was granted for a line from Port-au-Prince to Salt Lake (50 miles). This railway is intended to connect ultimately the capitals of Hayti and the Dominican Republic. The depression in trade rather increased in 1899, but in the spring of 1900 a proposal was brought forward for the consolidation of the debt, the creditors relinquishing the guarantee of a percentage of the revenue collected, and accepting a gold-bearing bond, augmented 10 per cent. in value, with interest at the rate of 1 per cent. in gold per month, and payable in fourteen years, the expectation being that the consequent great revival of trade on the conclusion of this arrangement would enable the Government within that period to meet amply their obligations. Still it is to be feared that the country can be saved from ultimate disaster only by the more direct intervention and guidance of the white man. The religion is nominally Roman Catholic, but the bulk of the black population are becoming more and more demoralized by secret addiction to pagan practices, including Vaudoux worship, the horrid rites of which imply human sacrifice. The chief towns are Port-au-Prince (61,000), Cap-Haïtien (29,000), Les Cayes (25,000), Gonaives (18,000), and Port de Pain (10,000). They are practically stationary as regards all signs of improvement. II. SANTO DOMINGO, OR THE DOMINICAN REPUBLIC, with an area of about 20,000 square miles, has a population of about 500,000. Government is in the hands of a National Congress of 24 Deputies, a President with executive power elected by an electoral college, and an administrative Ministry appointed by the President. For several years this part of the island has been in a very perturbed political condition, and this culminated in July 1899 in the assassination of President Heureaux. The incoming Government found it necessary to demonetize the paper currency, and the inconvenience caused by this measure to the foreign merchants in the country, who are the chief holders of the paper, was but slightly remedied (October 1900) by certain temporary expedients. The revenue in 1898 amounted to 1,550,294 dollars gold. The foreign debt is about £4,350,000, exclusive of arrears of interest, and the internal about 2,850,000 dollars gold and 10,125,000 dollars silver. There is a small army, and the republic owns three small gunboats. The total value of the imports in 1897 was 1,702,568 dollars gold, and of the exports 4,675,939 dollars; and in 1899 the values were 1,669,994 dollars and 4,166,617 dollars. The sugar-cane is being more and more cultivated, there being now eighteen large plantations. Tobacco, coffee, bananas, and cocoa are the other chief products. Large quantities of mahogany, cedar, and satinwood are also exported; and other exports are honey, wax, gums, hides, lignum vitæ, and logwood. There are deposits of iron, gold, copper, salt, and other minerals, but no attempt has been made to exploit them. In 1899 162 vessels of 157,106 tons entered the port of Puerto Plata. Internal communication is mostly of a primitive kind, and there is a lack of good roads. The capital is Santo Domingo, with a population of about 25,000. A railway extends from Sanchez, on the bay of Samaná, to La Vega (62 miles), and further extensions are in progress or projected.

See *Where Black Rules White*, by HESKETH PRICHARD. London, 1900.

Hayward, Abraham (1801–1884), English man of letters, son of Joseph Hayward, of an old Wiltshire family, was born at Wilton, near Salisbury, on 22nd November 1801. After education at Blundell's School, Tiverton, he entered the Inner Temple in 1824, and was called to the bar in June 1832. He took part as a Conservative in the discussions of the London Debating Society, where his opponents were Roebuck and John Stuart Mill. The editorship of the *Law Magazine; or, Quarterly Review of Jurisprudence*, which he held from 1829 to 1844, brought him into connexion with John Austin, G. Cornewall Lewis, and such foreign jurists as Savigny, whose tractate on contemporary legislation and jurisprudence he rendered into English. In 1833 he travelled abroad, and on his return printed privately a

translation of Goethe's *Faust* into English prose (pronounced by Carlyle to be the best version extant in his time). A second and revised edition was published after another visit to Germany in January 1834, in the course of which Hayward met Tieck, Chamisso, De La Motte Fouqué, Varnhagen von Ense, and Madame Goethe. In 1878 he contributed the rather colourless volume on Goethe to Blackwood's Foreign Classics. A successful translation was in those days a first-rate credential for a reviewer, and Hayward began contributing to the *New Monthly*, the *Foreign Quarterly*, the *Quarterly Review*, and the *Edinburgh Review*. His first successes in this new field were won in 1835–36 by articles on Walker's "*Original*" and on "Gastronomy." The essays were reprinted to form one of his best volumes, *The Art of Dining*, in 1852. In February 1835 he was elected to the Athenæum Club under Rule II., and he remained for nearly fifty years one of its most conspicuous and most influential members. He was also a subscriber to the Carlton, but ceased to frequent it when he became a Peelite. At the Temple, Hayward, whose reputation was rapidly growing as a connoisseur not only of a bill of fare but also (as Swift would have said) of a bill of company, gave *recherché* dinners, at which ladies of high rank and elegance appreciated the wit of Sydney Smith and Theodore Hook, the dignity of Lockhart and Lyndhurst, and the oratory of Macaulay. At the Athenæum and in political society he to some extent succeeded to the position of Croker. He and Macaulay were commonly said to be the two best-read men in town. Hayward got up every important subject of discussion immediately it came into prominence, and concentrated his information in such a way that he habitually had the last word to say on a topic. When Rogers died, or when *Vanity Fair* was published, when the *Greville Memoirs* was issued, or a revolution occurred on the Continent, Hayward, whose memory was as retentive as his power of accumulating documentary evidence was exhaustive, wrote an elaborate essay on the subject for the *Quarterly* or the *Edinburgh*. He followed up his paper by giving his acquaintances no rest until they either assimilated or undertook to combat his views. Political ladies first, and statesmen afterwards, came to recognize the advantage of obtaining Hayward's good opinion. In this way the "old rèviewing hand" became an acknowledged link between Society, letters, and politics. As a professional man he was less successful; his promotion to be Q.C. in 1845 excited a storm of opposition, and, disgusted at not being elected a Bencher of his Inn in the usual course, Hayward virtually withdrew from legal practice. In February 1848 he became one of the chief leader-writers for the Peelite organ, the *Morning Chronicle*. The morbid activity of his memory, however, continued to make him many enemies. He alienated Disraeli by tracing a purple patch in his official eulogy of Wellington to a newspaper translation from Thiers's funeral panegyric on General St Cyr. His sharp tongue made an enemy of Roebuck, and he disgusted the friends of Mill by the stories he raked up for an obituary notice of the great economist (*The Times*, 10th May 1873). He broke with Henry Reeve in 1874 by a venomous review of the *Greville Memoirs*, in which Reeve was compared to the beggarly Scot deputed to let off the blunderbuss which Bolingbroke (Greville) had charged. His enemies prevented him from enjoying a well-selected *quasi*-sinecure, which both Palmerston and Aberdeen admitted to be his due. Warren attacked him (very unjustly, for Hayward was anything but a parasite) as Venom Tuft in *Ten Thousand a Year*; and Disraeli aimed at him partially in Ste Barbe (in *Endymion*), though the satire here was directed primarily against Thackeray. After his break with Reeve, Hayward devoted himself more exclusively to the *Quarterly*. His essays on Chesterfield and Selwyn were reprinted in 1854. Collective editions of his articles appeared in volume form in 1858, 1873, and 1874, and *Selected Essays* in two volumes, 1878. In his useful but far from flawless edition of the *Autobiography, Letters, and Literary Remains of Mrs* (*Thrale*) *Piozzi* (1861), he again appears as a supplementer and continuator of J. W. Croker. His *Eminent Statesmen and Writers* (1880) commemorates to a large extent personal friendships with such men as Dumas, Cavour, and Thiers, whom he knew intimately. As a counsellor of great ladies and of politicians, to whom he held forth with a sense of all-round responsibility surpassing that of a cabinet minister, Hayward retained his influence to the last years of his life. But he had little sympathy with modern ideas. He used to say that he had outlived every one that he could really look up to. He died, a bachelor, in his rooms at 8 St James's Street (a small museum of autograph portraits and reviewing trophies) on 2nd February 1884.

Two volumes of Hayward's *Correspondence* (edited by H. E. Carlisle) were published in 1886. In *Vanity Fair* (27th November 1875) he may be seen as he appeared in later life. (T. SE)

Hazara, a district of British India, in the Peshawar division of the Punjab, with an area of 2991 square miles. The population in 1881 was 407,075, and in 1891 was 516,288, giving an average density of 173 persons per square mile; in 1901 it was 710,668, showing an increase of 38 per cent. The land revenue and rates were Rs.2,90,495, the incidence of assessment being R.0–4–5 per acre; the cultivated area in 1896–97 was 419,540 acres, of which 55,674 were irrigated, mainly from private canals; the number of police was 487; the number of schools in 1896–97 was 458, with 8086 pupils, the proportion of boys at school to the male population of school-going age being 7·8 per cent.; the registered death-rate in 1897 was 23·30 per 1000. There are no railways, navigable rivers, or government canals in the district, and only 44 miles of metalled roads. There is one printing-press.

Hazaribagh, a town and district of British India, in the Chota Nagpur division of Bengal. Population (1881), 15,306; (1891), 16,672. There are a government high school, with 175 pupils in 1896–97, a central jail, with a daily average of 932 convicts, and a reformatory school, with 342 boys. It has ceased to be a military cantonment since the European penitentiary was abolished. Dublin University Mission maintains an English high school, with 139 boys. The DISTRICT comprises an area of 7021 square miles, with a population in 1881 of 1,104,742, and in 1891 of 1,164,315, giving an average density of 166 persons per square mile. Classified according to religion, Hindus numbered 960,187; Mahommedans, 114,773; aborigines, 87,866; Christians, 889, of whom 223 were Europeans; Jains, 600. In 1901 the population was 1,178,301, showing an increase of 1 per cent. The land revenue and rates were Rs.1,76,877; the number of police was 493; boys at school in 1896–97 numbered 14,252, being 16·7 per cent. of the male population of school-going age; the registered death-rate in 1897 was 48·12 per 1000, this great mortality being due to drought and high prices of grain. The district contains an important coalfield at Karharbari, which supplies the East Indian Railway. There are altogether six mines, employing 10,000 persons, with an out-turn of about 650,000 tons a year. There are also ten mica mines, which are gaining in importance, with an annual out-turn of 10,000 maunds, valued at Rs.1,74,000. Tea cultivation does not flourish. For 1897 four gardens

furnished returns, with 611 acres under tea, producing 36,200 lb. The only railway is the branch of the East Indian to the coalfield at Giridhi, where there is a technical school maintained by the railway company; but the district is traversed by the Grand Trunk Road.

Hazleton, a city of Luzerne county, Pennsylvania, U.S.A., in 40° 57′ N. and 75° 58′ W., on Hazle Creek and on the Lehigh Valley Railway. It is in a level valley, and its plan is regular. It is situated within the anthracite coal district, and its industries are largely connected with coal-mining. Population (1880), 6935; (1890), 11,872; (1900), 14,230, of whom 2732 were foreign-born.

Heanor, a parish and village in the Ilkeston division of Derbyshire, England, 10 miles north-west of Nottingham, with a station, opened in 1890, on the Midland Railway. The church is an ancient edifice, in great part rebuilt, and there are several other places of worship. A technical school is installed in Heanor Hall. Large hosiery works employ over 1000 persons, and collieries are worked in the parish. Population of the urban district, which includes Codnor-cum-Loscoe (1901), 16,249.

Heat. See separate articles CALORIMETRY, CONDUCTION, &c.

Hebburn, a town and railway station in the Jarrow parliamentary division of county Durham, England, on the Tyne, 4 miles east-north-east of Gateshead. The churches are—three Established, Roman Catholic, Presbyterian, and Methodist (various). There are also a mechanics' institute, a drill-hall, and a theatre. It has extensive shipbuilding and engineering works, rope and sail factories, and chemical, colour, and cement works. Area of urban district, 1180 acres. Population (1881), 11,802; (1901), 20,901.

Hebden Bridge, a town and railway station in the Sowerby parliamentary division of Yorkshire, England, on the Calder and Hebden, 7 miles west by north of Halifax. There is a parish church, and two Wesleyan and three Baptist chapels. The town has cotton factories, dye-works, foundries, and manufactories of shuttles. There is fine scenery in the neighbourhood. Area of urban district (a civil parish), 478 acres; population (1881), 5007; (1901), 7536.

Hebrides, The, or WESTERN ISLES, a large group of islands off the west coast of Scotland, between 55° 35′ and 58° 30′ N. and 5° 40′ and 8° 40′ W. They consist of two chief groups, the Outer Hebrides—comprising, amongst others, Lewis, Harris, North and South Uist, Benbecula, Barra—and the Inner Hebrides, which are more scattered, and the principal of which are Skye, Rum, Eigg, Canna, Coll, Tiree, Mull, Iona, Colonsay, Jura, and Islay. The former group is attached to the counties of Ross and Inverness, the latter to the shires of Inverness and Argyll. Lewis and Harris, Skye, and North and South Uist are noticed under separate headings.

Hebron, now el-Khalîl, some 20 miles S. by S.W. of Jerusalem, in 31° 32′ N. and 35° 6′ E., with an altitude of 3040 feet. There are a British medical mission, a German Protestant mission with church and schools, and, near Abraham's Oak, a Russian mission. Since 1880 several notices of the Harám, within which are the tombs of the Patriarchs, have appeared.

See CONDER. Pal. Exp. Fund, *Memoirs*, iii. 333, &c.—CTE. RIANT. *Archives de l'Orient Latin*, ii. 411, &c.—DALTON and CHAPLIN. P. E. F. *Quarterly Statement*, 1897.—GOLDZIEHER. "Das Patriarchengrab in Hebron," in *Zeitschrift d. Dn. Pal.-Vereins*, xvii.

Hefele, Karl Josef von (1809–1893), German theologian, was born in Würtemberg on 15th March 1809. In 1839, after his ordination to the priesthood, he became professor of the Catholic Faculty of Theology at Tübingen. In 1842 he became a member of the National Assembly of Würtemberg. In 1869 he was made bishop of Rottenburg. His literary activity, which had been considerable, was in no way diminished by his elevation to the episcopate. Among his numerous theological works may be mentioned his well-known edition of the *Apostolic Fathers*, issued in 1839; his *Life of Cardinal Ximenes*, published in 1844; and his still more celebrated *History of the Councils of the Church*, in seven volumes, which appeared between 1865 and 1874. His theological opinions inclined towards the more liberal school in the Roman Catholic Church, but he nevertheless received considerable signs of favour from its authorities. He was made one of the special advisers of the Pope. When the Vatican Council of 1870 was about to assemble he published at Naples his *Causa Honorii Papae*, which aimed at demonstrating the moral and historical impossibility of Papal infallibility. About the same time he brought out a work in German on the same subject. He took rather a prominent part in the discussions at the council, associating himself with Dupanloup and Darboy in his opposition to the doctrine of Infallibility, and supporting their arguments from his large stores of knowledge of ecclesiastical history. In the preliminary discussions he voted against the promulgation of the dogma. He was absent from the important sitting on 18th June 1870, and did not send in his submission to the decrees until 1871. But in 1872 he took part in the congress summoned by the Ultramontanes at Fulda, and by his judicious use of minimizing tactics he kept his diocese free from any participation in the Old Catholic schism. The last four volumes of the second edition of his *History of the Councils* have been described as skilfully adapted to the new situation created by the Vatican decrees. During the later years of his life he undertook no further literary efforts on behalf of his Church, but retired into comparative privacy. He died on 6th June 1893. (J. J. L*.)

Heidelberg, a town of Germany, grand-duchy of Baden, on the river Neckar, 13 miles by rail south-east of Mannheim. The town has continued to grow towards the south-west, a new villa quarter having been built there, partly on the slopes of the Geisberg, partly in the plain at its foot. At the same end of the town the "new" bridge (1877) connects the Bismarck Square or Gardens with Neuenheim on the opposite bank of the Neckar, but now really an integral part of Heidelberg. A little lower down, and on the Heidelberg side of the river, are the botanical gardens of the university. A wire-rope railway runs from the Corn Market up to the level of the castle, and is continued thence to the Molkenkur (348 feet above the castle), a favourite point of view for seeing the beauties of the neighbourhood. In 1894 a double observatory was founded on the Geisberg, above the castle hill, and on the "great terrace" of the castle a monument to Viktor von Scheffel, unveiled in 1891, testifies the town's gratitude to the poet's praise of her. The university was frequented by 1553 students in 1900, and had 149 professors. Its library numbers 400,000 volumes and 4500 MSS. The university buildings were restored in part in 1886. Its institutions embrace a children's hospital, zoological and mineralogical museums, and a botanical garden, all connected with the university; also a technical school and Dr Schweninger's sanatorium. Population (1885), 29,364; (1900), 40,119.

Heidenheim, a town of Würtemberg, in Germany, 31 miles by rail north by east of Ulm. It is the seat of cotton and woollen, tobacco, machinery, and chemical factories, bleaching-grounds, dyeworks, and breweries, and corn and cattle markets. It is overlooked by the ruins of the castle of Hellenstein. Population (1885), 6709; (1901), 10,439.

Heilbronn, a town of Würtemberg, Germany, 33 miles by rail north of Stuttgart, and on the river Neckar. The church of St Kilian's was thoroughly restored in 1886–95. The town possesses a historical museum, a fine synagogue, and monuments to the emperors William I. and Frederick III. and to Schiller, as well as to Robert Mayer (1814–78), a native of the town, whose name is associated with the discovery of the mechanical theory of heat. Population (1885), 27,758; (1901), 37,883.

Helder, or Den Helder, a town in the province of North Holland, Netherlands, 40 miles north by west of Amsterdam, on the Marsdiep, the old sea road to Amsterdam. Before the construction of the North Sea Canal its harbour, the Nieuwe Diep, and the North Holland Canal served as an outer port to Amsterdam. It is now a fortified maritime station of the first class, with numerous batteries and forts, an arsenal, docks, and a state wharf. The garrison and marine establishments sustain the industries of the town, which has a zoological station. Population (1900), 25,159.

Helena, capital of Phillips county, Arkansas, U.S.A., on the west bank of the Mississippi, at an altitude of 193 feet. It is on the Arkansas Midland, the St Louis, Iron Mountain and Southern, and the Yazoo and Mississippi Valley railways. Situated in the alluvial region of the lower Mississippi, the richest cotton-producing region on earth, it is an important compressing and shipping point for cotton. It contains also cotton-seed oil and lumber mills. Population (1880), 3652; (1900), 5550, of whom 265 were foreign-born and 3400 were negroes.

Helena, capital of Lewis and Clark county and of the state, Montana, U.S.A., in 46° 37′ N. and 112° 03′ W., at the eastern base of the Rocky Mountains, at an altitude of 4009 feet. It was founded as a mining camp in 1864, in Little Prickly Pear Gulch, but has now spread down the narrow gulch and over the broad valley below. Most of its site is level, but its plan is irregular. It is entered by the Northern Pacific and the Great Northern railways, with several branches connecting it with neighbouring mining districts. It is said to be the wealthiest city in the United States in proportion to its population, and it is the financial centre of Montana, as Butte is the mining centre. It is the seat of the Montana Wesleyan University, a Methodist Episcopal institution, founded in 1890, which in 1899 had 15 instructors and 77 students. Population (1880), 3624; (1890), 13,834; (1900), 10,770, of whom 2793 were foreign-born and 228 were negroes.

Helensburgh, a burgh of barony and police burgh of Dumbartonshire, Scotland, on the north shore of the Firth of Clyde, opposite Greenock, 23 miles west-north-west of Glasgow by rail. Most of the inhabitants are Glasgow business men. Numerous villas have sprung up; Roman Catholic, Congregational, and Baptist chapels, and Victoria Halls have been erected. There are also a fever hospital and a monument to Henry Bell, the pioneer of steam navigation, who died here. Population (1881), 7693; (1901), 8554.

Heller, Stephen (1815–1888), Austrian pianist and composer, was born at Pesth, 15th May 1815. (Fétis's dictionary says 1814, but this is almost certainly wrong.) He was at first intended for a lawyer, but at nine years of age performed so successfully at a concert that he was sent to Vienna to study under Czerny. Halm was his principal master, and from the age of twelve he gave concerts in Vienna, and made a tour through Hungary, Poland, and Germany. At Augsburg he had the good fortune to fall ill and to be befriended by a wealthy family, who practically adopted him and gave him the opportunity to complete his musical education. In 1838 he went to Paris, and soon became intimate with Liszt, Chopin, Berlioz, and the set of romantics, among whom was Hallé, throughout his life an indefatigable performer of Heller's music. In 1849 he came to England and played a few times, and in 1862 he appeared with Hallé at the Crystal Palace. He outlived the great reputation he had enjoyed among cultivated amateurs for so many years, and was almost forgotten when he died at Paris on 14th January 1888. His pianoforte pieces, almost all of them published in sets and provided with fancy names, do not perhaps show very startling originality, but their grace and refinement could not but make them popular with players and listeners of all classes. He was by far the best of the composers who wrote nothing but what is called "drawing-room" music. (J. A. F. M.)

Heligoland, in German *Helgoland*, one of the Frisian Islands, belonging to Prussia, to which it was ceded by Great Britain in 1890, situated in the North Sea, 28 miles north-west from the mouth of the Elbe, in 54° 10′ N. and 7° 53′ E. Since its cession by Great Britain (see Germany: *History*) the island has been strongly fortified, the old English batteries having given place to armoured turrets mounting guns of the heaviest calibre. It has thus become an important strategical base for the German navy. Inside the Düneninsel the largest ships can ride safely at anchor and take in coal and other supplies. In 1892 a biological institute, with a marine museum and aquarium (1900) attached, was opened. It now claims to be the most fashionable watering-place in Germany, and during the season—June to October—it is largely resorted to by visitors from Hamburg and other German towns for sea-bathing. In 1899, 854 vessels of 161,723 tons cleared the island. Since 1891 it has been attached to the province of Schleswig-Holstein. Population (1900), 2307.

Helmholtz, Hermann Ludwig Ferdinand von (1821–1894), German philosopher and man of science, was born on 31st August 1821 at Potsdam, near Berlin. His father, Ferdinand, was a teacher of philology and philosophy in the Gymnasium, while his mother was a Hanoverian lady, a lineal descendant of the great Quaker William Penn. Delicate in early life, Helmholtz became by habit a student, and his father at the same time directed his thoughts to natural phenomena. He soon showed mathematical powers, but these were not fostered by the careful training mathematicians usually receive, and it may be said that in after years his attention was directed to the higher mathematics mainly by force of circumstances. As his parents were poor, and could not afford to allow him to follow a purely scientific career, he became a surgeon of the Prussian army. In 1842 he wrote a thesis in which he announced the discovery of nerve-cells in ganglia. This was his first work, and from 1842 to 1894, the year of his death, scarcely a year passed without several important, and in some cases epoch-making, papers on scientific subjects coming from his pen. He lived in Berlin from 1842 to 1849, when he became professor of physiology in Königsberg. There he remained from 1849 to 1855, when he removed to the chair of physiology in Bonn. In 1858 he became professor of

physiology in Heidelberg, and in 1871 he was called to occupy the chair of physics in Berlin. To this professorship was added in 1887 the post of director of the physio-technical institute at Charlottenburg, near Berlin, and he held the two positions together until his death on the 8th of September 1894.

His investigations occupied almost the whole field of science, including physiology, physiological optics, physiological acoustics, chemistry, mathematics, electricity and magnetism, meteorology, and theoretical mechanics. At an early age he contributed to our knowledge of the causes of putrefaction and fermentation. In physiological science he investigated quantitatively the phenomena of animal heat, and he was one of the earliest in the field of animal electricity. He studied the nature of muscular contraction, causing a muscle to record its movements on a smoked glass plate, and he worked out the problem of the velocity of the nervous impulse both in the motor nerves of the frog and in the sensory nerves of man. In 1847 Helmholtz read to the Physical Society of Berlin a famous paper, *Ueber die Erhaltung der Kraft* (on the conservation of force), which became one of the epoch-making papers of the century; indeed, along with Mayer, Joule, and Thomson (Lord Kelvin), he may be regarded as one of the founders of the now universally received law of the Conservation of Energy. The year 1851, while he was lecturing on physiology at Königsberg, saw the brilliant invention of the ophthalmoscope, an instrument which has been of inestimable value to medicine. It arose from an attempt to demonstrate to his class the nature of the glow of reflected light sometimes seen in the eyes of animals such as the cat. When the great ophthalmologist, von Graefe, first saw the fundus of the living human eye, with its optic disc and blood-vessels, his face flushed with excitement, and he cried, "Helmholtz has unfolded to us a new world!" Helmholtz's contributions to physiological optics are of great importance. He investigated the optical constants of the eye, measured by his invention, the ophthalmometer, the radii of curvature of the crystalline lens for near and far vision, explained the mechanism of accommodation by which the eye can focus within certain limits, discussed the phenomena of colour vision, and gave a luminous account of the movements of the eyeballs so as to secure single vision with two eyes. In particular he revived and gave new force to the theory of colour-vision associated with the name of Thomas Young, showing the three primary colours to be red, green, and violet, and he applied the theory to the explanation of colour-blindness. His great work on *Physiological Optics* (1856–66) is by far the most important book that has appeared on the physiology and physics of vision. Equally distinguished were his labours in physiological acoustics. He explained accurately the mechanism of the bones of the ear, and he discussed the physiological action of the cochlea on the principles of sympathetic vibration. Perhaps his greatest contribution, however, was his attempt to account for our perception of quality of tone. He showed, both by analysis and by synthesis, that quality depends on the order, number, and intensity of the over-tones or harmonics that may, and usually do, enter into the structure of a musical tone. He also developed the theory of differential and of summational tones. His work on *Sensations of Tone* (1862) may well be termed the *principia* of physiological acoustics. He may also be said to be the founder of the fixed-pitch theory of vowel tones, according to which it is asserted that the pitch of a vowel depends on the resonance of the mouth, according to the form of the cavity while singing it, and this independently of the pitch of the note on which the vowel is sung. For the later years of his life his labours may be summed up under the following heads: (1) On the conservation of energy; (2) on hydrodynamics; (3) on electro-dynamics and theories of electricity; (4) on meteorological physics; (5) on optics; and (6) on the abstract principles of dynamics. In all these fields of labour he made important contributions to science, and showed himself to be equally great as a mathematician and a physicist. He studied the phenomena of electrical oscillations from 1869 to 1871, and in the latter year he announced that the velocity of the propagation of electromagnetic induction was about 314,000 metres per second. Faraday had shown that the passage of electrical action involved time, and he also asserted that electrical phenomena are brought about by changes in intervening non-conductors or dielectric substances. This led Clerk Maxwell to frame his theory of electro-dynamics, in which electrical impulses were assumed to be transmitted through the ether by waves. Fitzgerald was the first to attempt to measure the length of electric waves; Helmholtz put the problem into the hands of his favourite pupil, Heinrich Hertz, and the latter finally gave an experimental demonstration of electromagnetic waves, the "Hertzian waves," on which the invention of wireless telegraphy depends, and the velocity of which is the same as that of light. The last investigations of Helmholtz related to problems in theoretical mechanics, more especially as to the relations of matter to the ether, and as to the distribution of energy in mechanical systems. In particular he explained the principle of least action, first advanced by Maupertuis, and developed by Hamilton, of quaternion fame. Helmholtz also wrote on philosophical and æsthetic problems. His position was that of an empiricist, denying the doctrine of innate ideas and holding that all knowledge is founded on experience, hereditarily transmitted or acquired.

The life of Helmholtz was uneventful in the usual sense. He was twice married, first, in 1849, to Olga von Velten (by whom he had two children, a son and daughter), and secondly, in 1861, to Anna von Mohl, of a Würtemberg family of high social position. Two children were born of this marriage, a son, Robert, who died in 1889, after showing in experimental physics indications of his father's genius, and a daughter, who married a son of Werner von Siemens. Helmholtz was a man of simple but refined tastes, of noble carriage, and somewhat austere manner. His life from first to last was one of devotion to science, and he must be accounted, on intellectual grounds, one of the foremost men of the 19th century. (J. G. M.)

Helmond, town of the province of North Brabant, Netherlands, on the canal between Bois-le-Duc and Maastricht (*Zuid-Willems vaart*), and on the railway from Boxtel to Venlo, 21 miles south-east of Bois-le-Duc. It is one of the industrial centres of the province, and has twenty-two factories, employing 3000 workpeople in weaving, dyeing, and printing cotton, engine works, a margarine manufactory, &c. There is an art school. Population with suburbs (1900), 11,436.

Helmstedt, a town of Germany, duchy of Brunswick, 30 miles west by north of Magdeburg by rail. The Walpurgis church was restored in 1893–94. There is a new classical school (1880–82). The agricultural school is quartered in the Marienberg nunnery (1176). Coal is mined in the vicinity. Population (1885), 9794; (1900), 14,259.

Helsingborg, a growing seaport town of Sweden, on the east side of the Sound, opposite to Elsinore (Helsingör) in Denmark, 56 miles by rail west-north-west of Malmö. The harbour, which is of artificial construction, was deepened in 1888–89, and subsequently enlarged to

2200 feet by 450 feet, with 24 feet depth. The export of agricultural produce has steadily declined since 1888, but other exports have increased. The chief exports are timber (nearly 2 million cubic feet), butter, and iron. In 1900, 4620 vessels of 756,300 tons cleared, as compared with 3749 vessels of 228,600 tons in 1886. The merchant fleet numbers 110 vessels of nearly 51,000 tons. There are several handsome new buildings, chief amongst them being the town hall (1894–96) and the church of Gustavus Adolphus (1897). Population (1880), 11,550; (1900), 24,670.

Helsingfors (Finnish, *Helsinki*), a seaport and the capital of Finland and of the government of Nyland, centre of the administrative, scientific, and industrial life of Finland. The fine harbour is divided into two parts by a promontory, and is protected at its entrance by a group of small islands, on one of which stands the fortress of Sveaborg. A third harbour is situated on the west side of the promontory, and all three have granite quays. Near the southern harbour is the market square, upon which stands the imperial palace. The finest street, the Esplanade, leads from it, and has a monument to Runeberg, two theatres (Swedish and Finnish), an athenæum (drawing and professional school), and other important buildings. There are also two excellent parks, many museums of natural sciences, antiquities, and art, several large libraries, and a "people's palace," founded by Miss Ally Trugg. Some of its scientific societies have a wide repute, such as the academy of sciences, the geographical, historical, Finno-Ugrian, biblical, medical, law, arts, and forestry societies, as also societies for spreading popular education, of arts and crafts, for the study of the flora and fauna, and so on. Five daily papers and a great number of other periodicals are published, in addition to admirable works of the geological survey, the land survey, the administration of roads and water communication, forestry, and other departments of government. The population, which was 32,113 in 1870, has rapidly grown since the construction of railways, and in 1899 was, with Sveaborg, 73,820. Nearly 55 per cent. speak Swedish and 36 Finnish, the remainder being Russians and Germans. The aggregate yearly production of all manufactories is about £1,000,000. The trade is important, Helsingfors being the chief port of Finland for imports (customs duties, £248,020), the total returns of foreign and coasting trade reaching about £2,000,000. It is visited every year by 760 vessels, 253,000 tons. It is connected by rail with St Petersburg (263 miles, *viâ* the Rihimäki junction) and Hangö (138 miles, at the entrance into the Gulf of Finland), as also with all the chief towns of Finland as far north as Uleåborg, Kuopio, and Ioensuu.

Helvoetsluys (Dutch, *Hellevoetsluis*), town, Netherlands, province of South Holland, 17 miles W.S.W. of Rotterdam. Formerly an outer port to Rotterdam, it is, since the construction of the new waterway from Rotterdam to the sea, only a fortified marine station and port. Population (1900), 4293.

Hemichorda.—This zoological term was introduced by Bateson in 1884, without special definition, as equivalent to Enteropneusta, which then included the single genus Balanoglossus. It has since been extended so as to embrace some other forms, the anatomy of which was at that time imperfectly known. The special attention which has of late years been devoted to these animals is due to the fact that they are generally considered to lie near the base of the Vertebrata, and may eventually throw some light on the origin of that great stem from invertebrate ancestors. The relations of the Hemichorda and allied groups may be represented by the following table:—

I. HEMICHORDA. Bateson.
  1. *Vermiformia*, Lankester . . Phoronis.
  2. *Pterobranchia*, Lankester . . {Cephalodiscus. Rhabdopleura.
  3. *Enteropneusta*, Gegenbaur . . {Balanoglossus and others.
II. PROTOCHORDA, Balfour.
  1. *Urochorda*, Lankester . . . {Ascidians or Tunicata.
  2. *Cephalochorda*, Lankester . . {Amphioxus and others.
III. VERTEBRATA=Craniata, Euchorda, Holochorda, &c.

The external features of *Phoronis* and of its larva were described and figured in *Ency. Brit.*, vol. xix. pp. 433, 434. Internally the body cavity is divided by a septum into an anterior lophophoral ("collar") cavity and a posterior ("trunk") cavity. The alimentary canal is U-shaped, bent dorsally, and supported in the trunk

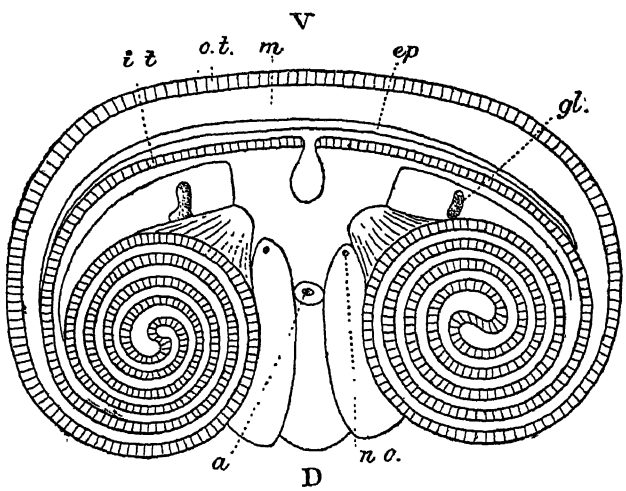


FIG. 1.—Anterior end of *Phoronis australis*, the tentacles cut off short at their origins. *a*, anus; D, dorsal surface; *ep*, epistome; *gl*, supposed glandular pit; *i.t.*, bases of inner series of tentacles; *m*, mouth; *n.o.*, nephridial opening; *o.t.*, bases of outer series of tentacles; V, ventral surface. (*After Benham.*)

cavity by mesenteries; the chambers between these latter are not completely separated from one another. The blood system is complex. There is a pair of typical nephridia, each with two funnels, which open on opposite sides of a mesentery; they appear to serve also as genital ducts. The nervous system lies immediately below the ectoderm; there is a nerve band along the spiral lophophore, with nerves to the tentacles and elsewhere; a slight concentration of nerve-cells between mouth and anus may represent an indefinite central ganglion (Figs. 1, 2). Two ectodermal pits, containing specialized cells, lying dorsally to the inner series of tentacles, have been variously interpreted as glands and as sense-organs. Segmentation is holoblastic and sub-equal; the blastula undergoes an embolic gastrulation. According to Masterman, the blastopore persists as the mouth. The larva is known as *Actinotrocha*. Its body cavity is divided into three sections: a protocœle (head or proboscis cavity), which is formed as a two-horned archenteric diverticulum, similar to those of *Amphioxus* and of the directly developing *Balanoglossus*; a mesocœle (collar cavity), arising as a pair of at first solid masses of cells, probably by proliferation of endoderm cells outwardly; and a metacœle (trunk cavity), formed as a pair of endodermal outgrowths, which may possibly have been originally archenteric diverticula. The anatomy of the larva is represented in Figs. 3, 4, and will be further discussed later. In metamorphosis

the præ-oral lobe (proboscis or hood) is apparently absorbed or swallowed, carrying with it the central nervous system; the adult thus has no protocœle. According to Ikeda, the mesocœle of the larva becomes a vascular space; that of the adult is a new formation.

The external characters of *Cephalodiscus* and *Rhabdopleura*, with figures, will be found in *Ency. Brit.*, vol.

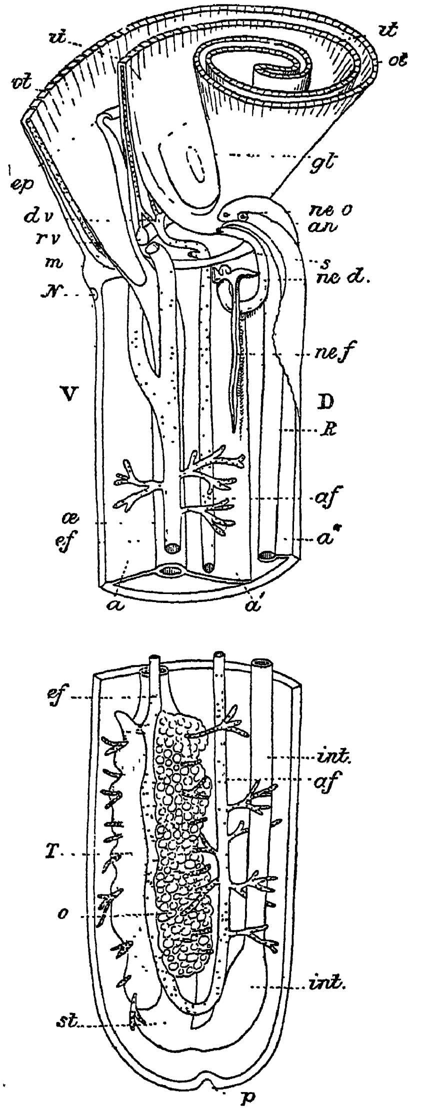


FIG 2.—Diagram of the anterior and posterior ends of *Phoronis*, the left half of the body-wall cut away: in the upper half, the left lateral mesentery cut away, but the left nephridium untouched; in the lower half all mesenteries omitted. *a*, œsophageal mesentery; *a'*, right lateral mesentery; *a''*, rectal mesentery; *af*, afferent vessel; *an*, anus; D, dorsal side; *d.v.*, right vessel supplying tentacles; *ef*, efferent vessel; *ep*, epistome; *gl*, "glandular" pit; *int.*, intestine; *i.t.*, bases of inner whorl of tentacles; *m*, mouth; *N*, nerve-band; *ne. d.*, nephridial duct; *ne. f.*, large nephridial funnel, opening into rectal chamber; the smaller funnel, which opens into the œsophageal chamber, is to the left of the top of the larger; *ne. o.*, nephridial opening to the exterior; *o*, ovary; *œ*, œsophagus; *o.t.*, bases of outer whorl of tentacles; *p*, posterior pit; *R*, rectum; *r.v.*, right vessel receiving blood from tentacles; *s*, septum between mesocœle and metacœle; *st*, stomach; *T*, testis; V, ventral side. (*Modified from drawings by Benham.*)

xix. pp. 434–436. In addition to, or in correction of, the information there given, the following points should be noted:—The præ-oral lobe or buccal shield of *Cephalodiscus* corresponds, not to the little epistome of *Phoronis*, but to the præ-oral lobe of *Actinotrocha*. Protocœle, mesocœle, and metacœle are well marked. The protocœle opens by two pores to the exterior, through the front part of that concentration of nerve matter which appears to represent a cerebral ganglion or brain; the mesocœle, which is continued into the lophophore and tentacles, opens also by two "collar pores." The alimentary canal is U-shaped, flexed dorsally; it has a pair of gill slits, and gives off an anterior cæcum (notochord, stomochord). A pair of ovaries, formerly regarded as eyes, lie in the metacœle, and open by oviducts to the exterior; the male organs have not been seen. A stalk or stolon, on the ventral side of the body posteriorly, contains a portion of the metacœle divided into two by a mesentery, a ventral nerve, and spaces interpreted by Masterman as blood sinus; from this pedicle are developed the buds, of which the whole alimentary canal is formed by an invagination of ectoderm at the site of the mouth. The buds become detached from the stolon, and free in the cœnœcium (Figs. 5, 6).

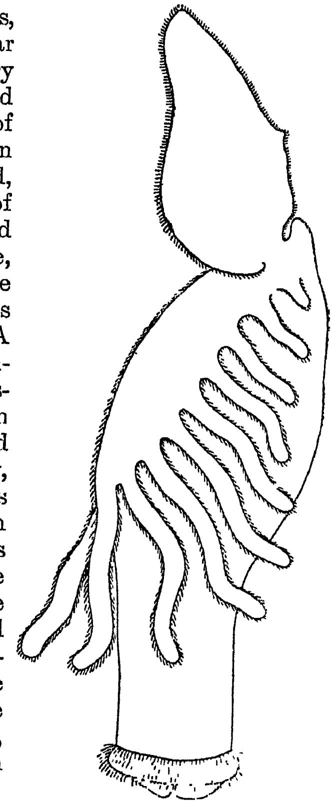


FIG. 3.—Lateral view of a late *Actinotrocha* larva of *Phoronis*. (*After Masterman.*)

Rhabdopleura has been shown to possess protocœle, mesocœle with collar pores (the "ciliated patches" of the earlier article), and metacœle; a stomochord, and nerve ganglion, all as in *Cephalodiscus*. Proboscis pore and gill slits have not been detected, possibly owing only to the minuteness of the animal. There is a stolon of similar structure and position to that of *Cephalodiscus*, but each individual budded from this remains permanently attached at the end of his branch of the adherent ramifying stolon, which unites all the individuals into a true colony. Nothing is known of the embryology of *Rhabdopleura*, and practically nothing of that of *Cephalodiscus*.

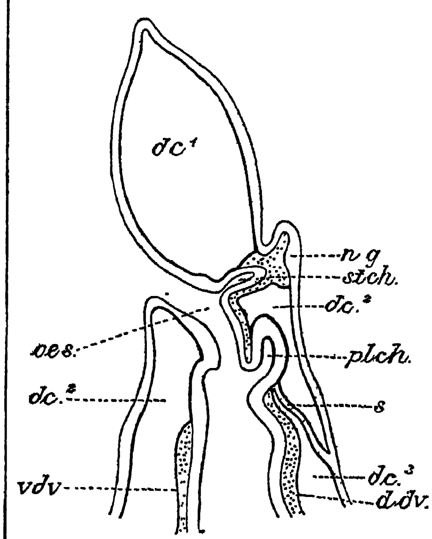


FIG. 4.—Anterior part of a dorso-ventral section of *Actinotrocha* (not exactly median): *dc*¹, protocœle; *dc*², mesocœle; *dc*³, metacœle; *dbv*, dorsal blood-vessel; *n.g.*, nerve ganglion; *œs.*, œsophagus; *plch*, pleurochord of one side; *s*, septum between mesocœle and metacœle; *stch*, stomochord; *vbv*, ventral blood-vessel. (*Modified from a drawing by Masterman.*)

The *Enteropneusta* are described in a separate article, BALANOGLOSSUS.

The reader can only estimate the homological value of the various internal structures of forms, at first sight so

distinct from one another, after a careful study of the memoirs cited below; the most that can be done here is to point out the more salient features which have led to the association of those animals as Hemichorda.

The Notochord.—This structure, which occurs in the embryos of all Vertebrata, and persists in many of them throughout life, has always been recognized as one of their chief morphological characters. It is not disputed that this is homologous with the notochord of *Amphioxus*, and only a few authorities refuse to admit some relationship between the latter and the "notochord" of *Enteropneusta*, for which Willey's term "stomochord" will here be used. The stomochord is a forward dorsal diverticulum of the gut in the collar region, which pushes before it the wall of the præ-oral body cavity or protocœle. According to Willey, its completest development is represented in

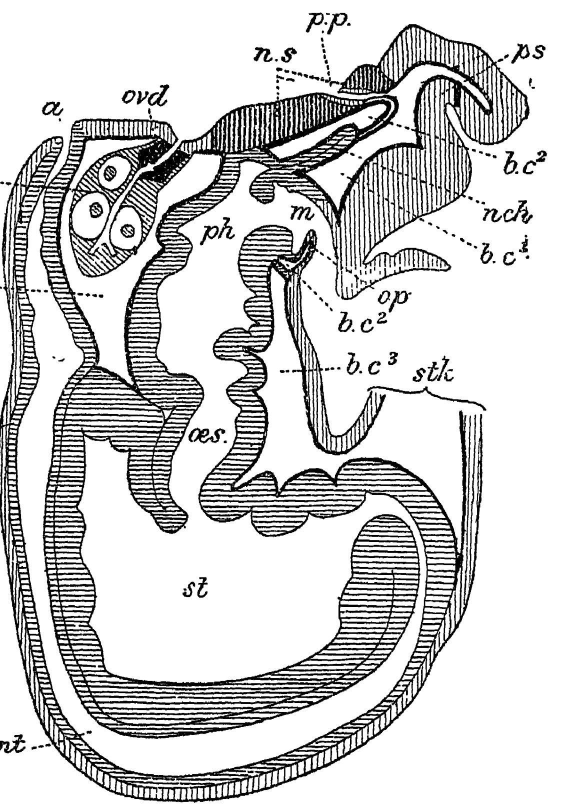


FIG. 5.—Dorso-ventral section of an adult *Cephalodiscus* (not exactly median): *a*, anus; *bc*1, protocœle; *bc*2, mesocœle; *bc*3, metacœle; *int.*, intestine; *m*, mouth; *nch*, stomochord; *n.s.*, nervous system; *œs.*, œsophagus; *op*, operculum; *ov*, ovary; *ovd*, oviduct; *vh*, pharynx; *p.p.*, proboscis pore; *p.s.*, proboscis stalk; *st*, stomach; *stk*, cut origin of stolon or pedicle. (*After Harmer.*)

Fig. 1; the cells of which it is composed frequently exhibit that vacuolation which is generally associated with a stiffening function, and is particularly well developed in Vertebrate notochords. In *Cephalodiscus* and *Rhabdopleura* there exists a simpler diverticulum or stomochord, with the same general relations, but not exhibiting vacuolation. As regards *Actinotrocha*, we suffer from a multiplicity of so-called "notochords." Masterman describes in *Actinotrocha* and *Cephalodiscus* a pair of "pleurochords," lateral evaginations of the gut in the collar region, the cells of which are vacuolated; these lie farther back than the Enteropneustan stomochord, and do not project into the protocœle. Roule in the *Actinotrocha* of another species of *Phoronis*, and Ikeda in Japanese species, describe not two, but a single diverticulum of vacuolated cells in the collar; this projects, however, not dorsally towards the protocœle, but ventrally, not above but below the œsophagus. On the other hand, Masterman, and (more recently) Menon in Indian species, describe a median dorsal non-vacuolated diverticulum; this, although formed just outside what he describes as the mouth, shifts inwards, and comes to have the topographical relations of a stomochord. He formerly regarded this and the stomochord of *Cephalodiscus* as homologous with the subneural gland of *Urochorda*, refusing to recognize it as of notochordal significance on the grounds of its structure, of its relations to other organs, and of his preference for regarding the pleurochords as the paired homologues of the Enteropneust stomochord. As regards the question of histological structure, it is not wise to lay too much stress on this evidence; the vacuolated cells of *Cephalodiscus* and *Actinotrocha* are not particularly chordoid-looking, and there is no evidence of their being stiffer than surrounding tissues; there appear to be gland cells among them. Further, Spengel, Hill, and Willey have shown that "pygochordal" vacuolated tissue occurs on the ventral side of the caudal gut in various *Enteropneusta*; again, chordoid tissue of a stiffening nature is widely distributed in the animal kingdom, from the tentacles of Hydromedusæ upwards. The general topographical relations of the organ are those of the stomochord of *Enteropneusta*, although in details of this as of other portions of their anatomy the three smaller members differ from *Enteropneusta*. On the whole, there seems little reason at present to deny to this median stomochord in *Actinotrocha*, *Rhabdopleura*, and *Cephalodiscus* a homology with at any rate some part of the stomochord of *Enteropneusta*. This would agree with the homologies suggested by Willey, that the pleurochords are homologous with the lateral pouches, and Roule's ventral diverticulum with the ventral cæcum, of such an Enteropneust stomochord as is represented in Fig. 7.

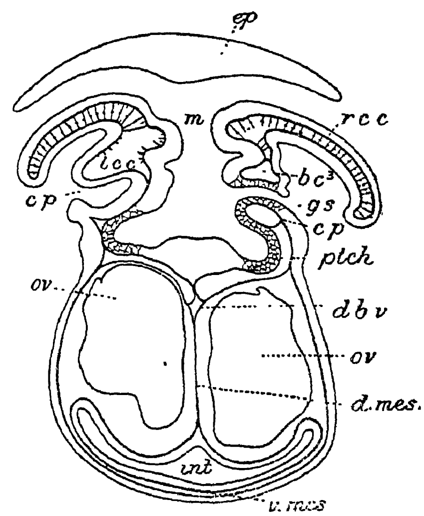


FIG. 6.—Nearly transverse section of *Cephalodiscus*: *bc*3, metacœle; *c.p*, collar pore; *dbv*, dorsal blood-vessel; *d. mes.*, dorsal mesentery; *ep.* epistome; *g s.*, gill slit; *int*, intestine; *l.c.c.*, left mesocœle; *m*, mouth; *ov.*, ovary; *plch*, pleurochord; *r.c c*, right mesocœle; *v. mes.*, ventral mesentery. The distribution of the "chordoid" tissues on gill slits and pleurochords is shown by reticulations. (*Modified from a drawing by Masterman.*)

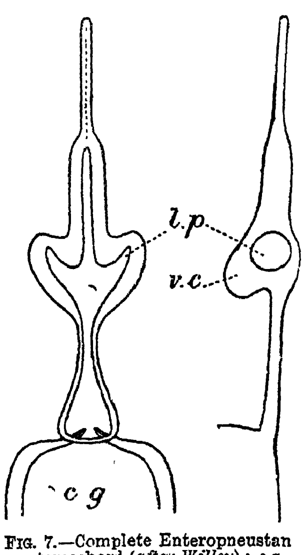


FIG. 7.—Complete Enteropneustan stomochord (*after Willey*): *c.g.*, collar gut; *l.p.*, lateral pouch; *v.c.*, ventral cæcum.

The Cœlom and its Openings.—In all the Hemichorda the cœlom exhibits three well-defined regions separated from one another by septa: (1) An impaired præ-oral protocœle (head or proboscis cavity), which is present in

Actinotrocha, but lost in adult *Phoronis*, and persists in the other three; (2) a mesocœle (collar or lophophoral cavity), first paired, then single, in *Actinotrocha;* paired in the remainder, and continued into the lophophore and tentacles when they occur; (3) a paired metacœle or trunk cavity. It is interesting to note that these three are present in the development of *Amphioxus* (MacBride, *Quart. Journ. Micr. Science*, xl. 589). The protocœle and mesocœle communicate with the exterior by pores or canals, presumably for excretory functions; the protocœle by two pores in *Actinotrocha* and *Cephalodiscus*, by two or one in *Enteropneusta*, but none have been observed in *Rhabdopleura;* the mesocœle opens by a pair of pores in all cases.

Gill-slits.—While the *Enteropneusta* have numerous gill-slits, *Cephalodiscus* has but a single pair, and none have been detected in *Rhabdopleura* or *Actinotrocha;* it is less remarkable that two such small animals as the latter should lack them, than that *Cephalodiscus* should possess them. The pleurochords of *Cephalodiscus* and *Actinotrocha*, as Willey suggests, are possibly vestiges of a lost pair of gill-slits; their size, shape, and position, and the presence of vacuolated tissue in the walls of both (Fig. 6), render this homology probable.

These points are enough to show that the marked morphological similarities justify the inclusion of these three forms among the Hemichorda. But how they stand phylogenetically to each other and to *Euchorda*, whether they or any of them represent in any sense an ancestral phase, a blind side-path, or a degradation of structure, there is at present no adequate evidence to show.

The three forms treated here are sessile, and in this point bear to the *Enteropneusta* a relation analogous to that between many Ascidians and the Cephalochorda, an analogy the more striking if that interpretation be accepted which assigns to the Ascidians a single pair of gill-slits, greatly enlarged and subdivided.

Mention should be made here of a curious resemblance in many anatomical points between *Phoronis* and the Sipunculoidea (*Gephyrea inermia*), but our knowledge of the development of the latter group does not at present tend to show any intimate relationship between the two.

AUTHORITIES.—**Phoronis**—BENHAM, *Quart. Journ. Micr. Sci.*, xxx. 125; CORI, *Zeit. wiss. Zool.*, li.; MASTERMAN, *Quart. Journ. Micr. Sci.*, xl. 281, and xliii. 375; IKEDA, *Journ. Coll. Tokyo*, xiii.; MENON, *Quart. Journ. Micr. Sci.*, xlv.—**Cephalodiscus**—HARMER, appendix to "*Challenger*" *Report on Cephalodiscus;* MASTERMAN, *Quart. Journ. Micr. Sci.*, xl. 281; and *Trans. Roy. Soc. Edin.*, xxxix. 507.—**Rhabdopleura**—FOWLER, *Festschrift für Leuckart*, 1892.—**General**—WILLEY, *Quart. Journ. Micr. Sci.*, xlii. 223; MASTERMAN, *ibid.*, xliii. 375. (G. H. FO.)

Hems, or HUMS, ancient *Emessa*, a town of Syria, on the right bank of the Orontes. After its capitulation it became the capital of a *jund*, or military district, which under the Omeiyad Caliphs extended from Palmyra to the sea. Under the Arabs it was one of the largest cities in Syria, with walls and a strong citadel, which stood on a hill. Its men were noted for their courage in war, and its women for their beauty. The climate was extolled for its excellence, and the land for its fertility. A succession of gardens bordered the Orontes, and the vineyards were remarkable for their abundant yield of grapes. When it capitulated the great church of St John was divided between the Christians and Moslems, an arrangement which apparently lasted until the arrival of the Turks. Its decay probably dates from the invasion of the Mongols (1260), who fought two important battles with the Egyptians (1281 and 1299) in its vicinity. The construction of a carriage road to Tripolis has led to a partial revival of prosperity and to an export of cereals and fruit. The population numbers 30,000 (Moslems 20,000, Christians 10,000). About 7 miles above Hems is the mediæval Lake Kedes, in the vicinity of which was the Hittite city Kedesh.

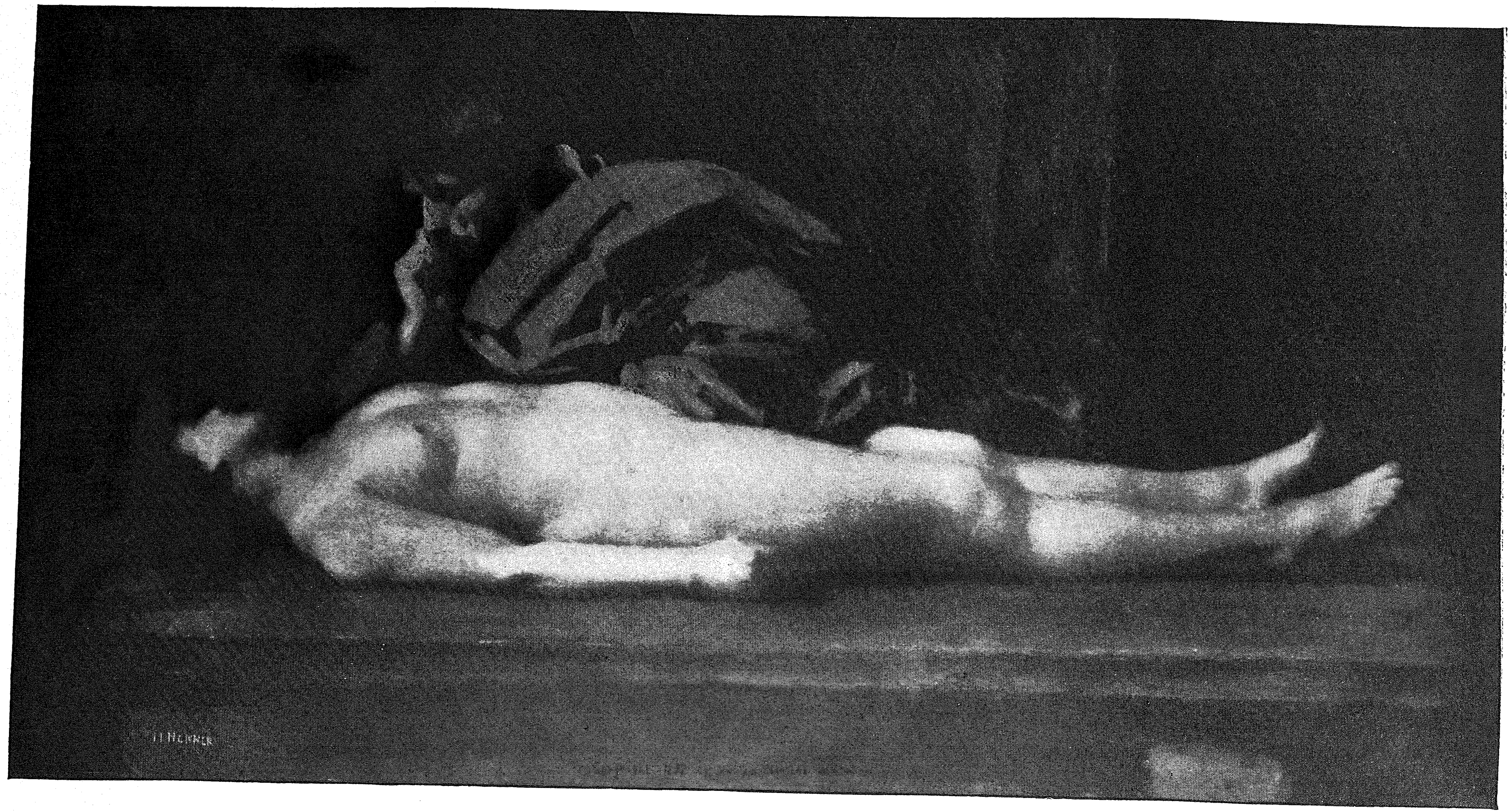
GUY LE STRANGE. *Palestine under the Moslems.*—CONDER. *Heth and Moab.*—BAEDEKER. *Handbook to Syria and Palestine.* (C. W. W.)

Henderson, capital of Henderson county, Kentucky, U.S.A., on the south bank of the Ohio river, at an altitude of 370 feet. It has three railways—the Louisville and Nashville, the Illinois Central, and the Louisville, Henderson, and St Louis. It has tobacco and cotton factories. Population (1880), 5365; (1900), 10,272, of whom 341 were foreign-born and 4029 were negroes.

Hendon, a suburb of London, in the Harrow parliamentary division of Middlesex, England, on the Brent, 7 miles north-west of St Pancras. The churches are—three Established (St Mary's is old), a Roman Catholic, and several chapels; at Mill Hill also are a Roman Catholic college for the training of missionaries and the well-known grammar school. The Brent reservoir for the Regent Canal occupies 350 acres. Area of civil parish (an urban district), 8382 acres. Population (1881), 10,484; (1901), 22,450.

Hendricks, Thomas Andrews (1819–1885), Vice-President of the United States, was born at Zanesville, Ohio, on the 7th of September 1819. He received a college education, and began in 1843 a successful career at the bar. Identifying himself with the Democratic party, he was sent to Congress in 1851, and from that time till his death was active and prominent in politics. His official service included two terms as representative (1851–55), one as head of the General Land Office (1855–59), one as senator (1863–69), and one as governor of Indiana (1872–76). From 1868 he was put forward for nomination for the Presidency at every Democratic convention save that of 1872. His defeats in 1876 and 1884 by Tilden and Cleveland respectively were followed in each case by his nomination for Vice-President, and in the latter year he was elected; but before the year in which he assumed office (1885) was ended he died at Indianapolis, 25th November.

Henle, Friedrich Gustav Jakob (1809–1885), German pathologist and anatomist, was born on 9th July 1809 at Fürth, in Franconia. After studying medicine at Heidelberg and at Bonn, where he took his doctor's degree in 1832, he became prosector in anatomy to Johannes Müller at Berlin. During the six years he spent in that position he published a large amount of work, including three anatomical monographs on new species of animals, and papers on the structure of the lacteal system, the distribution of epithelium in the human body, the structure and development of the hair, the formation of mucus and pus, &c. In 1840 he accepted the chair of anatomy at Zürich, and in 1844 he was called to Heidelberg, where he taught not only anatomy, but physiology and pathology. About this period he was engaged on his complete system of general anatomy, which formed the sixth volume of the new edition of Sömmering's treatise, published at Leipzig between 1841 and 1844. While at Heidelberg he published a zoological monograph on the sharks and rays, in conjunction with his master Müller, and in 1846 his famous *Manual of Rational Pathology* began to appear; this marked the beginning of a new era in pathological study, since in it physiology and pathology were treated, in Henle's own words, as "branches of one science," and the facts of disease were systematically considered with reference to their physiological relations. In 1852 he moved to Göttingen, whence he issued three years later the first



"The Levite Ephraim." By J. J. Henner.

(*Copyright 1898, by Braun, Clement, and Co.*)

instalment of his great *Handbook of Systematic Human Anatomy*, the last volume of which was not published till 1873. This work was perhaps the most complete and comprehensive of its kind that had so far appeared, and it was remarkable not only for the fulness and minuteness of the anatomical descriptions, but also for the number and excellence of the illustrations with which they were elucidated. During the latter half of his life Henle's researches were mainly histological in character, his investigations embracing the minute anatomy of the blood vessels, serous membranes, kidney, eye, nails, central nervous system, &c. He died at Göttingen on 13th May 1885.

Henley-on-Thames, a municipal borough (incorporated 1883, extended 1892) and market-town in the Henley parliamentary division of Oxfordshire, England, 36 miles to London by rail. The grammar school has been reorganized, and the Henley Blue Coat school incorporated with it. Recent erections are a new town-hall and an isolation hospital. Area, 571 acres. Population (1881), 4601; (1901), 5984. For the regatta, see ROWING.

Henner, Jean Jacques (1829-——), French painter, was born 5th March 1829 at Dornach (Alsace). At first a pupil of Drolling and of Picot, he entered the École des Beaux-Arts in 1848, and took the Prix de Rome with a painting of "Adam and Eve finding the Body of Abel" (1858). At Rome he was guided by Flandrin, and, among other works, painted four pictures for the gallery at Colmar. He first exhibited at the Salon in 1863 a "Bather Asleep," and subsequently contributed "Chaste Susanna" (1865); "Byblis turned into a Spring" (1867); "The Magdalene" (1878); "Portrait of M. Hayem" (1878); "Christ Entombed" (1879); "Saint Jerome" (1881); "Herodias" (1887); "A Study" (1891); "Christ in His Shroud," and a "Portrait of Carolus-Duran" (1896); a "Portrait of Mlle. Fouquier" (1897); "The Levite of the Tribe of Ephraim" (1898), for which a first-class medal was awarded to him (see PLATE); and "The Dream" (1900). Among other professional distinctions Henner also took a Grand Prix for painting at the Paris International Exhibition of 1900. He was made Knight of the Legion of Honour in 1873, Officer in 1878, and Commander in 1889. In 1889 he succeeded Cabanel in the Institut de France.

E. BRICON. *Psychologie d'Art.* Paris, 1900.—C. PHILLIPS. *Art Journal*, 1888.—F. WEDMORE. *Magazine of Art*, 1888.

Henry Maurice, PRINCE OF BATTENBERG (1858–1896), was the third son of Prince Alexander of Hesse and his morganatic wife, the beautiful Countess Julia von Hauke, to whom was granted in 1858 the title of Princess of Battenberg, which her children inherited. He was born at Milan 5th October 1858, was educated with a special view to military service, and in due time became a lieutenant in the first regiment of Rhenish hussars. By their relationship to the grand dukes of Hesse the princes of Battenberg were brought into close contact with the English Court, and Prince Henry paid several visits to England, where he soon became popular both in public and in private circles. It therefore created but little surprise when, towards the close of 1884, it was announced that Queen Victoria had sanctioned his engagement to the Princess Beatrice. The wedding took place at Whippingham on the 23rd of July 1885, and after the honeymoon the prince and princess settled down to a quiet home life with the queen, being seldom absent from the Court, and accompanying her Majesty in her annual visits to the Continent. Three sons and a daughter were the issue of the marriage. On 31st July 1885 a Bill to naturalize Prince Henry was passed by the House of Lords, and he received the title of Royal Highness. He was made a Knight of the Garter and a member of the Privy Council, and also appointed a colonel in the army, and afterwards captain-general and governor of the Isle of Wight and governor of Carisbrooke Castle. He adapted himself very readily to English country life, for he was an excellent shot and an enthusiastic yachtsman. Coming of a martial race, the prince would gladly have embraced an active military career, and when the Ashanti expedition was organized in November 1895 he volunteered to join it. But when the expedition reached Prahsu, about 30 miles from Kumasi, he was struck down by fever, and being promptly conveyed back to the coast, was placed on board H.M.S. *Blonde*. On 17th January he seemed to recover slightly, but a relapse occurred on the 19th, and he died on the evening of the 20th off the coast of Sierra Leone.

Henselt, Adolf von (1814–1889), German composer, was born at Schwabach, in Bavaria, 12th May 1814. At three years old he began to learn the violin, and at five the pianoforte under Frau v. Fladt. On obtaining financial help from Ludwig I. he went to study under Hummel in Weimar, and thence in 1832 to Vienna, where, besides studying composition under Sechter, he made a great success as a concert pianist. In order to recruit his health he made a prolonged tour in 1836 through the chief German towns. In 1837 he settled at Breslau, where he had married, but in the following year he migrated to St Petersburg, where previous visits had made him *persona grata* at Court. He then became Court pianist and inspector of musical studies in the Imperial Institute of Female Education, and was ennobled. In 1852 and again in 1867 he visited England, though in the latter year he made no public appearance. St Petersburg was his home practically until his death, which took place at Warmbrunn on 10th October 1889. The characteristic of Henselt's playing was a combination of Liszt's sonority with Hummel's smoothness. It was full of poetry, remarkable for the great use he made of extended chords, and for his perfect technique. He excelled in his own works and in those of Weber and Chopin. His concerto in F minor is frequently played on the Continent; and of his many valuable studies, *Si oiseau j'étais* is almost hackneyed. His A minor trio deserves to be better known. At one time Henselt was second to Rubinstein in the direction of the St Petersburg Conservatorium.

(R. H. L.)

Henzada, a district of Lower Burma, formerly in the Pegu, but now in the Irrawaddy division. Area, 2886 square miles. Population (1891), 438,131; (1901), 484,774. There were, in 1899, 1329 villages, which paid a revenue of Rs.15,06,834. Of the population 419,639 were Buddhists and Jains, 2781 Hindus, 2364 Mahommedans, and 13,372 Christians, 13,234 of whom were natives, chiefly Karens, besides 4 Parsis and 9 non-Christian Karens. Of a total area of 1,847,040 acres, 459,870 acres were cultivated in 1899, 989,314 acres were not available for cultivation, and 182,829 acres other than fallow were cultivable, but not cultivated. The rainfall in 1898–99, taken at Henzada, was 77·96 inches. The bulk of the cultivation is rice, but 6179 acres were under tobacco. The chief town of the district is HENZADA, which had in 1899 a population of 19,762. It is a municipal town, with ten elective and three *ex-officio* members. It has a third-class district jail, capable of holding 311 prisoners. Other municipal towns in the district are Zalun, with a population of 6006; Myanaung, with a population of 5489; and Kyangin,

with a population of 8116, according to the 1891 census. The village of Lemyethna had a population of 5614. The steamers of the Irrawaddy Flotilla Company call at Henzada and Myanaung. (J. G. SC.)

Heppenheim, a town of Germany, grand-duchy of Hesse-Darmstadt, on the Bergstrasse, between Darmstadt and Heidelberg, 21 miles north of the latter by rail. It possesses a parish church which is reputed to have been built originally by Charlemagne about 805, a large lunatic asylum, and an interesting town hall. On an isolated hill close by stand the extensive ruins of the castle of Starkenburg, built by the abbot of Lorsch in 1064. Hops, wine, and tobacco are grown, and there are large stone quarries. Population (1900), 5777.

Herat.—The Afghan province of Herat, including the valley of the Heri (or Hari) Rud, was carefully surveyed during the progress of the Russo-Afghan Boundary Commission in 1884–85–86, when the dominating fortress of Herat was strengthened and extended for possible defence against Russia. The position of the city was then found to be a little to the south and east of the point previously assigned to it. It lies in 34° 20′ 30″ N. and 62° 11′ 0″ E., at an altitude of 2500 feet above sea-level. The long narrow valley of the Heri Rud, starting from the western slopes of the Koh-i-Baba, extends almost due west for 300 miles before it takes its great northern bend at Kuhsán, and passes northwards through the broken ridges of the Siah Bubuk (the western extremity of the range which we now call Paropamisus) towards Sarakhs. For the greater part of its length it drains the southern slopes only of the Paropamisus and the northern slopes of a parallel range called Koh-i-Safed. The Paropamisus forms the southern face of the Turkestan plateau, which contains the sources of the Murghab river; the northern face of the same plateau is defined by the Band-i-Turkestan. On the south of the plateau we find a similar succession of narrow valleys dividing parallel flexures, or anticlinals, formed under similar geological conditions to those which appear to be universally applicable to the Himalaya, the Hindu Kush, and the Indus frontier mountain systems. From one of these long lateral valleys the Heri Rud receives its principal tributary, which joins the main river below Obeh, 180 miles from its source; and it is this tributary (separated from the Heri Rud by the narrow ridges of the Koh-i-Safed and Band-i-Baián) that offers the high road from Herat to Kabul, and not the Heri Rud itself. From its source to Obeh the Heri Rud is a valley of sandy desolation. There are no glaciers near its sources, although they must have existed there in geologically recent times, but masses of melting snow annually give rise to floods, which rush through the midst of the valley in a turbid red stream, frequently rendering the river impassable and cutting off the crazy brick bridges at Herat and Tirpul. It is impossible, whilst watching the rolling, seething volume of flood-water which swirls westwards in April, to imagine the waste stretches of dry river bed which in a few months' time (when every available drop of water is carried off for irrigation) will represent the Heri Rud. The soft shales or clays, of the hills bounding the valley render these hills especially subject to the action of denudation, and the result, in rounded slopes and easily accessible crests, determines the nature of the easy tracks and passes which intersect them. At the same time, any excessive local rainfall is productive of difficulty and danger from the floods of liquid mud and loose boulders which sweep like an avalanche down the hill sides. It was a sudden storm of this nature which led to the disaster on the Chashma Sabz pass in April 1885, when the British Boundary Commission lost a company of mule-drivers and much valuable property. The intense cold which usually accompanies these sudden northern blizzards of Herat and Turkestan is a further source of danger.

From Obeh, 50 miles east of Herat, the cultivated portion of the valley commences, and it extends, with a width which varies from 8 to 16 miles, to Kuhsán, 60 miles west of the city. But the great stretch of highly irrigated and valuable fruit-growing land, which appears to spread from the walls of Herat east and west as far as the eye can reach, and to sweep to the foot of the hills north and south with an endless array of vineyards and melon-beds, orchards and villages, varied with a brilliant patchwork of poppy growth brightening the width of green wheat-fields with splashes of scarlet and purple—all this is really comprised within a narrow area which does not extend beyond a ten-miles' radius from the city. The system of irrigation by which these agricultural results are attained is most elaborate. The despised Herati Tajak, in blue shirt and skull-cap, and with no instrument better than a three-cornered spade, is as skilled an agriculturist as is the Ghilzai engineer, but he cannot effect more than the limits of his water-supply will permit. He adopts the Karez (or, Persian, *Kanát*) system of underground irrigation, as does the Ghilzai in Afghanistan, and brings every drop of water that he can find to the surface; but it cannot be said that he is more successful than the Ghilzai. It is the startling contrast of the Herati oasis with the vast expanse of comparative sterility that encloses it which has given such a fictitious value to the estimates of the material wealth of the valley of the Heri Rud.

The valley about Herat includes a flat alluvial plain which might, for some miles on any side except the north, be speedily reduced to an impassable swamp by means of flood-water from the surrounding canals. Three miles to the south of the city the river flows from east to west, spanned by the Pal-i-Malún, a bridge possessing grand proportions, but which was in 1885 in a state of grievous disrepair and practically useless. East and west stretches the long vista of the Heri Rud. Due north the hills called the Koh-i-Mulla Khwaja appear to be close and dominating, but the foot of these hills is really about 3 miles distant from the city. Under the shadow of them stands the world-famed Ziarat of Gazargarh, the last resting-place of the greatest of Afghan rulers, Dost Mahomed Khan. This northern line of barren, broken sandstone hills is geographically no part of the Paropamisus range, from which it is separated by a stretch of sandy upland about 20 miles in width, called the Dasht-i-Hamdamao, or Dasht-i-Ardewán, formed by the talus or drift of the higher mountains, which, washed down through centuries of denudation, now forms long sweeping spurs of gravel and sand, scantily clothed with wormwood scrub and almost destitute of water. Through this stretch of *dasht* the drainage from the main water-divide breaks downwards to the plains of Herat, where it is arrested and utilized for irrigation purposes. To the north-east of the city a very considerable valley has been formed between the Paropamisus and the subsidiary Koh-i-Mulla Khwaja range, called Korokh. Here there are one or two important villages and a well-known shrine marked by a group of pine trees which is unique in this part of Afghanistan. The valley leads to a group of passes across the Paropamisus into Turkestan, of which the Zirmast is perhaps the best known.

Paropamisus.—The main water-divide between Herat and the Turkestan Chol (the loess district) has been called Paropamisus for want of any well-recognized general

name. To the north of the Korokh valley it exhibits something of the formation of the Hindu Kush (of which it is apparently a geological extension), but as it passes westwards it becomes broken into fragments by processes of denudation, until it is hardly recognizable as a distinct range at all. The direct passes across it from Herat (the Baba and the Ardewán) wind amongst masses of disintegrating sandstone for some miles on each side of the dividing water-shed, but farther west the rounded knolls of the rain-washed downs may be crossed almost at any point without difficulty. The names applied to this débris of a once formidable mountain system are essentially local and hardly distinctive. Beyond this range the sand and clay loess formation spreads downwards like a tumbled sea, hiding within the folds of its many-crested hills the twisting course of the Kushk and its tributaries.

Kushk.—The exact position of Herat, with reference to the Russian station of Kushk (now the terminus of a branch railway from Merv), is as follows:—From Herat, a gentle ascent northwards for 3 miles reaches to the foot of the Koh-i-Mulla Khwaja, crossing the Jui Nao or "new" canal, which here divides the gravel-covered foot hills from the alluvial flats of the Heri Rud plain. The crest of the outer ridges of this subsidiary range is about 700 feet above the city, at a distance of 4 miles from it. For 28 miles farther the road winds first amongst the broken ridges of the Koh-i-Mulla Khwaja, then over the intervening *dasht* into the southern spurs of the Paropamisus to the Ardewán pass. This is the highest point it attains, and it has risen about 2150 feet from Herat. From the pass it drops over the gradually decreasing grades of a wide sweep of Chol (which here happens to be locally free from the intersecting network of narrow ravines which is generally a distinguishing feature of Turkestan loess formations) for a distance of 35 miles into the Russian railway station, falling some 2700 feet from the crest of the Paropamisus.

City and Fortress of Herat.—The city and fortress of Herat were found in 1885 to differ in no very material degree from the city and fortress of 1845, and the description given in the ninth edition of this work is still fairly accurate. The bazaar was poor in 1885, and trade was slack. Even in the streets converging on the Charsu lines of shops were closed and business was at a standstill; but never, in the most flourishing circumstances, could the markets of Herat have ever rivalled those of Kandahar or Kabul. Within the walls of the city there is not a building which can claim any architectural distinction; the streets are narrow, closed in with high walls, and unutterably filthy; many of the highways are but tunnels, with roofs sagging beneath a weight of overcrowded mud tenements. So poor was the trade of the Herat bazaar that the business introduced by the Afghan Boundary Commission made a most appreciable difference in its appearance. By the spring of 1886 the shops were gay with Bokhara embroideries and silks and the carpets of Adraskand and Turkestan; the roof of the Charsu was almost in a state of repair, whilst a whole streetful of shopkeepers had again taken down their shutters and resumed business.

When the Royal Engineers of the Russo-Afghan Boundary Commission entered Herat in 1885 they found its defences in various stages of disrepair. The gigantic rampart was unflanked, and the covered ways in the face of it subject to enfilade from end to end. The ditch was choked, the gates were unprotected; the tumbled mass of irregular mud buildings which constituted the city clung tightly to the walls; there were no gun emplacements. Outside, matters were almost worse than inside. To the north of the walls the site of old Herat was indicated by a vast mass of débris—mounds of bricks and pottery intersected by a network of shallow trenches, where the only semblance of a protective wall was the irregular line of the Tal-i-Bangi. South of the city was a vast area filled in with the graveyards of centuries. Here the trenches dug by the Persians during the last siege were still in a fair state of preservation; they were within a stone's-throw of the walls. Round about the city on all sides were similar opportunities for close approach; even the villages stretched out long irregular streets towards the city gates. To the north-west, beyond the Tal-i-Bangi, the magnificent outlines of the Mosalla filled a wide space with the glorious curves of dome and gateway and the stately grace of tapering minars, but the impressive beauty of this, by far the finest architectural structure in all Afghanistan, could not be permitted to weigh against the fact that the position occupied by this pile of solid buildings was fatal to the interests of effective defence. By the end of August 1885, when a political crisis had supervened between Great Britain and Russia, under the orders of the Amir the Mosalla was destroyed; but four minars standing at the corners of the wide plinth still remain to attest to the glorious proportions of the ancient structure, and to exhibit samples of that decorative tilework, which for intricate beauty of design and exquisite taste in the blending of colour still appeals to the memory as unique. At the same time the ancient graveyards round the city were swept smooth and levelled; obstructions were demolished, outworks constructed, and the defences generally renovated. Whether or no the strength of this bulwark of North-Western Afghanistan should ever be practically tested, the general result of the most recent investigations into the value of Herat as a strategic centre has been largely to modify the once widely-accepted view that the key to India lies within it.

Since the Afghan Boundary Commission visited Herat very little has been written about it. Major C. E. YATE's *Northern Afghanistan* (London, 1888) contains much general information; but the exhaustive reports of the Boundary Commission have not been published. The above description is compiled from unpublished notes. (T. H. H*.)

Hérault, a department in the south of France, washed by the Mediterranean and traversed by the Cevennes mountains.

Area, 2403 square miles. The population increased from 439,044 in 1886 to 469,684 in 1896, and to 488,285 in 1901. Births in 1899 numbered 10,357, of which 526 were illegitimate, against 10,517 deaths; marriages numbered 3646. The department had in 1896 989 schools, with 56,000 pupils, and its illiterates form less than 1 per cent. of the population. The surface under cultivation amounts to 1,008,226 acres, of which 306,420 acres are arable and 415,150 acres vineyards. Hérault takes the first place among the departments for the manufacture of wine, as well for the abundance of its production, exceeding in 1899 12,300,000 hectolitres (270,600,000 gallons), as for its quality, which gave to the production the value of £9,393,000. Cereals and grass lands, on the other hand, give a very poor return, the olive yielding in 1899 £66,000, and the mulberry £7300; both thrive in this department, which also in 1898 produced 2451 cwts. of silk-worm cocoons. The live stock includes 22,130 horses, 10,610 mules, 6300 asses, 8360 cattle, 349,170 sheep, 20,000 goats, and 17,000 pigs. The mining industry in 1898 produced 201,000 metric tons of coal, 4000 tons of iron, and the salt-pans yielded 40,000 tons of salt. The industry in metals has, however, no large establishments. The distilleries manufactured in 1898 438,000 gallons of alcohol. The most populated places are Montpellier, the capital, with 76,364 inhabitants in 1901; Béziers, 52,077; and Cette, 33,065.

Heredia, José Maria de (1842- ——), the modern master of the French sonnet, was born at Fortuna Cafeyere, near Santiago de Cuba, on the 22nd November 1842, being in blood part Spanish Creole and part French. At the age of eight he came from the West Indies to

France, returning thence to Havana at seventeen, and finally making France his home not long afterwards. For some time he studied at the École des Chartes. In the later 'sixties, with M. Coppée, M. Sully-Prudhomme, Verlaine, and others less distinguished, he made one of the band of poets who gathered round Leconte de Lisle and took, or accepted, the name of Parnassiens. To this new school, form—the technical side of their art—was of supreme importance, and, in reaction against the influence of Musset, they rigorously repressed in themselves all personal feeling and emotion. "True poetry," said M. de Heredia in his discourse on entering the Academy—"true poetry dwells in nature and in humanity, which are eternal, and not in the heart of the creature of a day, however great." M. de Heredia's place in the movement was soon assured. He wrote very little, and published even less, but his sonnets circulated in MS., and gave him a reputation before they appeared in 1893, together with a few longer poems, as a volume, under the title of *Les Trophées*. He was elected to the Academy on the 22nd February 1894, in the place of Mazade, the publicist. Few purely literary men can have entered the Academy with credentials so small in quantity. A small volume of verse—a translation, with introduction, of Diaz del Castillo's *History of the Conquest of New Spain* (1878-81)—a translation of the life of the nun Alferez (1894), De Quincey's "Spanish Military Nun"—and one or two short pieces of occasional verse, and an introduction or so—this is but small literary baggage, to use the French expression. But the sonnets are of their kind among the most superb in modern literature. "A *Légende des siècles* in sonnets" M. Coppée has called them. Each presents a picture, striking, brilliant, drawn with unfaltering hand—the picture of some characteristic scene in man's long history. The verse is flawless, polished like a gem; and its sound has distinction and fine harmony. If one may suggest a fault, it is that each picture is sometimes too much of a picture only, and that the poetical line, like that of M. de Heredia's master, Leconte de Lisle himself, is occasionally overcrowded. M. de Heredia is none the less one of the most skilful craftsmen who have ever practised the art of verse.

Heredity.—Heredity is the name given to the generalization, drawn from the observed facts, that animals and plants closely resemble their progenitors. (That the resemblance is not complete involves in the first place the subject of Variation (*q.v.*); but it must be clearly stated that there is no adequate ground for the current loose statements as to the existence of opposing "laws" or "forces" of heredity and variation.) In the simplest cases there seems to be no separate problem of heredity. When a creeping plant propagates itself by runners, when a Nais or Myrianida breaks up into a series of similar segments, each of which becomes a worm like the parent, we have to do with the general fact that growing organisms tend to display a symmetrical repetition of equivalent parts, and that reproduction by fission is simply a special case of metamerism. When we try to answer the question why the segments of an organism resemble one another, whether they remain in association to form a segmented animal, or break into different animals, we come to the conclusion, which at least is on the way to an answer, that it is because they are formed from pieces of the same protoplasm, growing under similar conditions. It is apparently a fundamental property of protoplasm to be able to multiply by division into parts, the properties of which are similar to each other and to those of the parent.

This leads us directly to the cases of reproduction where there is an obvious problem of heredity. In the majority of cases among animals and plants the new organisms arise from portions of living matter, separated from the parents, but different from the parents in size and structure. These germs of the new organisms may be spores, reproductive cells, fused reproductive cells, or multicellular masses (see REPRODUCTION). For the present purpose it is enough to state that they consist of nucleated masses of protoplasm known as cells. These pass through an embryological history, in which by growth, multiplication, and specialization they form structures closely resembling the parents. Now, if it could be shown that these reproductive masses arose directly from the reproductive masses which formed the parent body, the problems of heredity would be extremely simplified. If the first division of a reproductive cell set apart one mass to lie dormant for a time and ultimately to form the reproductive cells of the new generation, while the other mass, exactly of the same kind, developed directly into the new organism, then heredity would simply be a delayed case of what is called organic symmetry, the tendency of similar living material to develop in similar ways under the stimulus of similar external conditions. The cases in which this happens are very rare. In the Diptera the first division of the egg-cell separates the nuclear material of the subsequent reproductive cells from the material that is elaborated into the new organism to contain these cells. In the Daphnidæ and in Sagitta a similar separation occurs at slightly later stages; in Vertebrates it occurs much later; while in some Hydroids the germ-cells do not arise in the individual which is developed from the egg-cell at all, but in a much later generation, which is produced from the first by budding. However, it is not necessary to dismiss the fertile idea of what Nussbaum and Weismann, who drew attention to it, called "continuity of the germ-plasm." Weismann has shown that an actual series of organic forms might be drawn up in which the formation of germ-cells begins at stages successively more remote from the first division of the egg-cell. He has also shown evidence, singularly complete in the case of the Hydroids, for the existence of an actual migration of the place of formation of the germ-cells, the migration reaching farther and farther from the egg-cell. He has elaborated the conception of the germ-track, a chain of cell generations in the development of any creature along which the reproductive material saved over from the development of one generation for the germ-cells of the next generation is handed on in a latent condition to its ultimate position. And thus he supposes a real continuity of the germ-plasm, extending from generation to generation in spite of the apparent discontinuity in the observed cases. The conception certainly ranks among the most luminous and most fertile contributions of the 19th century to biological thought, and it is necessary to examine at greater length the superstructure which Weismann has raised upon it.

Weismann's Theory of the Germ-plasm.—A living being takes its individual origin only where there is separated from the stock of the parent a little piece of the peculiar reproductive plasm, the so-called germ-plasm. In sexless reproduction one parent is enough; in sexual reproduction equivalent masses of germ-plasm from each parent combine to form the new individual. The germ-plasm resides in the nucleus of cells, and Weismann identifies it with the nuclear material named chromatin. Like ordinary protoplasm, of which the bulk of cell bodies is composed, germ-plasm is a living material, capable of growing in bulk without alteration of structure when it is supplied with appropriate food. But it is a living material much more complex than protoplasm. In the first place, the mass of germ-plasm which is the starting-point of a new individual consists of several, sometimes of many, pieces named "idants," which are the chromosomes, into

a definite number of which the nuclear material of a dividing cell breaks up. These idants are a collection of "ids," which Weismann tentatively identifies with the microsomata contained in the chromosomes, which are visible after treatment with certain reagents. Each id contains all the possibilities—generic, specific, individual —of a new organism, or rather the directing substance which in appropriate surroundings of food, &c., forms a new organism. Each id is a veritable microcosm, possessed of a historic architecture that has been elaborated slowly through the multitudinous series of generations that stretch backwards in time from every living individual. This microcosm, again, consists of a number of minor vital units called "determinants," which cohere according to the architecture of the whole id. The determinants are hypothetical units corresponding to the number of parts of the organism independently variable. Lastly, each determinant consists of a number of smaller hypothetical units, the "biophores." These are adaptations of a conception of De Vries, and are supposed to become active by leaving the nucleus of the cell in which they lie, passing out into the general protoplasm of the cell and ruling its activities. Each new individual begins life as a nucleated cell, the nucleus of which contains germ-plasm of this complex structure derived from the parent. The reproductive cell gives rise to the new individual by continued absorption of food, by growth, cell-divisions, and cell-specializations. The theory supposes that the first divisions of the nucleus are "doubling," or homogeneous divisions. The germ-plasm has grown in bulk without altering its character in any respect, and, when it divides, each resulting mass is precisely alike. From these first divisions a chain of similar doubling divisions stretches along the "germ-tracks," so marshalling unaltered germ-plasm to the generative organs of the new individual, to be ready to form the germ-cells of the next generation. In this mode the continuity of the germ-plasm from individual to individual is maintained. This also is the immortality of the germ-cells, or rather of the germ-plasm, the part of the theory which has laid so large a hold on the popular imagination, although it is really no more than a reassertion in new terms of biogenesis. With this also is connected the celebrated denial of the inheritance of acquired characters. It seemed a clear inference that, if the hereditary mass for the daughters were separated off from the hereditary mass that was to form the mother, at the very first, before the body of the mother was formed, the daughters were in all essentials the sisters of their mother, and could take from her nothing of any characters that might be impressed on her body in subsequent development. In the later elaboration of his theory Weismann has admitted the possibility of some direct modification of the germ-plasm within the body of the individual acting as its host.

The mass of germ-plasm which is not retained in unaltered form to provide for the generative cells is supposed to be employed for the elaboration of the individual body. It grows, dividing and multiplying, and forms the nuclear matter of the tissues of the individual, but the theory supposes this process to occur in a peculiar fashion. The nuclear divisions are what Weismann calls "differentiating" or heterogeneous divisions. In them the microcosms of the germ-plasm are not doubled, but slowly disintegrated in accordance with the historical architecture of the plasm, each division differentiating among the determinants and marshalling one set into one portion, another into another portion. There are differences in the observed facts of nuclear division which tend to support the theoretical possibility of two sorts of division, but as yet these have not been correlated definitely with the divisions along the germ-tracks and the ordinary divisions of embryological organogeny. The theoretical conception is, that when the whole body is formed, the cells contain only their own kind of determinants, and it would follow from this that the cells of the tissues cannot give rise to structures containing germ-plasm less disintegrated than their own nuclear material, and least of all to reproductive cells which must contain the undisintegrated microcosms of the germ-plasm. Cases of bud-formation and of reconstructions of lost parts (see REGENERATION) are regarded as special adaptations made possible by the provision of latent groups of accessory determinants, to become active only on emergency.

It is to be noticed that Weismann's conception of the processes of ontogeny is strictly evolutionary, and in so far is a reversion to the general opinion of biologists of the 17th and 18th centuries. These supposed that the germ-cell contained an image-in-little of the adult, and that the process of development was a mere unfolding or evolution of this, under the influence of favouring and nutrient forces. Hartsoeker, indeed, went so far as to figure the human spermatozoon with a mannikin seated within the "head," and similar extremes of imagination were indulged in by other writers for the spermatozoon or ovum, according to the view they took of the relative importance of these two bodies. Wolff, in his *Theoria Generationis* (1759), was the first distinguished anatomist to make assault on these evolutionary views, but his direct observations on the process of development were not sufficient in bulk nor in clarity of interpretation to convince his contemporaries. Naturally the improved methods and vastly greater knowledge of modern days have made evolution in the old sense an impossible conception; we know that the egg is morphologically unlike the adult, that various external conditions are necessary for its subsequent progress through a slow series of stages, each of which is unlike the adult, but gradually approaching it until the final condition is reached. None the less, Weismann's theory supposes that the important determining factor in these gradual changes lies in the historical architecture of the germ-plasm, and from the theoretical point of view his theory remains strictly an unfolding, a becoming manifest of hidden complexity.

Hertwig's View.—The chief modern holder of the rival view, and the writer who has put together in most cogent form the objections to Weismann's theory, is Oscar Hertwig. He points out that there is no direct evidence for the existence of differentiating as opposed to doubling divisions of the nuclear matter, and, moreover, he thinks that there is very generally diffused evidence as to the universality of doubling division. In the first place, there is the fundamental fact that single-celled organisms exhibit only doubling division, as by that the persistence of species which actually occurs alone is possible. In the case of higher plants, the widespread occurrence of tissues with power of reproduction, the occurrence of budding in almost any part of the body in lower animals and in plants, and the widespread powers of regeneration of lost parts, are easily intelligible if every cell like the egg-cell has been formed by doubling division, and so contains the germinal material for every part of the organism, and thus, on the call of special conditions, can become a germ-cell again. He lays special stress on those experiments in which the process of development has been interfered with in various ways at various stages, as showing that the cells which arise from the division of the egg-cell were not predestined unalterably for a particular rôle, according to a predetermined plan. He dismisses Weismann's suggestion of the presence of accessory determinants which remain latent unless they happen to be required,

as being too complicated a supposition to be supported without exact evidence, a view in which he has received strong support from those who have worked most at the experimental side of the question. From consideration of a large number of physiological facts, such as the results of grafting, transplantations of tissues, and transfusions of blood, he concludes that the cells of an organism possess, in addition to their patent microscopical characters, latent characters peculiar to the species, and pointing towards a fundamental identity of the germinal substance in every cell.

The Nuclear Matter.—Apart from these two characteristic protagonists of extreme and opposing views, the general consensus of biological opinion does not take us very far beyond the plainest facts of observation. The resemblances of heredity are due to the fact that the new organism takes its origin from a definite piece of the substance of its parent or parents. This piece always contains protoplasm, and as the protoplasm of every animal and plant appears to have its own specific reactions, we cannot exclude this factor; indeed many, following the views of Verworn, and seeing in the specific metabolisms of protoplasm a large part of the meaning of life, attach an increasing importance to the protoplasm in the hereditary mass. Next, it always contains nuclear matter, and, in view of the extreme specialization of the nuclear changes in the process of maturation and fertilization of the generative cells, there is more than sufficient reason for believing that the nuclear substance, if not actually the specific germ-plasm, is of vast importance in heredity. The theory of its absolute dominance depends on a number of experiments, the interpretation of which is doubtful. Nussbaum showed that in Infusoria non-nucleated fragments of a cell always died, while nucleated fragments were able to complete themselves; but it may be said with almost equal confidence that nuclei separated from protoplasm also invariably die—at least, all attempts to preserve them have failed. Hertwig and others, in their brilliant work on the nature of fertilization, showed that the process always involved the entrance into the female cell of the nucleus of the male cell, but we now know that part of the protoplasm of the spermatozoon also enters. Boveri made experiments on the cross-fertilization of non-nucleated fragments of the eggs of *Sphærechinus granularis* with spermatozoa of *Echinus microtuberculatus*, and obtained dwarf larvæ with only the paternal characters; but the nature of his experiments was not such as absolutely to exclude doubt. Finally, in addition to the nucleus and the protoplasm, another organism of the cell, the centrosome, is part of the hereditary mass. In sum, while most of the evidence points to a preponderating importance of the nuclear matter, it cannot be said to be an established proposition that the nuclear matter is the germ-plasm. Nor are we yet definitely in a position to say that the germinal mass (nuclear matter, protoplasm, &c., of the reproductive cells) differs essentially from the general substance of the organism—whether, in fact, there is continuity of *germ-plasm* as opposed to continuity of living material from individual to individual. The origin of sexual cells from only definite places, in the vast majority of cases, and such phenomena as the phylogenetic migration of their place of origin among the Hydromedusæ, tell strongly in favour of Weismann's conception. Early experiments on dividing eggs, in which, by separation or transposition, cells were made to give rise to tissues and parts of the organism which in the natural order they would not have produced, tell strongly against any profound separation between germ-plasm and body-plasm. It is also to be noticed that the failure of germ-cells to arise except in specific places may be only part of the specialized ordering of the whole body, and does not necessarily involve the interpretation that reproductive material is absolutely different in kind.

Amphimixis.—Hitherto we have considered the material bearer of heredity apart from the question of sexual union, and we find that the new organism takes origin from a portion of living matter, forming a material which may be called germ-plasm, in which resides the capacity to correspond to the same kind of surrounding forces as stimulated the parent germ-plasm by growth of the same fashion. In many cases (*e.g.*, asexual spores) the piece of germ-plasm comes from one parent, and from an organ or tissue not associated with sexual reproduction; in other cases (parthenogenetic eggs) it comes from the ovary of a female, and may have the apparent characters of a sexual egg, except that it develops without fertilization. In such cases the problem of heredity does not differ fundamentally from the symmetrical repetition of parts. In most of the higher plants and animals, however, sexual reproduction is the normal process, and from our present point of view the essential feature of this is that the germ-plasm which starts the new individual (the fertilized egg) is derived from the male (the spermatozoon) and from the female parent (the ovum). Although it cannot yet be set down sharply as a general proposition, there is considerable evidence to show that in the preparation of the ovum and spermatozoon for fertilization the nuclear matter of each is reduced by half (reducing division of the chromosomes), and that fertilization means the restoration of the normal bulk in the fertilized cell by equal contributions from male and female. So far as the known facts of this process of union of germ-plasms go, they take us no farther than to establish such a relation between the offspring and two parents as exists between the offspring and one parent in the other cases. Amphimixis has a vast importance in the theory of evolution (Weismann, for instance, regards it as the chief factor in the production of variations); for its relation to heredity we are as yet dependent on empirical observations.

Heredity and Development.—The actual process by which the germinal mass slowly assumes the characters of the adult—that is, becomes like the parent—depends on the interaction of two sets of factors: the properties of the germinal material itself, and the influences of substances and conditions external to the germinal material. Naturally, as Naegeli and Hertwig in particular have pointed out, there is no perpetual sharp contrast between the two sets of factors, for, as growth proceeds, the external is constantly becoming the internal; the results of influences, which were in one stage part of the environment, are in the next and subsequent stages part of the embryo. The differences between the exponents of evolution and epigenesis offer practical problems to be decided by experiment. Every phenomenon in development that is proved the direct result of epigenetic factors can be discounted from the complexity of the germinal mass. If, for instance, as Driesch and Hertwig have argued, much of the differentiation of cells and tissues is a function of locality and is due to the action of different external forces on similar material, then just so much burden is removed from what evolutionists have to explain. That much remains cannot be doubted. Two eggs similar in appearance develop side by side in the same sea-water, one becoming a mollusc, the other an Amphioxus. Hertwig would say that the slight differences in the original eggs would determine slight differences in metabolism and so forth, with the result that the segmentation of the two is slightly different; in the next stage the differences in metabolisms and other relations will be increased, and so on indefinitely. But in such cases *c'est le premier pas qui coûte*, and the absolute cost in theoretical complexity of

the germinal material can be estimated only after a prolonged course of experimental work in a field which is as yet hardly touched.

Empirical Study of Heredity.—The fundamental basis of heredity is the separation of a mass from the parent (germ-plasm) which under certain conditions grows into an individual resembling the parent. The goal of the study of heredity will be reached only when all the phenomena can be referred to the nature of the germ-plasm and of its relations to the conditions under which it grows, but we have seen how far our knowledge is from any attempt at such references. In the meantime, the empirical facts, the actual relations of the characters in the offspring to the characters of the parents and ancestors, are being collected and grouped. In this inquiry it at once becomes obvious that every character found in a parent may or may not be present in the offspring. When any character occurs in both, it is generally spoken of as transmissible and of having been transmitted. In this broad sense there is no character that is not transmissible. In all kinds of reproduction, the characters of the class, family, genus, species, variety or race, and of the actual individual, are transmissible, the certainty with which any character appears being almost in direct proportion to its rank in the descending scale from order to individual. The transmitted characters are anatomical, down to the most minute detail; physiological, including such phenomena as diatheses, timbre of voice, and even compound phenomena, such as gaucherie and peculiarity of handwriting; psychological; pathological; teratological, such as syndactylism and all kinds of individual variations. Either sex may transmit characters which in themselves are necessarily latent, as, for instance, a bull may transmit a good milking strain. In forms of asexual reproduction, such as division, budding, propagation by slips, and so forth, every character of the parent may appear in the descendant, and apparently even in the descendants produced from that descendant by the ordinary sexual processes. In reproduction by spore formation, in parthenogenesis and in ordinary sexual modes, where there is an embryological history between the separated mass and the new adult, it is necessary to attempt a difficult discrimination between acquired and innate characters.

Acquired Characters.—Every character is the result of two sets of factors, those resident in the germinal material and those imposed from without. Our knowledge has taken us far beyond any such idea as the formation of a germinal material by the collection of particles from the adult organs and tissues (gemmules of Darwin). The inheritance of any character means the transmission in the germinal material of matter which, brought under the necessary external conditions, develops into the character of the parent. There is necessarily an acquired or epigenetic side to every character; but there is nothing in our knowledge of the actual processes to make necessary or even probable the supposition that the result of that factor in one generation appears in the germ-plasm of the subsequent generations, in those cases where an embryological development separates parent and offspring. The development of any normal, so-called "innate," character, such as, say, the assumption of the normal human shape and relations of the frontal bone, requires the co-operation of many factors external to the developing embryo, and the absence of abnormal distorting factors. When we say that such an innate character is transmitted, we mean only that the germ-plasm has such a constitution that, in the presence of the epigenetic factors and the absence of abnormal epigenetic factors, the bone will appear in due course and in due form. If an abnormal epigenetic factor be applied during development, whether to the embryo *in utero*, to the developing child, or in after life, abnormality of some kind will appear in the bone, and such an abnormality is a good type of what is spoken of as an "acquired" character. Naturally such a character varies with the external stimulus and the nature of the material to which the stimulus is applied, and probability and observation lead us to suppose that as the germ-plasm of the offspring is similar to that of the parent, being a mass separated from the parent, abnormal epigenetic influences would produce results on the offspring similar to those which they produced on the parent. Scrutiny of very many cases of the supposed inheritance of acquired characters shows that they may be explained in this fashion—that is to say, that they do not necessarily involve any feature different in kind from what we understand to occur in normal development. The effects of increased use or of disuse on organs or tissues, the reactions of living tissues to various external influences, to bacteria, to bacterial or other toxins, or to different conditions of respiration, nutrition, and so forth, we know empirically to be different in the case of different individuals, and we may expect that when the living matter of a parent responds in a certain way to a certain external stimulus, the living matter of the descendant will respond to similar circumstances in a similar fashion. The operation of similar influences on similar material accounts for a large proportion of the facts. In the important case of the transmission of disease from parent to offspring it is plain that three sets of normal factors may operate, and other cases of transmission must be subjected to similar scrutiny: (1) a child may inherit the anatomical and physiological constitution of either parent, and with that a special liability of failure to resist the attacks of a widespread disease; (2) the actual bacteria may be contained in the ovum or possibly in the spermatozoon; (3) the toxins of the disease may have affected the ovum, or the spermatozoon, or through the placenta the growing embryo. Obviously in the first two cases the offspring cannot be said in any strict sense to have inherited the disease; in the last case, the theoretical nomenclature is more doubtful, but it is at least plain that no inexplicable factor is involved.

It is to be noticed, however, that "Lamarckians" and "Neo-Lamarckians" in their advocacy of an inheritance of "acquired characters" make a theoretical assumption of a different kind, which applies equally to "acquired" and to "innate" characters. They suppose that the result of the epigenetic factors are reflected on the germ-plasm in such a mode that in development the products would display the same or a similar character without the co-operation of the epigenetic factors on the new individual, or would display the result in an accentuated form if with the renewed co-operation of the external factors. Such an assumption presents its greatest theoretical difficulty if, with Weismann, we suppose the germ-plasm to be different in kind from the general soma-plasm, and its least theoretical difficulty if, with Hertwig, we suppose the essential matter of the reproductive cells to be similar in kind to the essential substance of the general body cells. But, apart from the differences between such theories, it supposes, in all cases where an embryological development lies between parent and descendant, the existence of a factor towards which our present knowledge of the actual processes gives us no assistance. The separated hereditary mass does not contain the organs of the adult; the Lamarckian factor would involve the translation of the characters of the adult back into the characters of the germ-cell in such a fashion that when the germ-cell developed these characters would be re-translated again into those which originally had been produced by co-operation between germ-plasm characters and epigenetic factors. In the present state of our

knowledge the theoretical difficulty is not fatal to the Lamarckian supposition; it does no more than demand a much more careful scrutiny of the supposed cases. Such a scrutiny has been going on since Weismann first raised the difficulty, and the present result is that no known case has appeared which cannot be explained without the Lamarckian factor, and the vast majority of cases have been resolved without any difficulty into the ordinary events of which we have full experience. Taking the empirical data in detail, it would appear first that the effects of single mutilations are not inherited. The effects of long-continued mutilations are not inherited, but Darwin cites as a possible case the Mahommedans of Celebes, in whom the prepuce is very small. Brown-Séquard thought that he had shown in the case of guinea-pigs the inheritance of the results of nervous lesions, but analyses of his results leave the question extremely doubtful. The inheritance of the effects of use and disuse is not proved. The inheritance of the effects of changed conditions of life is quite uncertain. Naegeli grew Alpine plants at Munich, but found that the change was produced at once and was not increased in a period of thirteen years. De Candolle starved plants, with the result of producing better blooms, and found that seedlings from these were also above the average in luxuriance of blossom, but in these experiments the effects of selection during the starvation, and of direct effect on the nutrition of the seeds, were not eliminated. Such results are typical of the vast number of experiments and observations recorded. The empirical issue is doubtful, with a considerable balance against the supposed inheritance of acquired characters.

Empirical Study of Effects of Amphimixis.—Inheritance is theoretically possible from each parent and from the ancestry of each. In considering the total effect it is becoming customary to distinguish between "blended" inheritance, where the offspring appears in respect of any character to be intermediate between the conditions in the parents; "prepotent" inheritance, where one parent is supposed to be more effective than the other in stamping the offspring (thus, for instance, Negroes, Jews, and Chinese are stated to be prepotent in crosses); "exclusive" inheritance, where the character of the offspring is definitely that of one of the parents. Such a classification depends on the interpretation of the word character, and rests on no certain grounds. An apparently blended character or a prepotent character may on analysis turn out to be due to the inheritance of a certain proportion of minuter characters derived exclusively from either parent. De Vries, arguing from experiments on plant hybrids, declares that no real mingling exists, but that the hybrids possess, in a simple form, some of the characters of each. He believes that characters must be analysed into ultimate units, and that when this is done the hybrid will be found never to exhibit the character of one parent (absent in the other) in a reduced form, but simply to have it or not to have it, and he obtained extremely interesting experimental results in support of his view. (For further details as to inheritance in crosses see HYBRIDISM.) Even leaving out of the question the actual interpretation of "character," there is a still greater difficulty, a fundamental one, in making empirical comparisons between the characters of parents and offspring. At first sight it seems as if this mode of work were sufficiently direct and simple, and involved no more than a mere collection of sufficient data. The cranial index, or the height of a human being and of so many of his ancestors being given, it would seem easy to draw an inference as to whether or no in these cases brachycephaly or stature were inherited. But our modern conceptions of the individual and the race make it plain that the problems are not so simple. With regard to any character, the race type is not a particular measurement, but a curve of variations derived from statistics, and any individual with regard to the particular character may be referable to any point of the curve. A tall race like the modern Scots may contain individuals of any height within the human limits; a dolichocephalic race like the modern Spaniards may contain extremely round-headed individuals. What is meant by saying that the one race is tall or the other dolichocephalic, is merely that if a sufficiently large number be chosen at random, the average height of the one race will be great, the cranial index of the other low. It follows that the study of variation must be associated with, or rather must precede, the empirical study of heredity, and we are beginning to know enough now to be certain that in both cases the results to be obtained are practically useless for the individual case, and of value only when large masses of statistics are collected. No doubt, when general conclusions have been established, they must be acted on for individual cases, but the results can be predicted not for the individual case, but only for the average of a mass of individual cases. It is impossible within the limits of this article to discuss the mathematical conceptions involved in the formation and applications of the method, but it is necessary to insist on the fact that these form an indispensable part of any valuable study of empirical data. One interesting conclusion, which may be called the "ancestral law" of heredity, with regard to any character, such as height, which appears to be a blend of the male and female characters, whether or no the apparent blend is really due to an exclusive inheritance of separate components, may be given from the work of Galton and Pearson. Each parent, on the average, contributes $\frac{1}{4}$ or $(0{\cdot}5)^2$, each grandparent $\frac{1}{16}$ or $(0{\cdot}5)^4$, and each ancestor of n^{th} place $(0{\cdot}5)^{2n}$. But, this, like all other deductions, is applicable only to the mass of cases and not to any individual case.

Regression.—An important result of the quantitative work brings into prominence the steady tendency to maintain the type which appears to be one of the most important results of amphimixis. In the tenth generation a man has 1024 tenth grandparents, and is thus the product of an enormous population, the mean of which can hardly differ from that of the general population. Hence this heavy weight of mediocrity produces regression or progression to type. Thus in the case of height, a large number of cases being examined, it was found that fathers of a stature of 72 inches had sons with a mean stature of 70·8 inches, a regression towards the normal stature of the race. Fathers with a stature of 66 inches had sons with a mean of 68·3 inches, a progression towards the normal. It follows from this that where there is much in-and-in breeding the weight of mediocrity will be less, and the peculiarities of the breed will be accentuated.

Atavism.—Under this name a large number of ordinary cases of variation are included. A tall man with very short parents would probably be set down as a case of atavism if the existence of a very tall ancestor were known. He would, however, simply be a case of normal variation, the probability of which may be calculated from a table of stature variations in his race. Less marked cases set down to atavism may be instances merely of normal regression. Many cases of more abnormal structure, which are really due to abnormal embryonic or post-embryonic development, are set down to atavism, as, for instance, the cervical fistulæ, which have been regarded as atavistic persistences of the gill clefts. It is also used to imply the reversion that takes place when domestic varieties are set free and when species or

varieties are crossed (see HYBRIDISM). Atavism is, in fact, a misleading name covering a number of very different phenomena.

Telegony is the name given to the supposed fact that offspring of a mother to one sire may inherit characters from a sire with which the mother had previously bred. Although breeders of stock have a strong belief in the existence of this, there are no certain facts to support it, the supposed cases being more readily explained as individual variations of the kind generally referred to as "atavism." None the less, two theoretical explanations have been suggested: (1) that spermatozoa, or portions of spermatozoa, from the first sire may occasionally survive within the mother for an abnormally long period; (2) that the body, or the reproductive cells of the mother, may be influenced by the growth of the embryo within her, so that she acquires something of the character of the sire. The first supposition has no direct evidence to support it, and is made highly improbable from the fact that a second impregnation is always necessary. Against the second supposition Pearson brings the cogent empirical evidence that the younger children of the same sire show no increased tendency to resemble him. (See TELEGONY.)

AUTHORITIES.—The following books contain a fair proportion of the new and old knowledge on this subject:—BATESON. *Materials for the Study of Variation.* 1894.—DELAGE. *La Structure du Protoplasma et les Théories sur l'Hérédité* (a very full discussion and list of literature).—EIMER. *Organic Evolution.* English translation by Cunningham. 1890.—EWART. *The Penycuik Experiments.* 1899.—GALTON. *Natural Inheritance.* 1887.—HERTWIG. *Evolution or Epigenesis?* English translation by Chalmers Mitchell. 1896.—PEARSON. *The Grammar of Science.* 1900. VERWORN. *General Physiology.* English translation. 1899. WEISMANN. *The Germ Plasm.* English translation by Parker. 1893.—Lists of separate papers are given in the annual volumes of the *Zoological Record* under heading "General Subject."

(P. C. M.)

Hereford, a municipal and parliamentary borough, railway station, ancient city, and county town of Herefordshire, England, on the river Wye, 144 miles from London by rail. Since 1885 its parliamentary representation has been reduced to one member. A musical festival of the choirs of Hereford, Gloucester, and Worcester cathedrals is held annually in rotation at these cities. The new gardens and public walk were opened in 1893. A suspension bridge for foot passengers across the river Wye was opened in 1897 as a memorial of Queen Victoria's Diamond Jubilee. The corporation commenced the supply of electricity in 1899. Area of borough, 5037 acres. Population (1881), 19,821; (1900), 21,382.

Herefordshire, a west midland county of England, bounded on the W. by Brecknock and Radnor in Wales, on the N. by Shropshire, on the W. by Worcester, and on the S. by Gloucester and Monmouth.

Area and Population.—The area of the ancient and administrative county, as given in the census returns of 1891, is 537,363 acres, or 840 square miles, with a population in 1881 of 121,249. and in 1891 of 115,949, of whom 56,090 were males and 59,859 females, the number of persons per square mile being 138, and of acres to a person 4·63. In 1894 the boundary of the administrative county was altered by a transference from Worcester, and a transference to Monmouth; in 1895 the parts of the parish of Leintwardine in Salop were transferred to Hereford; and in 1897 the parishes of Acton, Beauchamp, and Mathon Rural were transferred from Worcester to Hereford, and part of the parish of Cradley and the parish of Stoke Bliss from Hereford to Worcester. The area of the registration county is 535,846 acres, with a population in 1891 of 113,346, of which 32,427 were urban and 80,919 rural. Within the registration area the decrease of population between 1881 and 1891 was 3·93 per cent. Between 1881 and 1891 the excess of births over deaths was 11,374, but the decrease in population was 4642. In 1901 the population of the ancient county was 114,401.

The following table gives the numbers of marriages, births, and deaths, with the number of illegitimate births, for 1880, 1890, and 1898:—

Year.	Marriages.	Births.	Deaths.	Illegitimate Births.	
				Males.	Females.
1880	673	3420	2084	136	116
1890	708	2998	1943	106	93
1898	691	2814	1895	117	102

The number of marriages in 1899 was 759, of births 2808, and of deaths 1881.

The following table gives the marriage-, birth-, and death-rates per 1000 of the resident population, with the percentage of illegitimate births, for a series of years:—

	1870–79.	1880.	1880–89.	1890.	1888–97.	1898.
Marriage-rate .	11·6	11·3	11·6	12·4	12·9	12·6
Birth-rate .	28·9	28·8	27·3	26·3	26·8	25·7
Death-rate .	18·6	17·5	17·3	17·1	17·6	17·3
Percentage of Illegitimacy .	7·3	7·4	7·7	6·6	7·2	7·8

The marriage-, birth-, and death-rates are all much below the average, but the percentage of illegitimate births is much above it, as is usually the case in rural counties. In 1891 the natives of Scotland in the county numbered 2610, the natives of Ireland 4409, and foreigners 1717.

Constitution and Government.—The ancient county is divided into two parliamentary divisions, and it also includes the parliamentary borough of Hereford, returning one member. There are two municipal boroughs: Hereford (21,382) and Leominster (5826). The urban districts are Bromyard (1663), Kington (1953), Ledbury (3259), and Ross (3302). The county is in the Oxford circuit, and assizes are held at Hereford. The boroughs of Hereford and Leominster have separate commissions of the peace, and the borough of Hereford has in addition a separate court of quarter-sessions. The ancient county, which is almost entirely in the diocese of Hereford, contains 200 entire ecclesiastical parishes or districts, and parts of 20 others.

Education.—The number of elementary schools on 31st August 1899 was 191, of which 30 were board and 161 voluntary schools, the latter including 150 National Church of England schools, 4 Roman Catholic, and 7 "British and other." The average attendance at board schools was 3203, and at voluntary schools 12,432. The total school board receipts for the year ended 29th September 1898 were £11,160. The income under the Agricultural Rates Act was over £1041.

Agriculture.—About four-fifths of the total area of the county is under cultivation, and about two-thirds of this is in permanent pasture. Nearly 27,000 acres are under orchards—chiefly of apples and pears—the county, notwithstanding its much smaller area, ranking in this respect next to Devon. Over 40,000 acres are under woods, much of which is oak, and about 600 acres are under small fruit. About three-eighths of the total acreage under corn crops, which has largely diminished, is still occupied by wheat, but since 1880 its acreage has diminished by more than one-third; barley has decreased in acreage almost in proportion to the increase of the acreage under oats, which now occupies second place. Turnips occupy about three-fourths of the acreage under green crops, and both mangolds and vetches are also largely grown. About 7000 acres are under hops. The following table gives the main divisions of the cultivated area at intervals from 1880:—

Year.	Total area under Cultivation.	Corn Crops.	Green Crops.	Clover.	Permanent Pasture.	Fallow.
1880	443,854	100,315	31,114	38,429	255,693	12,302
1885	446,621	89,377	33,106	43,126	267,364	6,936
1890	444,974	85,690	30,928	37,313	278,542	5,785
1895	445,306	73,665	27,569	42,371	288,565	4,795
1900	447,974	76,575	25,406	38,237	297,421	2,355

The following table gives the numbers of the principal live stock for the same years:—

Year.	Total Horses.	Total Cattle.	Cows or Heifers in Milk or in Calf.	Sheep.	Pigs.
1880	21,326	75,221	24,829	260,099	21,054
1885	23,114	90,713	32,293	315,068	27,275
1890	22,203	87,911	30,577	326,347	30,040
1895	24,144	88,632	29,413	318,593	33,626
1900	23,357	96,503	32,374	330,270	24,286

Industries and Trade.—There are no signs of any revival of manufacturing enterprise. According to the report for 1898 of the chief inspector of factories (1900), the total number of persons employed in factories and workshops in 1897 was 2428, as compared with 2192 in 1896; of these 1710 persons were employed in non-textile factories. Paper is manufactured. Limestone was raised in 1899 to the amount of 13,646 tons.

AUTHORITIES.—*Notes on the Birds of Hereford* (published by the Woolhope Field Club). Hereford, 1888; *Flora of Herefordshire*. Hereford, 1889.—COOKE. *Visitation of Herefordshire*, 1569. Exeter, 1886.—HAVERGAL. *Herefordshire Words and Phrases*. Walsall, 1887.—HUTCHINSON. *Herefordshire Biographies*. Hereford, 1890. —TIMMINS. *Nooks and Corners of Hereford*. London, 1892.

(T. F. H.)

Herford, a town of Prussia, province of Westphalia, on the Werra, 60 miles by rail west-south-west of Hanover and 9 miles north-east of Bielefeld. It is the seat of considerable linen, cotton, sugar, furniture, carpet, and other industries. It has an agricultural school. Population (1885), 15,902; (1900), 25,120.

Hergenroether, Joseph von (1824–1890), German cardinal, was born at Würzburg, in Bavaria, 15th September 1824. He studied at Würzburg and at Rome. He afterwards became parish priest at Zellingen near his native city, in 1851 teacher, and in 1855 professor of Common Law in the University of Munich. Here he gained the reputation of being one of the most learned theologians on the Ultramontane side of the Infallibility question, which had begun to be discussed. In 1868 he was sent to Rome to arrange the proceedings of the Vatican Council. In 1870 he wrote *Anti-Janus*, an answer to the celebrated *Letters of Janus*, which made a great sensation at the time of the council. In 1877 he was made prelate of the Papal household; he became cardinal deacon in 1879, and was afterwards made curator of the Vatican archives. He wrote a standard and highly important life of Photius, Patriarch of Constantinople (1866–69), and he was also the author of a work on the Roman Catholic Church and the State in their historic development (Fribourg, 1872), a manual of Church history (1876), a sketch of the history of the Popes (Würzburg, 1879), and a life of Cardinal Maury (1878). He died in 1890. (J. J. L*.)

Heringsdorf, a seaside resort of Prussia, province of Pomerania, on the north coast of the island of Usedom, and 5 miles by rail north-west of Swinemünde. It is surrounded by beech woods, and is perhaps the most popular seaside resort on the German shore of the Baltic, being frequented by some 12,000 visitors annually.

Heri Rud. See HERAT.

Herisau, the largest town in the Swiss half-canton of Appenzell-Ausser-Rhoden, on the railway between Winkeln ($2\frac{1}{2}$ miles distant) and Appenzell ($13\frac{3}{4}$ miles distant). Its population (mainly Protestant and German-speaking) in 1901 was 13,518. It stands 2546 feet above the sea-level. Its church was built in 1516–20. The chief manufacture is that of muslins, and the town is by far the largest and most important in the entire canton.

Herkimer, capital of Herkimer county, New York, U.S.A., on the river Mohawk, on the Erie canal, and on the New York Central and Hudson River Railway. It is in a farming and dairy region. Population (1900), 5555, of whom 724 were foreign-born.

Herne, a town of Prussia, province of Westphalia, 15 miles by rail north-west of Dortmund. It has coal mines, boilerworks, gunpowder mills, &c. It was made a town in 1897. Population (1885), 9906; (1900), 27,999.

Herne Bay, a seaside resort of England, on the north coast of Kent, 62 miles by rail east from London, visited in summer by large numbers of London families. It has grown up since 1830, and has a somewhat pebbly beach, a pier nearly a mile long, and an esplanade. It has communication with London by steamboat, and in the season coaches run to Canterbury ($7\frac{1}{2}$ miles inland). Three miles to the east is Reculvers, the Roman *Regulbium*, a fortified camp for the protection of the Isle of Thanet. Its twin church towers are conspicuous objects, though the church was taken down, owing to the encroachments of the sea, in 1804. Bishop Ridley was at one time (16th century) vicar of Herne, the village behind Herne Bay. Population (1901), 6688.

Hernösand, a seaport town, on the east coast of Sweden, 3 miles south of the Ångerman river, connected by a branch line (70 miles) at Långsele with the main railway to the north of Sweden. It has an export trade in timber ($33\frac{1}{2}$ million cubic feet annually), iron, and wood-pulp. In 1900 the port was cleared by 783 vessels of 410,700 tons, but is, as a rule, closed by ice from the beginning of December to the beginning of May. Population (1890), 5789; (1900), 7890.

Herodas, or HERONDAS (for the name is spelt differently in the few places where he is mentioned), is the author of short humorous dramatic scenes in verse, written under the Alexandrian empire in the 3rd century B.C. Apart from the intrinsic merit of these pieces, they are interesting in the history of Greek literature as being a new species, illustrating Alexandrian methods. They are called Μιμίαμβοι, "Mime-iambics." Mimes were the Dorian product of South Italy and Sicily, and the most famous of them—from which Plato is said to have studied the drawing of character—were the work of Sophron. These were scenes in popular life, written in the language of the people, vigorous with racy proverbs such as we get in other reflections of that region—in Petronius and the *Pentamerone*. Two of the best known and the most vital among the "Idylls of Theocritus," the 2nd and the 15th, we know to have been derived from mimes of Sophron. What Theocritus is doing there, Herodas, his contemporary, is doing in another manner—casting old material into novel form, upon a small scale, under strict conditions of technique. The method is entirely Alexandrian: Sophron had written in a peculiar kind of rhythmical prose; Theocritus uses the hexameter and Doric, Herodas the "scazon" or "lame" iambic (with a dragging spondee at the end) and the old Ionic dialect with which that curious metre was associated. That, however, hardly goes beyond the choice and form of words; the structure of the sentences is close-knit Attic. But the grumbling metre and quaint language suit the tone of common life Herodas aims at realizing; for, as Theocritus may be called Idealist, Herodas is a Realist unflinching. His persons talk in vehement exclamations and emphatic turns of speech, with proverbs and fixed phrases; and occasionally, where it is designed as proper to the part, with the most naked coarseness of expression.

The scene of the second and the fourth (and presumably of all) is laid at Cos, and the speaking characters in each are never more than three. In Mime I. the old nurse, now the professional *go-between* or *bawd*, calls on Metriche, whose husband has been long away in Egypt, and endeavours to excite her interest in a most desirable young man, fallen deeply in love with her at first sight. After hearing all the arguments Metriche declines with dignity, but consoles the old woman with an ample glass of wine, this kind being always represented with the taste of Mrs Gamp. II. is a monologue by the Πορνοβοσκός (*whoremonger*) prosecuting a merchant-trader for breaking into his establishment at night and attempting to carry off one of the inmates, who is produced in court. The

vulgar blackguard, who is a stranger to any sort of shame, remarking that he has no evidence to call, proceeds to a peroration in the regular oratorical style, appealing to the Coan judges not to be unworthy of their traditionary glories. In fact, the whole oration is also a burlesque in every detail of an Attic speech at law; and in this case we have the material from which to estimate the excellence of the parody. In III. a desperate mother brings to the schoolmaster a truant urchin, with whom neither she nor his incapable old father can do anything. In a voluble stream of interminable sentences she narrates his misdeeds and implores the schoolmaster to flog him. The boy accordingly is hoisted on another's back and flogged; but his spirit does not appear to be subdued, and the mother resorts to the old man after all. IV. is a visit of two poor women with an offering to the temple of Asclepius at Cos. While the humble cock is being sacrificed, they turn, like the women in the *Ion* of Euripides, to admire the works of art; among them a small boy strangling a vulpanser—doubtless the work of Boethus that we know—and a sacrificial procession by Apelles, "the Ephesian," of whom we have an interesting piece of contemporary eulogy. The oily sacristan is admirably painted in a few slight strokes. V. brings us very close to some unpleasant facts of ancient life. The *jealous woman* accuses one of her slaves, whom she has made her favourite, of infidelity; has him bound and sent degraded through the town to receive 2000 lashes; no sooner is he out of sight than she recalls him to be branded "at one job." The only pleasing person in the piece is the little maidservant—permitted liberties as a *verna* brought up in the house—whose ready tact suggests to her mistress an excuse for postponing execution of a threat made in ungovernable fury. VI. is *a friendly chat* or *a private conversation*, the nature of which must be found out from the original. It is an ugly subject; but allowance being made for it, this dialogue between two women is as clever and amusing as the rest, with some delicious touches. Our interest is engaged here in a certain Kerdon, the artistic shoemaker, to whom we are introduced in VII. (the name had already become generic for the shoemaker as the typical representative of retail trade), a little bald man with a fluent tongue, complaining of hard times, who bluffs and wheedles by turns. VIII. opens with a mistress waking up her maids to listen to her dream; but we have only the beginning, and all the other fragments are too small to speak of here.

Within the limits of 100 lines or less Herodas presents us with a highly entertaining scene and with characters definitely drawn. Some of these had been perfected no doubt upon the Attic stage, where the tendency in the 4th century had been gradually to evolve accepted types—not individuals, but generalizations from a class, an art in which Menander's was esteemed the master-hand. The Πορνοβοσκός and the Μαστροπός we can piece together from succeeding literature, and see how skilfully the established traits are indicated here. This is achieved by true dramatic means, with touches never wasted and the more delightful often because they do not clamour for attention. The execution has the qualities of first-rate Alexandrian work in miniature, such as the epigrams of Asclepiades possess, the finish and firm outlines; and these little pictures bear the test of all artistic work—they do not lose their freshness with familiarity, and gain in interest as one learns to appreciate their subtle points.

The papyrus MS., obtained from the Fayyum, is in the possession of the British Museum, and was first printed by Mr Kenyon in 1891. The best text now is by Professor Crusius (Teubner), and there are convenient French versions (with introductions) by MM. Dalmeyda (Hachette), Ristelhueber (Delagrave), and Boisacq (Thorin). There is a complete edition, with commentary and translation by the writer of this article.

(W. G. H.)

Herschell, Farrer Herschell, 1st Baron (1837–1899), Lord High Chancellor of England, was born 2nd November 1837. His father was the Rev. Ridley Haim Herschell, a native of Strzelno, in Prussian Poland, who, when a young man, exchanged the Jewish faith for Christianity, took a leading part in founding the British Society for the Propagation of the Gospel among the Jews, and, after many journeyings, settled down to the incumbency of a Nonconformist chapel near the Edgware Road, in London, where he ministered to a large congregation. His mother was a daughter of Mr William Mowbray, a merchant of Leith. Foreign travel, a love for which he derived from his father, and music, which he learnt from his mother, were throughout Herschell's life his chief, if not his only, recreations. In 1854 young Herschell went to a grammar school at Denmark Hill, and shortly afterwards became a student at University College, Gower Street. In 1857 he took his B.A. degree at the University of London. He was reckoned the best speaker in the school debating society, and he displayed there the same command of language and lucidity of thought which were his characteristics during his official life. His early interest in oratory was so keen that when the debate on the seizure of the lorcha *Arrow* was announced to come on in the House of Commons, he spent six or seven hours in the dismal little room appropriated in those days to strangers, in order to secure a front seat in the gallery. The reputation which Herschell enjoyed during his school days was maintained after he became a law-student at Lincoln's Inn. In 1858 he entered the chambers of Mr Thomas Chitty, the famous common-law pleader, father of the late Lord Justice Chitty. His fellow pupils, amongst whom were A. L. Smith, afterwards Master of the Rolls, and Arthur Charles, afterwards judge of the Queen's Bench Division, gave him the sobriquet of "the chief baron" in recognition of his superiority. He subsequently read with Mr Hannen, afterwards Lord Hannen. In 1860 he was called to the bar and joined the northern circuit, then in its palmy days of undividedness. For four or five years he did not obtain much work. Fortunately, he was never a poor man, and so was not forced into journalism, or other paths of literature, in order to earn a living. Two of his contemporaries, each of whom achieved great eminence, found themselves in like case. One of these, Charles Russell, became Lord Chief-Justice of England; the other, William Court Gully, Speaker of the House of Commons. It is said that these three friends, dining together during a Liverpool assize some years after they had been called, agreed that their prospects were anything but cheerful. Certain it is that about this time Herschell meditated quitting England for Shanghai and practising in the consular courts there. Herschell, however, soon made himself useful to Edward James, the then leader of the northern circuit, and to John Richard Quain, the leading stuff-gownsman. For the latter he was content to note briefs and draft opinions, and when, in 1866, Quain donned "silk," it was on Herschell that a large portion of his mantle descended.

The first occasion on which Herschell greatly distinguished himself in court was as counsel for a young woman who was indicted at Carlisle for the murder of her illegitimate child, aged some two years, by drowning it in the Eden. The trial took place before Baron Bramwell, and at his request Herschell defended the accused. He did not succeed in obtaining an acquittal, the evidence against his client being too strong, but he made so

powerful a speech to the jury, that the learned baron commenced his summing up as follows:—"Gentlemen, there is one aspect of this trial which makes me proud of the profession to which I belong. The prisoner at the bar has apparently not a friend nor a shilling in the world, but no wealth or position could possibly have bought a more able, more eloquent, or more zealous defence than that which has been made on her behalf." This piece of "luck" (if that is the right word) became the opportunity which, being taken advantage of to the full, brought other opportunities in its train. Business began to flow in gradually, but not in any rushing stream. On the promotion of Quain to the bench in 1872, Herschell applied to be made a queen's counsel, an application which was granted as a matter of course. He had all the necessary qualifications for a leader—a clear, though not resonant voice; a calm, logical mind; a sound knowledge of legal principles; and (greatest gift of all) an abundance of common-sense. He never wearied the judges by arguing at undue length, and he knew how to retire with dignity from a hopeless cause. His only weak point was cross-examination. In handling a hostile witness he had neither the insidious persuasiveness of a Hawkins nor the compelling, dominating power of a Russell. But he made up for all by his speech to the jury, marshalling such facts as told in his client's favour with the most consummate skill. He very seldom made use of notes, but trusted to his memory, which he had carefully trained. By this means he was able to conceal his art, and to appear less as a paid advocate than as an outsider interested in the case anxious to assist the jury in arriving at the truth. By 1874 Herschell's business had become so good that he turned his thoughts to Parliament. Again his "luck" did not desert him. In February of that year there was a general election, with the result that the Conservative party came into power with a majority of fifty. The usual crop of petitions followed. The two Radicals (Thompson and Henderson) who had been returned for Durham City were unseated, and an attack was then made on the seats of two other Radicals (Bell and Palmer) who had been returned for Durham county. For one of these last Herschell was briefed. He made so excellent an impression on the local Radical leaders that they asked him to stand for Durham City; and after a fortnight's electioneering, he was elected as junior member. Between 1874 and 1880 Herschell was most assiduous in his attendance in the House of Commons. He was not a frequent speaker, but a few great efforts sufficed in his case to gain for him a reputation as a debater. The best examples of his style as a private member will be found in *Hansard* under the dates 18th February 1876, 23rd May 1878, 6th May 1879. On the last occasion he carried a resolution in favour of abolishing actions for breach of promise of marriage except when actual pecuniary loss had ensued, the damages in such cases to be measured by the amount of such loss. The grace of manner and solid reasoning with which he acquitted himself during these displays obtained for him the notice of Mr Gladstone, who in 1880 appointed Herschell Solicitor-General.

Herschell's public services from 1880 to 1885 were of great value, particularly in dealing with the "cases for opinion" submitted by the Foreign Office and other departments. He was also very helpful in speeding Government measures through the House, notably the Irish Land Act 1881, the Corrupt Practices and Bankruptcy Acts 1883, the County Franchise Act 1884, and the Redistribution of Seats Act 1885. This last was a bitter pill for Herschell, since it halved the representation of Durham City, and so gave him statutory notice to quit. Reckoning on the local support of the Cavendish family, he contested the North Lonsdale division of Lancashire; but in spite of the powerful influence of Lord Hartington, he was badly beaten at the poll, though Mr Gladstone again obtained a majority in the country. Herschell now thought he saw the Solicitor-Generalship slipping away from him, and along with it all prospect of high promotion. Lord Selborne and Sir Henry James, however, successively declined Mr Gladstone's offer of the Woolsack, and in 1886 Herschell, by a sudden turn of fortune's wheel, found himself in his forty-ninth year Lord Chancellor. This event had been neatly foreshadowed in a song written for some theatricals which took place at Christmas 1885 at Whitburn Hall, county Durham, the country house of the late Sir Hedworth Williamson, and sung in a burlesque by Sir Hedworth's eldest son, who was supposed to have met with a similar rebuff in a neighbouring constituency. The author of the song was Herschell's friend, Mr Hugh Shield, Q.C., "the poet of the northern circuit." One of its stanzas ran thus-

I then threw up the sponge—reflecting
  How oft electors judgment lack,
And felt less sore on recollecting
  That e'en Sir Farrer gets the sack.
Oh yes—he'll get the Sack again, too,
  In spite of North Lonsdale's defeat,
A worthier honour he'll attain to,
  And on the Woolsack find a seat.

Herschell's Chancellorship lasted barely six months, for in August 1886 Mr Gladstone's Home Rule Bill was rejected in the Commons and his Administration fell. In August 1892, when Mr Gladstone returned to power, Herschell again became Lord Chancellor. In September 1893, when the second Home Rule Bill came on for second reading in the House of Lords, Herschell took advantage of the opportunity to justify the "sudden conversion" to Home Rule of himself and his colleagues in 1885 by comparing it to the Duke of Wellington's conversion to Catholic Emancipation in 1829 and to that of Sir Robert Peel to Free Trade in 1846. In 1895, however, his second Chancellorship came to an end with the defeat of the Rosebery Ministry.

Whether sitting at the Royal Courts in the Strand, on the judicial committee of the Privy Council, or in the House of Lords, Lord Herschell's judgments were distinguished for their acute and subtle reasoning, for their grasp of legal principles, and, whenever the occasion arose, for their broad treatment of constitutional and social questions. He was not a profound lawyer in the sense in which that term was applied to Lord Blackburn or Mr Justice Willes, but his quickness of apprehension was such that it was an excellent substitute for great learning. In construing a real property will or any other document, his first impulse was to read it by the light of nature, and to decline to be influenced by the construction put by the judges on similar phrases occurring elsewhere. But when he discovered that certain expressions had acquired a technical meaning which could not be disturbed without fluttering the dovecotes of the conveyancers, he would yield to the established rule, even though he did not agree with it. He was perhaps seen at his judicial best in *Vagliano* v. *Bank of England* (1891) and *Allen* v. *Flood* (1898). Latterly he showed a tendency, which seems to grow on some judges, to interrupt counsel overmuch. The case last mentioned furnishes an example of this. The question involved was what constituted a molestation of a man in the pursuit of his lawful calling. At the close of the argument of counsel, whom he had frequently interrupted, one of their lordships, noted for his pretty wit, observed that although there might be a doubt as to what amounted to such molestation in point

of law, the House could well understand, after that day's proceedings, what it was in actual practice. In addition to his political and judicial work, Herschell rendered many public services. In 1888 he presided over an inquiry directed by the House of Commons with regard to the Metropolitan Board of Works. He acted as chairman of two royal commissions, one on Indian currency, the other on vaccination. He took a great interest in the National Society for the Prevention of Cruelty to Children, not only promoting the Acts of 1889 and 1894, but also bestowing a good deal of time in sifting the truth of certain allegations which had been brought against the management of that society. In June 1893 he was appointed chancellor of the University of London in succession to the Earl of Derby, and he entered on his new duties with his usual thoroughness. "His views of reform," writes Mr Victor Dickins, the accomplished registrar of the university, "were always most liberal and most frankly stated, though at first they were not altogether popular with an important section of university opinion. He disarmed opposition by his intellectual power, rather than conciliated it by compromise, and sometimes was perhaps a little masterful, after a fashion of his own, in his treatment of the various burning questions that agitated the university during his tenure of office. His characteristic power of detachment was well illustrated by his treatment of the proposal to remove the university to the site of the Imperial Institute at South Kensington. Although he was at that time chairman of the Institute, the most irreconcilable opponent of the removal never questioned his absolute impartiality." With the Imperial Institute Herschell had been officially connected from its inception. He was chairman of the provisional committee appointed by the Prince of Wales to formulate a scheme for its organization, and he took an active part in the preparation of its charter and constitution in conjunction with Lord Thring, Lord James, Sir Frederick Abel, and Mr John Hollams. He was the first chairman of its council, and, except during his tour in India in 1888, when he brought the Institute under the notice of the Indian authorities, he was hardly absent from a single meeting. For his special services in this connexion he was made G.C.B. in 1893, this being the only instance of a Lord Chancellor being decorated with an order.

In 1897 he was appointed, jointly with Lord Justice Collins, to represent Great Britain on the Venezuela Boundary Commission, which assembled in Paris in the spring of 1899. So complicated a business involved a great deal of preparation and a careful study of maps and historic documents. Not content with this, he accepted in 1898 a seat on the joint high commission appointed to adjust certain boundary and other important questions pending between Great Britain and Canada on the one hand and the United States on the other hand. He started for America in July of that year, and was received most cordially at Washington. His fellow commissioners elected him their president. In February 1899, while the commission was in full swing, he had the misfortune to slip in the street, and in falling to fracture a hip bone. He bore his confinement to bed with stoic fortitude, and no word of complaint escaped his lips. But his constitution, which at one time was a robust one, had been undermined by constant hard work, and proved unequal to sustaining the shock. On 1st March, only a fortnight after the accident, he died at the Shoreham Hotel, Washington, a *post-mortem* examination revealing disease of the heart. Mr Hay, Secretary of State, at once telegraphed to Mr Choate, the United States ambassador in London, the "deep sorrow" felt by President McKinley; and Sir Wilfred Laurier said the next day, in the Parliament Chamber at Ottawa, that he regarded Herschell's death "as a misfortune to Canada and to the British Empire." A funeral service held in St John's Episcopal Church, Washington, was attended by the President and Vice-President of the United States, by the cabinet ministers, the judges of the supreme court, the members of the joint high commission, and a large number of senators and other representative men. The body was brought to London in a British man-of-war, and a second funeral service was held in Westminster Abbey before it was conveyed to its final resting-place at Tincleton, Dorset, in the parish church of which he had been married. Herschell left a widow, granddaughter of Vice-Chancellor Kindersley; a son, Richard Farrer, who succeeded him as second baron; and two daughters.

AUTHORITIES.—In the above article use has been made mainly of private information and personal knowledge. A "reminiscence" of Herschell by Mr Speaker Gully will be found in *The Law Quarterly Review* for April 1899. *The Journal of the Society of Comparative Legislation* (of which he had been president from its formation in 1893) contains, in its part for July of the same year, notices of him by Lord James of Hereford, Lord Davey, Mr Victor Williamson (his executor and intimate friend), and also by Mr Justice Brewer and Senator Fairbanks (both of the United States). (M. H. C.)

Hersfeld, a town of Prussia, province of Hesse-Nassau, 26 miles north of Fulda by rail, and on the river Fulda. The parish church was restored in 1899. Here is a military school. Population (1885), 7262; (1900), 7908.

Herstal, a town of Belgium, in the province and 3 miles by rail N.E. of the town of Liége, of which it is almost a suburb. In 1889 a syndicate of Liége gunmakers, having received an order from the Government for 150,000 military repeating rifles, founded "La Fabrique Nationale d'Armes de Guerre" here. It is the second largest private factory of military repeating rifles in Europe. The motive power of the works is supplied by electricity. About 1000 workmen and 900 workwomen are employed. They are capable of turning out 250 completely finished repeating rifles and 25,000 cartridges a day. Population (1899), 17,655.

Hertford, a municipal borough (extended, 1892), market-town, and county town in the Hertford parliamentary division (since 1885) of the county of Hertfordshire, England, on the Lea, 23 miles north of London by rail. The old church of All Saints' was burned in 1891; a new one has been erected, in the Perpendicular style, of red Runcorn stone. Other recent erections include a public library and school of art, a Congregational hall, a Volunteer drill-hall and armoury, and a joint hospital (Hertford and Ware) for infectious diseases. The shire hall or town-hall and the general infirmary have been enlarged. Works for Oriental printing have been introduced. Population, on 816 acres (1881), 7714; (1891), 7548; (1891), on the area as afterwards extended (1136 acres), 9023; (1901), 9322.

Hertfordshire, a south midland county of England, bounded on the S. by Middlesex, on the S.W. by Buckingham, on the N.W. by Bedford, on the N. by Cambridge, and on the E. by Essex.

Area and Population.—The area of the ancient county is 406,161 acres, or 635 square miles, with a population in 1881 of 203,140, and in 1891 of 220,162, of whom 106,471 were males and 113,691 females; the number of persons per square mile being 347, and of acres to a person 1·84. The area of the administrative county, as given in the census returns, is 406,932 acres, with a population in 1891 of 224,532; but several alterations in the area have since taken place. In 1895 the parish of Nettleden and

parts of the parish of Ivinghoe were transferred from Buckingham; in 1896 additions were made by the transference from Cambridge of the parish of Royston, and the part of each of the parishes of Bassingbourne, Kneesworth, and Melbourn, which is included in the North Royston special drainage district, and by the transference from Middlesex of part of the rural district and parish of South Mimms; and in 1897 part of the parish of Caddington, and the parishes of Kensworth and Studham were transferred to Bedford, while the hamlet of Humbershoe, part of the parish of Houghton Regis, the parish of Holywell, and parts of the parish of Shillington were transferred from Bedford. The area of the registration county is 443,787 acres, with a population in 1891 of 215,179, of whom 68,118 were urban and 147,061 rural. Within the registration area the increase of population between 1881 and 1891 was 6·29 per cent., the increase being due chiefly to the erection of villas in the districts adjoining London. Between 1881 and 1891 the excess of births over deaths was 25,361, and the actual increase in the resident population was 1233. The population in 1901 was 250,350.

The following table gives the number of marriages, births, and deaths, with the number of illegitimate births, for 1880, 1890, and 1898:—

Year.	Marriages.	Births.	Deaths.	Illegitimate Births.	
				Males.	Females.
1880	1093	6254	3567	161	172
1890	1228	5722	3579	161	117
1898	1545	5680	3446	138	106

The number of marriages in 1899 was 1615, of births 5701, and of deaths 3673.

The following table gives the marriage-, birth-, and death-rates per 1000 of the population, with the percentage of illegitimate births, for a series of years:—

	1870–79.	1880.	1880–89.	1890.	1889–98.	1899.
Marriage-rate	11·8	10·8	10·7	11·5	11·9	13·8
Birth-rate	32·2	30·9	29·5	26·7	26·7	25·4
Death-rate	18·7	17·6	17·0	16·7	16·0	15·4
Percentage illegitimate births	5·9	5·3	4·4	4·2	4·8	4·3

In 1891 there were in the county 1344 Scots, 841 Irish, and 525 foreigners.

Constitution and Government.—The ancient county is divided into four parliamentary divisions, and has no parliamentary borough. The administrative county contains three municipal boroughs: Hemel Hempstead (11,264 in 1901), Hertford (9322), and St Albans (16,019). The following are urban districts: Baldock (2057), Barnet (7876), Bishop's Stortford (7143), Cheshunt (12,288), East Barnet Valley (10,094), Great Berkhampstead (5219), Harpenden (4725), Hitchin (10,072), Hoddesdon (4711), Rickmansworth (5627), Royston (3517), Stevenage (3957), Tring (4368), Ware (5573), and Watford (29,023). The county is in the home circuit, and assizes are held at Hertford. The boroughs of Hertford and St Albans have separate commissions of the peace. All the civil parishes within 12 miles of, or of which no portion is more than 15 miles from, Charing Cross, are included in the metropolitan police district. The ancient county, which is chiefly in the diocese of St Albans, contains 159 entire ecclesiastical parishes or districts and parts of 5 others.

Education.—There is a residential college for schoolmistresses (St Albans Diocesan) at Bishop's Stortford. The number of elementary schools on 31st August 1899 was 241, of which 39 were board and 202 voluntary schools; the latter including 183 National Church of England schools, 4 Roman Catholic, and 15 "British and other." The average attendance at board schools was 9405, and at voluntary schools 27,633. The total school board receipts for the year ended 29th September 1898 were over £46,224. The income under the Technical Instruction Act was over £171, and that under the Agricultural Rates Act was over £857.

Agriculture.—There is an increasing London trade in corn, malt, vegetables, and fruit. More than three-fourths of the total area is under cultivation, and more than one-third of this is in permanent pasture. Over 1700 acres are under orchards, chiefly of apples and cherries; and strawberries also are largely grown. Wheat still occupies nearly one-half of the total area under corn crops, but its acreage is gradually diminishing; oats and barley occupy each about one-fourth. About two-thirds of the area under green crops is occupied by turnips, swedes, and mangolds, many cows being kept for the supply of milk and butter to London. The following table gives the larger main acreages of the cultivated area at intervals of five years from 1880:—

Year.	Total Area under Cultivation.	Corn Crops.	Green Crops.	Clover.	Permanent Pasture.	Fallow.
1880	340,117	144,038	40,436	37,445	98,765	19,430
1885	341,381	137,062	43,787	39,793	106,812	13,924
1890	341,782	133,122	36,349	41,483	116,134	14,394
1895	336,147	120,130	34,415	45,804	118,126	16,957
1900	332,187	121,498	32,425	45,667	120,687	11,289

The following table gives particulars regarding the principal live stock for the same years:—

Year.	Total Horses.	Total Cattle.	Cows or Heifers in Milk or in Calf.	Sheep.	Pigs.
1880	14,846	33,032	12,125	155,011	27,975
1885	13,975	37,731	13,708	169,507	32,464
1890	14,425	33,009	13,036	146,848	33,103
1895	15,554	30,068	12,734	121,480	33,689
1900	15,023	35,732	14,681	112,413	24,424

Industries and Trade.—According to the annual report for 1898 of the inspector of factories (1900), the total number of persons employed in factories and workshops in 1897 was 11,770, as compared with 10,418 in 1896. Non-textile factories employed 8503 persons, of whom 2953 were employed in the manufacture of paper. Watford is famed for its ales. Of the 2990 persons employed in workshops, 2003 were employed in clothing industries. In 1899, 46,888 tons of chalk were raised, 105,142 tons of gravel and sand, and 59,760 tons of clay.

Authorities.—J. E. Cussan. *History of Hertfordshire.* 3 vols. London, 1870–81.—Ilswick. *Nonconformity in Hertfordshire.* London, 1884.—*Visitation of Hertfordshire, 1572–1634,* in *Harleian Society's Publications,* vol. xvii. London, 1886.—Andrews. *Memorial Brasses in Hertfordshire.* London, 1886.—North. *Church Bells of Hertfordshire.* Hertford, 1886.—Pryor. *Flora of Hertfordshire.* Hertford, 1887.—Kingston. *Hertfordshire during the Civil War.* London, 1894.—See also various papers in *Middlesex and Hertfordshire Notes and Queries* (1895–98), which in January 1899 was incorporated in the *Home Counties Magazine.*

(T. F. H.)

Hertz, Heinrich Rudolf (1857–1894), German physicist, was born at Hamburg on 22nd February 1857. On leaving school he determined to adopt the profession of engineering, and in pursuance of this decision went to study in Munich in 1877. But soon coming to the conclusion that engineering was not his vocation he abandoned it in favour of physical science, and in October 1878 began to attend the lectures of Kirchhoff and Helmholtz at Berlin. In preparation for these he spent the winter of 1877–78 in reading up original treatises like those of Laplace and Lagrange on mathematics and mechanics, and in attending courses on practical physics under Jolly and Bezold; the consequence was that within a few days of his arrival in Berlin in October 1878 he was able to plunge into original research on a problem of electric inertia. For the best solution a prize was offered by the philosophical faculty of the University, and this he succeeded in winning with the paper which was published in 1880 on the "Kinetic Energy of Electricity in Motion." His next investigation, on "Induction in Rotating Spheres," he offered in 1880 as his dissertation for his doctor's degree, which he obtained with the rare distinction of *summâ cum laude.* Later in the same year he became assistant to Helmholtz in the physical laboratory of the Berlin Institute. During the three years he held this position he carried out researches on the contact of elastic solids, hardness, evaporation, and the electric discharge in gases, the last earning him the special commendation of Helmholtz. In 1883 he went to Kiel, becoming *privat-docent,* and there he began the studies in Maxwell's electromagnetic theory which a few years later resulted in the discoveries that rendered his name famous. These were actually made between 1885 and 1889, when he was

professor of physics in the Carlsruhe Polytechnic. He himself has recorded that their origin is to be sought in a prize problem proposed by the Berlin Academy of Science in 1879, having reference to the experimental establishment of some relation between electromagnetic forces and the dielectric polarization of insulators. Imagining that this would interest Hertz and be successfully attacked by him, Helmholtz specially drew his attention to it, and promised him the assistance of the Institute if he decided to work on the subject; but Hertz did not take it up seriously at that time, because he could not think of any procedure likely to prove effective. It was of course well known, as a necessity of Maxwell's mathematical theory, that the polarization and depolarization of an insulator must give rise to the same electromagnetic effects in the neighbourhood as a voltaic current in a conductor. The experimental proof, however, was still lacking, and though several experimenters had come very near its discovery, Hertz was the first who actually succeeded in supplying it, in 1887. Continuing his inquiries for the next year or two, he was able to discover the progressive propagation of electromagnetic action through space, to measure the length and velocity of electromagnetic waves, and to show that in the transverse nature of their vibration and their susceptibility to reflection, refraction, and polarization they are in complete correspondence with the waves of light and heat. The result was, in Helmholtz's words, to establish beyond doubt that ordinary light consists of electrical vibrations in an all-pervading ether which possesses the properties of an insulator and of a magnetic medium. Hertz himself gave an admirable account of the significance of his discoveries in a lecture on the relations between light and electricity, delivered before the German Society for the Advancement of Natural Science and Medicine at Heidelberg in September 1889. Since the time of these early experiments, various other modes of detecting the existence of electric waves have been found out in addition to the spark-gap which he first employed, and the results of his observations, the earliest interest of which was simply that they afforded a confirmation of an abstruse mathematical theory, have been applied to the practical purposes of signalling over considerable distances (see TELEGRAPHY, WIRELESS). In 1889 Hertz was appointed to succeed Clausius as ordinary professor of physics in the University of Bonn. There he continued his researches on the discharge of electricity in rarefied gases, only just missing the discovery of the X-rays described by Röntgen a few years later, and produced his treatise on the *Principles of Mechanics.* This was his last work, for after a long illness he died at Bonn on 1st January 1894. By his premature death science lost one of her most promising disciples. Helmholtz thought him the one of all his pupils who had penetrated farthest into his own circle of scientific thought, and looked to him with the greatest confidence for the further extension and development of his work.

Hertz's scientific papers have been translated into English by Professor D. E. Jones, and published in three volumes: *Electric Waves* (1893), *Miscellaneous Papers* (1896), and *Principles of Mechanics* (1899). The preface contributed to the first of these by Lord Kelvin, and the introductions to the second and third by Professors Lenard and Helmholtz, contain many biographical details, together with statements of the scope and significance of his investigations. A book by Dr Oliver Lodge on *Hertz and His Work* (London, 1895) may also be consulted. (H. M. R.)

Herzegovina. See BOSNIA AND HERZEGOVINA.

Hesse-Darmstadt, a grand-duchy of Germany, situated partly on the Rhine and Main, and partly surrounded by the province of Hesse-Nassau. Of the total area (2966 square miles), 64 per cent. is under cultivation, whilst forests cover over 31 per cent. The total number of farms in 1895 was 133,840, and of these 59,043 were less than $2\frac{1}{2}$ acres each, 65,419 between $2\frac{1}{2}$ and 25 acres (93 per cent. under 25 acres each), 9255 between 25 and 250 acres, and 123 exceeding 250 acres. In 1898 vines covered 30,840 acres, and produced 2,791,320 gallons of wine, valued at £225,000. The live stock in 1897 numbered 324,626 cattle, 271,595 pigs, 86,731 sheep, and 56,002 horses. In 1898 mineral products yielded 159,430 tons of iron ore, valued at £61,200; 218,384 tons of lignite, valued at £30,000; 37,916 tons of sulphuric acid, valued at £40,300; and 16,680 tons of salt, valued at £15,400. The smelting furnaces produced 19,868 tons of iron, valued at £188,500. In 1898–99 the sugar refineries yielded 14,000 tons of sugar; the breweries, 31,037,800 gallons of beer; and the distilleries, 398,100 gallons of pure alcohol. The grand-duchy is divided into three provinces, with area and population as follows:—

Provinces.	Area.	Pop. 1885.	Pop. 1890.	Pop. 1895.	Density per sq. Mile, 1895.
Upper Hesse .	1269	263,044	265,912	271,524	213·9
Rhenish Hesse .	531	291,142	307,329	322,934	608·1
Starkenburg .	1166	402,370	419,642	444,562	381·3
Totals . .	2966	956,556	992,883	1,039,020	350·3

In 1900 the population of the grand-duchy was 1,120,426, of whom 558,962 were males and 561,464 females. The number of emigrants who left the country decreased from 2503 in 1885 to 333 in 1899. In 1895 the Protestants numbered 694,962, or 67 per cent. of the whole; Roman Catholics 305,906, or 30 per cent.; and there were 24,618 Jews. For the year 1900–1 the ordinary revenue was estimated at £1,871,400, and the ordinary expenditure at £1,868,600; in addition there was an extraordinary revenue estimated at £602,600, and an extraordinary expenditure estimated at £483,700. In 1900 the public debt amounted to £13,373,200; and in 1900 the state contribution to the empire was fixed at £523,270.

Hesse-Nassau, a province of Prussia, with an area of 6060 square miles and a population of 1,897,981 (1900). The principal crops are potatoes and hay, oats, rye, and beetroot (for sugar), wheat, and barley. The vine was cultivated on 7490 acres in 1898, 97 per cent. of which were in the district of Wiesbaden; the yield of wine being 272,700 gallons, valued at £27,540, and including such brands as Johannisberg, Rüdesheim, Marcobrunner, Rauenthal, Assmannshausen, &c. But the year 1898 was a bad year for wine, the average yield for the years 1888–1897 having been 167 gallons annually per acre, as against $36\frac{1}{2}$ gallons in 1898. Tobacco and hops are also grown, though not on an extensive scale. Gardening, and the cultivation of fruit and vegetables, thrive in certain favoured localities. This province is an important pastoral region, and in 1897 possessed 565,303 cattle, 464,479 pigs, 390,790 sheep, and 80,544 horses. It has also one of the relatively largest forest areas (40 per cent. of province) in the kingdom of Prussia. Mining is one of the chief industries of the province. The production in 1898 amounted to 614,409 tons of iron, valued at £243,400; 380,275 tons of lignite, valued at £73,300; 9983 tons of lead, valued at £66,800; 12,197 tons of zinc, valued at £45,100; further, manganese, salt, and copper. The furnaces and smelting-works produced 24,637 tons of lead, valued at £312,900; 778,320 ounces of silver, valued at £113,400; 79,318 tons of iron, valued at £802,650; and 81,025 tons of sulphuric acid, valued at £98,900. In 1898–99 the sugar refineries yielded 10,370 tons of sugar;

the breweries, 45,666,800 gallons of beer; and the distilleries, 364,000 gallons of pure alcohol. There are numerous sandstone, slate, and clay quarries. The province is famous for its mineral springs, which abound specially in the Taunus region; the best known of the spas are Wiesbaden, Ems, Homburg, Schlangenbad, Schwalbach, Soden, &c. (For further particulars, see under PRUSSIA.)

Hewett, Sir Prescott Gardner, BART. (1812–1891), British surgeon, was born 3rd July 1812, being the son of a Yorkshire country gentleman. He lived for some years in early life in Paris, and started on a career as an artist, but abandoned it for surgery. He entered St George's Hospital, London (where his half-brother, Dr Cornwallis Hewett, was physician from 1825 to 1833), becoming demonstrator of anatomy and curator of the museum. He was the pupil and intimate friend of Brodie, and helped him in much of his work. Eventually he rose to be anatomical lecturer, assistant-surgeon, and surgeon to the hospital. In 1876 he was President of the College of Surgeons; in 1877 he was made serjeant-surgeon extraordinary to Queen Victoria, in 1884 serjeant-surgeon, and in 1882 he was created a baronet. He was a very good lecturer, but shrank from authorship; his lectures on *Surgical Affections of the Heart* were, however, embodied in his treatise on the subject in Holmes's *System of Surgery*. As a surgeon he was always extremely conservative, but hesitated at no operation, however severe, when convinced of its expediency. He was a perfect operator, and one of the most trustworthy of counsellors. He died 19th June 1891.

Hexham, a market-town and parish of England, county of Northumberland, on the south bank of the Tyne, 20 miles west of Newcastle, on the railway to Carlisle. In the neighbourhood there are barytes and coal mines. Since 1882 the town has belonged to the diocese of Newcastle. During the Middle Ages Hexham enjoyed peculiar rights of sanctuary, and the district around, known as Hexhamshire, formed a separate liberty down to the close of the 16th century. The Lancastrians were defeated by the Yorkists near here in 1463. Dr Joseph Parker, the well-known London preacher, was born at Hexham in 1830, and gives particulars of his early life there in his book, *A Preacher's Life*. Hexham gives its name to one of the four parliamentary divisions of the county. Area of urban sanitary district, 5136 acres. Population (1891), 5945; (1901), 7071.

Heyse, Johann Ludwig Paul (1830-——), German novelist and poet, was born at Berlin on 15th March 1830, being the son of the distinguished philologist. After producing in 1848 *Der Jungbrunnen*, a fanciful little tale entirely in the spirit of the romantic school, and in 1851 a tragedy on the story of Francesca da Rimini, he turned his attention to novel writing, and published at Munich in 1855 four novelettes in one volume, two of which at least were absolute masterpieces. These were the precursors of a series of similar volumes, necessarily unequal at times, but on the whole constituting such a mass of highly complex miniature fiction as perhaps never before proceeded from the pen of a single writer. Heyse works in the spirit of a sculptor: he seizes upon some picturesque incident or situation, and chisels and polishes until all the effect which it is capable of producing has been extracted from it. The success of the story usually depends upon the merit of the theme, for the artist's skill is generally much the same, and the situation usually leaves a deeper impression than the characters. Heyse is also the author of several novels on a larger scale, all of which have gained success and provoked abundant discussion. The more important are *Kinder der Welt* (1873), dealing with general, *Im Paradiese* (1875), with artistic society, and *Merlin* (1892), a defence of the idealism of life. He has also been a prolific but not a very successful dramatist, and has produced masterly translations of Leopardi, Giusti, and other southern poets.

Heywood, a municipal borough (1881), in the Heywood parliamentary division of Lancashire, England, 3 miles east of Bury and 9 miles north of Manchester, on the Lancashire and Yorkshire Railway. A technical school was opened in 1894. Heywood is a manufacturing town with an increasing population. Area, 3628 acres. Population (1881), 22,979; (1901), 25,461.

Hicks-Beach, Sir Michael Edward, BART. (1837-——), English statesman, son of the 8th baronet, whom he succeeded in 1854, was born in London in 1837, and educated at Eton and Christ Church, Oxford, where he graduated with a first-class in the school of law and modern history. In 1864 he was returned to Parliament as a Conservative for East Gloucestershire, the county in which his estates of Williamstrip Park were situated; and during 1868 he acted both as Parliamentary Secretary to the Poor Law Board and as Under-Secretary for the Home Department. In 1874 he married the daughter of the 3rd Earl Fortescue. In the same year he was made Chief Secretary for Ireland, and was included in the Cabinet in 1877. From 1878 to 1880 he was Secretary of State for the Colonies. In 1885 he was elected for West Bristol, and the Conservative party having returned to power, became Chancellor of the Exchequer and leader of the House of Commons. After Mr Gladstone's brief Home Rule Ministry in 1886 he entered Lord Salisbury's next Cabinet again as Irish Secretary, making way for Lord Randolph Churchill as leader of the House; but troubles with his eyesight compelled him to resign in 1887, and meanwhile Mr Goschen replaced Lord Randolph as Chancellor of the Exchequer. From 1888 to 1892 Sir Michael Hicks-Beach returned to active work as President of the Board of Trade, and in 1895—Mr Goschen being transferred to the Admiralty—he again became Chancellor of the Exchequer. As a Finance Minister he showed himself not only a vigorous guardian of the public purse, but also a particularly lucid expositor of his Budgets. In 1899 he lowered the fixed charge for the National Debt from twenty-five to twenty-three millions—a reduction imperatively required, apart from other reasons, by the difficulties found in redeeming Consols at their then inflated price. When compelled to find means for financing the war in South Africa, he insisted on combining the raising of loans with the imposition of fresh taxation; and besides raising the income-tax each year, up to 1s. 3d. in 1902, he introduced taxes on sugar and exported coal (1901), and in 1902 proposed the reimposition of the registration duty on corn and flour which had been abolished in 1869 by Mr Lowe. The sale of his Netheravon estates in Wiltshire to the War Office in 1898 occasioned some acrid criticism concerning the valuation, for which, however, Sir Michael himself was not responsible.

Hidalgo, a state of Mexico, bounded on the N. by the states of San Luis Potosí and Veracruz, on the E. by Puebla, on the S. by Mexico and Tlaxcala, and on the W. by Queretaro. Area, 8920 square miles. Population (1879), 427,350; (1900), 603,074. The agricultural products comprise cereals, coffee, sugar, cotton, tobacco, and maguey. Mining is the most important industry, the chief products being gold, silver, mercury, copper, iron, lead, zinc, antimony, manganese, and plumbago. The

state is divided into fifteen districts. The capital is Pachuca (40,487), and among other towns are Tulancingo (8303), Ixmiquilpan (7079), Actopan (5635).

Hiel, Emmanuel (1834–1899), Belgian-Dutch poet and prose writer, was born at Dendermonde, in Flanders, May 1834. He acted in various functions, from teacher and government official to journalist and bookseller, busily writing all the time both for the theatre and the magazines of North and South Netherlands. His last posts were those of librarian at the Industrial Museum and professor of declamation at the Conservatoire in Brussels. Among his better-known poetic works may be cited *Looverkens* ("Leaflets," 1857); *Nieuwe Liedekens* ("New Poesies," 1861); *Gedichten* ("Poems," 1863); *Psalmen, Zangen, en Oratorios* ("Psalms, Songs, and Oratorios," 1869); *De Wind* (1869), an inspiriting cantata, which had a large measure of success and was crowned; *De Liefde in 't Leven* ("Love in Life," 1870); *Elle* and *Isa* (two musical dramas, 1874); *Liederen voor Groote en Kleine Kinderen* ("Songs for Big and Small Folk," 1879); *Jakoba van Beieren* ("Jacquelein of Bavaria," a poetic drama, 1880); *Mathilda van Denemarken* (a lyrical drama, Ghent, 1890). His collected poetical works were published in three volumes at Rousselaere in 1885. Hiel took an active and prominent part in the so-called "Flemish movement" in Belgium, and we therefore find his name constantly associated with those of Jan van Beers, the Willems, and Peter Benoit. The last wrote some of his compositions to Hiel's verses, notably to his oratorios *Lucifer* (performed in London at the Royal Albert Hall and elsewhere) and *De Schelde* ("The Scheldt"); whilst the Dutch composer, Richard Hol (of Utrecht), composed the music to Hiel's "Ode to Liberty," and Van Gheluwe to the poet's "Songs for Big and Small Folk" (second edition, much enlarged, 1879), which has greatly contributed to their popularity in schools and among Belgian choral societies. Hiel also translated several foreign lyrics. His rendering of Tennyson's *Dora* appeared at Antwerp in 1871. For the national festival of 1880 at Brussels, to commemorate the fiftieth anniversary of Belgian independence, Hiel composed two cantatas, *Belgenland* ("The Land of the Belgians") and *Eer Belgenland* ("Honour to Belgium"), which, set to music, were much appreciated. He died at Schaerbeek, near Brussels, on the 27th of August 1899. Hiel's efforts to counteract Walloon influences and bring about a *rapprochement* between the Netherlanders in the north and the Teutonic racial sympathizers across the Rhine made him very popular with both, and a volume of his best poems was in 1874 the first in a collection of Dutch authors published at Leipzig. (H. Ti)

Hierapolis (1), Arabic *Manbij* or *Membij*, Turkish *Bembij*, occupying one of the finest sites in Northern Syria, in a fertile district, with an abundant water supply from large springs. In 1879, after the Russo-Turkish war, a colony of Circassians from Widin was planted in the ruins. (2) A Phrygian city, altitude 1100 feet, on the right bank of the Churuk Su (*Lycus*), about 8 miles above its junction with the Menderez (*Maeander*), situated on a broad terrace, 200 feet above the valley and 6 miles north of Laodicea. On the terrace rise warm, calcareous springs, that have deposited the vast incrustations of snowy whiteness from which the place gets its name, Pambúk Kalesi, "Cotton Castle." To these springs, which are slightly sulphureous, and to the Plutonium—a hole reaching deep into the earth, from which issued a mephitic vapour—the place owed its celebrity and sanctity. Here, at an early date, a religious establishment (*hieron*) existed, and the town which gradually grew round it became one of the greatest centres of Phrygian life. The chief religious festival was the Letoia, named after the goddess Leto, a local variety of the Mother Goddess (Cybele). Hierapolis was the seat of an early church (Col. iv. 13), with which tradition closely connects the Apostle Philip. It has been suggested by Professor Ramsay that the Plutonium, which had disappeared in the 4th century, was filled up and covered over by the Christians about A.D. 320.

Ramsay. *Cities and Bishoprics in Phrygia*, i. p. 84, &c. 1895. —Humann. *Altertümer von Hierapolis*. 1898. (C. W. W.)

Higginson, Thomas Wentworth (1823– ——), American author, reformer, and soldier, was born in Cambridge, Massachusetts, 22nd December 1823, being a descendant of Francis Higginson, minister of the church of Salem, Massachusetts, in 1629. He graduated at Harvard in 1841, and at the Harvard divinity school in 1847; entered the Unitarian ministry, and was pastor of churches in Newburyport and Worcester, Massachusetts, but left the ministry in 1858. Identifying himself with the anti-slavery movement, he was indicted for participation in the attempt to release Anthony Burns, a fugitive slave, in Boston in 1853; engaged in the effort to make Kansas a free state in 1856; sympathized with the abolitionist schemes of John Brown in 1859; and during the Civil War become colonel of the First South Carolina Volunteers, the first regiment recruited from former slaves who had been declared "contraband of war" by the Northern authorities. His army service continued until October 1864, when he resigned on account of a wound. His *Army Life in a Black Regiment* (1870) narrates his career and observations during his service in the field. At the conclusion of the war he devoted himself to literary work, first in Newport, Rhode Island, and then in his native place. His connexion with the periodical press has been constant. Many of his articles have been reissued in volumes. Of his books the best are *Out-Door Papers* (1863), a *Larger History of the United States* (1885), and *Cheerful Yesterdays* (autobiographical, 1898). During his whole life Colonel Higginson has been an ardent advocate of woman suffrage and "free religion," and in his later years left the Republican party, but continued to take part in politics as an Independent, and afterwards as a Democrat.

Highgate, a parish and district partly in the county of Middlesex and partly in the county of London, chiefly in the metropolitan borough of St Pancras. Highgate is situated on a hill (which reaches a height of 426 feet) on the Great North Road, 5½ miles north-west of the General Post Office. There are two chief ascents from London to the village of Highgate, viz., the West Hill and Highgate Hill, leading to the High Street. Holly Lodge, the residence of the Baroness Burdett Coutts, is on West Hill. Highgate is famous for mansions of historical interest, but several of them have been destroyed, such as Arundel House, where Bacon died in 1626, pulled down in 1825, and Andrew Marvell's cottage, cleared away in 1869. Cromwell House still exists, although a fire on 3rd January 1865 destroyed the upper floors. This mansion was presented by Oliver Cromwell to his eldest daughter, Bridget, on her marriage, 15th January 1646–47, with Henry Ireton. Lauderdale House, after many vicissitudes, is now the refreshment house of Waterlow Park. The site of the Grove was originally occupied by Dorchester House, the mansion of the marquis of Dorchester, a loyal adherent of Charles I. At No. 3, The Grove (the house of the late Mr James Gillman, surgeon), the poet Coleridge lived for eighteen years. The old burial ground (in which lie the remains of Coleridge) is under the college chapel. Highgate Archway, constructed in 1812 in order to make some

improvement in the roadway for the coaches travelling the Great North Road, has been rebuilt, and a new archway to carry a roadway 50 feet wide was completed in 1900. Near Whittington Stone, at the foot of Highgate Hill, are Whittington's Almshouses, removed from College Hill by the Mercers' Company. The association of Whittington with Highgate has, however, no authority in the original legend, for Bonehill or Bunhill is there designated as the place where he "turned again." Highgate can scarcely be said now to have any individual existence, and there are therefore no official statistics of the population of the place as a whole.

Highlands, formerly a city of Arapahoe county, Colorado, U.S.A., now a part of the city of Denver, on the west bank of the South Platte river, opposite Denver. Population (1890), 5161.

Higinbotham, George (1827–1893), Chief Justice of Victoria, sixth son of T. Higinbotham, of Dublin, was born on the 19th of April 1827, and educated at the Royal School, Dungannon, and at Trinity College, Dublin. After entering as a law student at Lincoln's Inn, and being engaged as reporter on the *Morning Chronicle* in 1849, he emigrated to Victoria, where he contributed to the *Melbourne Herald* and practised at the bar (having been "called" in 1853) with much success. In 1850 he became editor of the *Melbourne Argus*, but resigned in 1859 and returned to the bar. He was elected to the Legislative Assembly in 1861 for Brighton as an independent Liberal, was rejected at the general election of the same year, but was returned nine months later. In 1863 he became Attorney-General. Under the influence of Mr Higinbotham measures were passed through the Legislative Assembly of a somewhat extreme character; completely ignoring the rights and power of the Legislative Council, and the government was carried on without any Appropriation Act for more than a year. Mr Higinbotham, by his eloquence and earnestness, obtained great influence amongst the members of the Legislative Assembly, but his colleagues were not prepared to follow him as far as he desired to go. He contended that in a constitutional colony like Victoria the governor held the same position as the Sovereign in Great Britain, and that the Secretary of State for the Colonies had no right to fetter the discretion of the Queen's representative by any counsel or interference. Mr Higinbotham did not return to power with his chief, Sir James M'Culloch, after the defeat of the short-lived Sladen administration; and being defeated for Brighton at the next general election by a comparatively unknown man, he retired from politics and devoted himself to his large and lucrative practice at the bar. Amongst his other labours as Attorney-General he had codified all the statutes which were in force throughout the colony. In 1874 he was returned to the Legislative Assembly for Brunswick, but after a few months he resigned his seat. In 1880 he was appointed a puisne judge of the Supreme Court, and in 1886, on the retirement of Sir William Stawell, he was promoted to the office of Chief Justice. Mr Higinbotham was appointed president of the International Exhibition held at Melbourne in 1888–89, but did not take any active part in its management. One of his latest public acts was to subscribe a sum of £10, 10s. a week towards the funds of the strikers in the great Australian labour dispute of 1890, an act which did not meet with general approval. He died in 1893. (G. C. L.)

Hijar, a town of Eastern Spain, in the province of Teruel, on the right bank of the river Martin, situated in a plain. The neighbouring country produces wheat, wine, oils, fruit, and vegetables. The industries of Hijar are chiefly silk, linen, cotton, soap, and bricks. The principal structures are the parish church, the palace of the dukes of Hijar (title dating from 1268), and the town hall. Population (1897), 11,571.

Hilden, a town of Prussia, in the Rhine province, 9 miles south-east of Düsseldorf by rail. It has manufactures of silk, velvet, carpets, artificial wool, machinery, calico printing, and brickmaking. Population (1885), 7947; (1900), 11,301.

Hildesheim, a town and episcopal see of Prussia, province of Hanover, at the north foot of the Harz Mountains, 19 miles south-east of Hanover by electric railway. The 14th-century town hall was restored in 1883–92. The Knochenhauer House (1529), one of the finest examples of wooden architecture not only in Hildesheim, but in all Germany, was burnt in 1884, but has since been repaired. The Römer Museum, the geological section of which is especially noteworthy, is housed in the former church of St Martin's. New administrative offices were finished in 1888. Hildesheim is the seat of considerable industry, the chief productions being sugar, tobacco, vehicles, agricultural implements, gutta-percha wares, and bricks, and gardening is extensively carried on. Population (1885), 29,386; (1900), 42,973.

Hill, Octavia (1838–——) and **Miranda,** (1836–——), English philanthropic workers, were born in London, being daughters of Mr James Hill and granddaughters of Dr Southwood Smith, the pioneer of sanitary reform. They were brought up to take an interest in social problems, and Miss Octavia Hill's attention was early drawn to the evils of London housing, and the habits of indolence and lethargy induced in many of the lower classes by their degrading surroundings. As a result she conceived the idea of trying to free a few poor people from such influences, and Mr Ruskin, who sympathized with her plans, supplied the money for starting the work. For £750 Miss Hill purchased the 56 years' lease of three houses in one of the poorest courts of Marylebone. Another £78 was spent in building a large room at the back of her own house where she could meet the tenants. The houses were put in repair, cleansed, and let out in sets of two rooms. At the end of eighteen months it was possible to pay 5 per cent. interest, to repay £48 of the capital, as well as meet all expenses for taxes, ground rent, and insurance. What specially distinguished this scheme was that Miss Hill herself collected the rents, thus coming into contact with the tenants and helping to enforce regular and self-respecting habits. The success of her first attempt encouraged her to continue. Six more houses were bought and treated in a similar manner. A yearly sum was set aside for the repairs of each house, and whatever remained over was spent on such additional appliances as the tenants themselves desired. This encouraged them to keep their tenements in good repair. By the help of friends Miss Hill was now enabled to enlarge the scope of her work. In 1869 eleven more houses were bought, and gradually a band of helpers was trained to assist her. The plan was to set a visitor over a small court or block of buildings, to do whatever work in the way of rent collecting, visiting for the School Board, &c., was required. As years went on Miss Octavia Hill's work largely increased. Numbers of her friends bought and placed under her care small groups of houses, over which she fulfilled the duties of a conscientious landlord. Several large owners of tenement houses, notably the Ecclesiastical Commissioners, entrusted to her the management of such property, and consulted her about

plans of rebuilding; and a number of fellow-workers were trained by her in the management of houses for the poor. The results in Southwark (where Red Cross Hall was established) and elsewhere were very beneficial. Both Miss Miranda and Miss Octavia Hill have taken an interest in the movement for bringing beauty into the homes of the poor, and the former was practically the founder of the Kyrle Society, the first suggestion of which was contained in a paper read to a small circle of friends. Both sisters have worked for the preservation of open spaces, and helped to promote the work of the Charity Organization Society, and for several years Miss Miranda Hill has done admirable work in Marylebone as a member of the Board of Guardians.

Hiller, Ferdinand (1811–1885), German composer, was born at Frankfort-on-Main, 24th October 1811. Hiller was a link between the past era of great masters and the present. His first master was Aloys Schmitt, and when he was ten years of age his compositions and talent were so evidently above the average that his father, a well-to-do man, determined to send him to Hummel in Weimar. There he devoted himself to composition, among his work being the entr'actes to *Maria Stuart*, through which he made Goethe's acquaintance. Under Hummel, Hiller made great strides as a pianist, so much so that early in 1827 he went on a tour to Vienna, where he met Beethoven and produced his first quartet. After a brief visit home Hiller went to Paris in 1829, where he lived till 1836. His father's death necessitated his return to Frankfort for a time, but on 8th January 1839 he produced at Milan his opera *La Romilda*, and began to write his oratorio *Die Zerstörung Jerusalems*, one of his best works. Then he went to Leipzig, to his friend Mendelssohn, where in 1843–44 he conducted a number of the Gewandhaus concerts, and produced his oratorio. After a further visit to Italy to study sacred music, Hiller produced two operas, *Ein Traum* and *Conradin*, at Dresden in 1845 and 1847 respectively; he went as conductor to Düsseldorf in 1847 and Cologne in 1850, and conducted at the Opéra Italien in Paris in 1851 and 1852. At Cologne he became a power as conductor of the Gürzenich concerts and head of the Conservatorium. In 1884 he retired, and died 12th May in the following year. Hiller frequently visited England. He composed a work for the opening of the Royal Albert Hall, his *Nala and Damayanti* was performed at Birmingham, and he gave a series of pianoforte recitals of his own compositions at the Hanover Square Rooms in 1871. He had a perfect mastery over technique and form in musical composition, but his works are generally dry. He was a sound pianist and teacher, and occasionally a brilliant writer on musical matters. His compositions, numbering about two hundred, include six operas, two oratorios, six or seven cantatas, much chamber music, and a once-popular pianoforte concerto. (R. H. L.)

Hillsboro, capital of Hill county, Texas, U.S.A., on the Missouri, Kansas, and Texas, and the St Louis South-Western Railways. It is in the cotton region, and has local importance as a shipping and supply point. Population (1890), 2541; (1900), 5346, of whom 128 were foreign-born and 1751 were negroes.

Hilton, John (1804–1878), British surgeon, was born at Castle Hedingham, in Essex, in 1804, and was educated at Chelmsford, Boulogne-sur-Mer, and in Guy's Hospital, which he entered in 1824 (M.R.C.S. 1827, F.R.C.S. 1843). He was appointed demonstrator of anatomy in 1828, assistant-surgeon 1845, surgeon 1849. In 1867 he was President of the Royal College of Surgeons, and delivered the Hunterian oration. He was also surgeon-extraordinary to Queen Victoria. As Arris and Gale professor (1859–62) he delivered a course of lectures on "Rest and Pain," which have become classics. Hilton was the greatest anatomist of his time, and was nicknamed "Anatomical John." It was he who, with Towne the artist, enriched Guy's Hospital with its unique collection of models. In his grasp of the structure and functions of the brain and spinal cord he was far in advance of his contemporaries. As an operator he was more cautious than brilliant, and this was doubtless due partly to his living in the pre-anæsthetics period, and partly to his own consummate anatomical knowledge, as is indicated by the method for opening deep abscesses which is known by his name. But he could be bold when necessary; he was the first to reduce a case of obdurate hernia by abdominal section, and one of the first to practise lumbar colotomy. He died at Clapham on 14th September 1878.

Hilversum, a prosperous town in the province of North Holland, Netherlands, 10 miles north by east of Utrecht by rail. Formerly a small village with a Saxon population engaged in agriculture and linen-weaving (home industry), since 1848 it has become an industrial commune with thirty factories employing 800 workmen, mainly in the manufacture of floorcloths. It is a favourite place of residence for wealthy citizens of Amsterdam and Utrecht. In the vicinity are the Trompenberg sanatorium and the villages of Baarn and Soestdyk (with a royal summer palace). There are middle-class and technical schools. Population (1870), 6000; (1900), 19,442.

Himalaya.—Modern geographers restrict the term Himalaya to that portion of the mountain region between India and Tibet which is enclosed within the arms of the Indus and the Brahmaputra. From the bend of the Indus southwards towards the plains of the Punjab to the bend of the Brahmaputra southwards towards the plains of Assam, through a length of 1500 miles, is Himáleh or Himalaya. Beyond the Indus, to the north-west, the region of mountain ranges which stretches to a junction with the Hindu Kush south of the Pamirs is usually known as Trans-Himalaya. Thus the Himalaya represents the southern face of the great central upheaval—the plateau of Tibet—the northern face of which is represented by the Kuen Lun.

Structure of the Himalaya.

Throughout this vast space of elevated plateau and mountain face geologists now trace a system of main chains, or axes, extending from the Hindu Kush to Assam, arranged in approximately parallel lines, and traversed at intervals by main lines of drainage obliquely. Godwin-Austen indicates six of these geological axes as follows:—

(1) The main Central Asian axis, the Kuen Lun forming the northern edge or ridge of the Tibetan plateau.

(2) The Trans-Himalayan chain of Muztagh (or Karakoram), which is lost in the Tibetan uplands, passing to the north of the sources of the Indus.

(3) The Ladak chain, partly north and partly south of the Indus—for that river breaks across it about 100 miles above Leh. This chain continues south of the Tsanpo (or Upper Brahmaputra), and becomes part of the Himalayan system.

(4) The Zaskar, or main chain of the Himalaya, *i.e.*, the "snowy range" *par excellence*, indicated by Nanga Parbat (overlooking the Indus), and passing in a south-east direction to the southern side of the Deosai plains. Thence, bending slightly south, it extends to the line of snowy peaks which are seen from Simla and other hill stations. It leads past Chini to the famous peaks of Gangotri and Nanda Devi. This is the best known range of the Himalaya, and although its course eastwards to

the north of Nepal is not accurately traced, it probably includes Everest and Kanchinjunga in its stupendous array of snow-bound peaks ere it is merged in the mountains to the north of Assam.

(5) The outer Himalaya or Pir Panjal-Dhaoladhar ridge.

(6) The Sub-Himalaya, which is "easily defined by the fringing line of hills, more or less broad, and in places very distinctly marked off from the main chain by open valleys (dhúns) or narrow valleys, parallel to the main axis of the chain." These include the Siwaliks.

Interspersed between these main geological axes are many other minor ridges, on some of which are peaks of great elevation. In fact, the geological axis seldom coincides with the line of highest elevation, nor must it be confused with the main lines of water-divide of the Himalaya.

Accepting this general definition of the structure of the Himalaya, there is a certain amount of fresh matter of interest to be noted about many of these dominant features.

Present knowledge of the Himalaya.

The relation of the central Himalayan range (through which some of the most important rivers of the Indo-Gangetic plain force their way southwards) to that northern watershed of India which is lost in the Tibetan plateau is fully explained in the article HIMALAYA in the ninth edition of this Encyclopædia. South of this great central line of snowy peaks there is little to add to the information of twenty years ago, when the Dhúns and the Tarai and the valleys intersecting the outer Himalaya had been already examined so far as they lay within reach of examination. There were then wide Himalayan tracts which were not open to European exploration. Those tracts are for the most part still closed. Nepal, Bhutan, and the wild Mishmi and Abor hills to the north of the Assam valley are but partially mapped. On the other hand, Kashmir and the Kumaon and Garwhal districts have been closely surveyed, and the physiography of the little state of Sikkim is now well known. It is beyond the line of highest altitudes, to the eastern and western flanks of the great highlands of Tibet, that geographical exploration has lately been chiefly directed; and it is the physical relation between the Himalaya and these mountain borderlands enclosing the central plateau that still chiefly demands further elucidation.

The great northern watershed of India.

On the north and north-west of Kashmir the great water-divide which separates the Indus drainage area from that of the Yarkand and other rivers of Chinese Turkestan has been explored by Younghusband, and, more recently, by Deasy. The general result of their investigations has been to show that the Muztagh range, as it trends south-eastwards and finally forms a continuous mountain barrier together with the Karakoram, is the true water-divide west of the Tibetan plateau. Shutting off the sources of the Indus affluents from those of the Central Asian system of hydrography, this great water-parting is distinguished by a group of peaks of which the altitude is hardly less than that of the Eastern Himalaya, culminating in Mount Everest. Mount Godwin-Austen (28,278 feet high), only 730 feet lower than Everest, affords an excellent example in Asiatic geography of a dominating, peak-crowned watershed. From Kailas on the far west to the extreme north-eastern sources of the Brahmaputra, the great northern watershed of the Indo-Tibetan highlands has only been occasionally touched. Littledale, Du Rhins, and Bonvalot may have stood on it as they looked southwards towards Lhasa, but for some 500 or 600 miles east of Kailas it appears to be lost in the mazes of the minor ranges and ridges of the Tibetan plateau. Nor can it be said to be as yet well defined to the east of Lhasa, in spite of the enormous accession of information from Russian, American, French, and English sources which was gathered during the last twenty years of the 19th century concerning the northern face of the Tibetan plateau and the Tibeto-Chinese borderland.

Eastern Tibet.

The Tibetan plateau, or Chang, breaks up about the meridian of 92° E., and to the east of this meridian the affluents of the Tsanpo (the same river as the Dihong and subsequently to be known as the Brahmaputra) drain no longer from the elevated plateau, but from the rugged slopes of a wild region of mountains (of systematic conformation where its successive ridges are arranged in concentric curves around the great bend of the Brahmaputra), wherein are hidden the sources of all the great rivers of Burma and China. Neither immediately beyond this great bend, nor within it in the Himalayan regions lying north of Assam and east of Bhutan, have scientific investigations yet been systematically carried out; but we know that the largest of the Himalayan affluents of the Brahmaputra west of the bend derive their sources from the Tibetan plateau, and break down through the containing bands of hills, carrying deposits of gold from their sources to the plains, as do all the rivers of Western Tibet.

Himalaya north of the central chain of snowy peaks.

Although the northern limits of the Tsanpo basin are not sufficiently well known for us to locate the Indo-Tibetan watershed even approximately, there exists some scattered evidence of the nature of that strip of Northern Himalaya on the Tibeto-Nepalese border which lies between the line of greatest elevation and the trough of the Tsanpo. Recent investigations show that all the chief rivers of Nepal flowing southwards to the Tarai take their rise north of the line of highest crests, the "main range" of the Himalaya; and that some of them drain long lateral high-level valleys enclosed between minor ridges whose strike is parallel to the axis of the Himalaya and, occasionally, almost at right angles to the course of the main drainage channels breaking down to the plains. This formation brings the southern watershed of the Tsanpo to the immediate neighbourhood of the banks of that river. It also affords material evidence of that wrinkling or folding action which accompanied the process of upheaval, when the Central Asian highlands were raised, which is more or less marked throughout the whole of the north-west Indian borderland. North of Bhutan, between the Himalayan crest and Lhasa, this formation is approximately maintained; farther east, although the same natural forces first resulted in the same effect of successive folds of the earth's crust, forming extensive curves of ridge and furrow, the abundant rainfall and the totally distinct climatic conditions which govern the processes of denudation subsequently led to the erosion of deeper valleys enclosed between forest-covered ranges which rise steeply from the river banks.

Height of Himalayan peaks.

It may be noted that, although suggestions have been made from time to time of the existence of higher peaks north of the Himalaya than that which dominates the Everest group, there is no satisfactory evidence to support any such suggestion. Everest stands surrounded by pinnacles of such an altitude as make it difficult to detect its actual summit, which still ranks as the highest in the world. No satisfactory comparison of altitude can possibly be made except from a distance by means of trigonometrical observations. The mean of many such observations from the south-east has determined the height of Everest to be rather above 29,000 feet, and there is nothing to be seen beyond the group of pinnacles immediately sur-

rounding that peak which can compare with this altitude. Similar observations from the Tibetan plateau have hitherto been wanting; but recent travellers in Central Tibet have recorded nothing of greater altitude above the general level of the plateau (which may be taken at 15,000 feet) than 5000 or 6000 feet; and, looking southwards, have observed no distant peaks on the Nepal frontier which appeared to rival Everest. It is true that local native tradition, which regards Everest as a sacred mountain, seems to recognize some hitherto unmeasured higher peak in its neighbourhood; but it is obviously impossible that any conclusion could be formed as to the relative altitude of two unapproachable peaks from any position near the base of them. Such traditions are valueless.

Geological evolution of the Himalaya.

If the period 1880–1900 did not add much to our geographical knowledge of the Himalaya in those uncertain spaces where European exploration is impossible on account of political obstruction or the savage nature of the inhabitants, it led to much careful geological survey resulting in clearly-expressed opinions as to the conditions under which the mountain masses were evolved and their primary relations with the peninsula of India. The peninsula, which has been through countless ages of the past (since the close of the Palæozoic era) a land area, is now recognized as having included the Eastern Himalaya and the Assam hills in its periods of geological evolution; whilst the Western Himalaya belongs to that extra-peninsular area which has been repeatedly depressed beneath the sea up to the commencement of the Tertiary age. The older rocks of the Assam ranges are found to be closely related to those of the peninsula, and coal-bearing sandstones identical in character with those of the Bengal coalfields are found along the Himalaya from Sikkim eastwards.

In a remote geological age, at the commencement of the Cretaceous period, when a land connexion existed between South Africa and India, and the Maldive and Laccadive islands were prominent peaks defining a mountain range, the Eastern Himalaya appears to have been directly connected with the peninsula area without the intervening depression caused by the Gangetic plain. So far as we know, there are no marine deposits in the Eastern Himalaya, and it was part of the ancient Indian peninsula throughout the Palæozoic and Mesozoic ages, when all beyond the Aravalli range to the north-west was part of an ocean floor. The close of the Cretaceous period was the termination of a long period of repose and the commencement of another period of great earth movements which, gradually increasing in intensity, reached their maximum in the Pleiocene age, and are even now in process of reshaping the earth's surface, though with greatly diminished activity and force. The result of these movements was to drive back the sea, which covered all the north-western and northern trans-frontier of India, and to crush and fold the rocks, forcing them up into mountain ranges till marine limestones of nummulitic age have been raised to heights of 20,000 feet above the sea on the Himalaya; and sea-formed rocks of the trans-Indus frontier were compressed and crushed into jagged parallel lines of anticlinals, fringing a comparatively level surface of upheaved plateau. But there is direct evidence in the older composition of the rocks that the Himalayan upheaval was the result of a longer period of action and of earlier date than that of the Tertiary trans-Indus frontier hills. The immense mass of the Himalaya apparently precludes the possibility of elevation within the Tertiary period, and it seems probable that even so far back as the Pleiocene age it formed a mountain range not greatly inferior to that which now exists, and with the main drainage features marked out as at present. In those Tertiary beds, originally formed of river deposits and then tilted and compressed into the form of the Siwalik range flanking the foot of the Himalaya, are found beds of conglomerate and boulders close to the outlet of the modern rivers, proving that the ancient beds were not far from the modern channels, and that the rivers flowed much where they do now in the days when the gigantic mammals of Siwalik age roamed through the forests and plains that skirted the Himalayan foothills.

Indo-Gangetic depression.

Another result of those earth-movements which upheaved the Himalaya was the formation of the great parallel depression of the Indo-Gangetic plain. At first this depression had but one outlet, viz., by the Indus valley to the sea, but later the depression deepened between the Assam and Rajmahal hills, and through this channel Himalayan drainage was gradually diverted until, almost within historic times, the Jumna broke away eastwards instead of wandering in countless channels to the south and west, and established for ever the present water-divide between the Indus and Ganges. Such, briefly, is the general outline of Himalayan evolution as now understood, and the process of it has led to certain marked features of scenery and topography, to some of which allusion is made in the ninth edition of the *Encyclopædia Britannica*. The vast area of western trans-Indus hills has been raised above sea-level within the Tertiary period. Here we have beds of hard limestone or sandstone alternating with soft shales, which leads to the scooping out by erosion of long narrow valleys where the shales occur, and the passage of the streams through deep rifts or gorges across the hard limestone anticlinals, which stand in regular series of parallel ridges with the eroded valleys between.

The great mass of the Himalaya exhibits the same structure, due to the same conditions acting for a much longer period and on a much larger scale; but the structure is varied in the eastern portions of the mountains by the effect of different climatic conditions, and especially by the greater rainfall. Instead of wide, barren, wind-swept valleys, we here discover fertile alluvial plains—such as Manipur, for instance—but for the most part the erosive action of the river has been able to keep pace with the rise of the river bed, and we have deep, steep-sided valleys arranged between the same parallel system of folds as we see on the western frontier, connected by short transverse gaps where the rivers cross the folds, frequently to resume a course parallel to that originally held. An instance of this occurs where the Indus suddenly breaks through the well-defined Ladakh range in the North-west Himalaya to resume its north-westerly course after passing from the northern to the southern side of the range. The reason assigned for these extraordinary diversions of the drainage right across the general strike of the ridges is that it is antecedent—*i.e.*, that the lines of drainage were formed ere the folds or anticlinals were raised; and that the drainage has merely maintained the course originally held, by the power of erosion during the gradual process of upheaval.

In the outer valleys of the Himalaya the sides are generally steep, so steep as to be liable to landslip, whilst the streams are still cutting down the river beds and have not yet reached the stage of equilibrium. Here and there a valley has become filled with alluvial detritus owing to some local impediment in the drainage, and when this occurs there is usually to be found a fertile and productive field for agriculture. The straits of the Jhelam, below Baramulla, probably account for the lovely vale of Kashmir, which is in form (if not in principles of construction) a repetition on grand scale of the Maidán of the Afridi Tirah, where the drainage from the slopes of a great amphitheatre of hills is collected and then arrested by the gorge which marks the outlet to the Bara.

General Himalayan formation is typical.

Other rivers besides the Indus and the Brahmaputra commence by draining a considerable area north of the snowy range—the Sutlej, the Kosi, the Gandak, and the Sabansiri, for example. All these rivers break through the main snowy range ere they wind and twist their way through the southern hills to the plains of India. Here the "antecedent" theory will not suffice, for there is no sufficient catchment area north of the snows to support it. Their formation is explained by a process of "cutting back," by which the heads of these streams are gradually eating their way northwards owing to the greater rainfall on the southern than on the northern slopes. The result of this process is well exhibited in the relative steepness of slope on the Indian and Tibetan sides of the passes to the Indus plateau. On the southern or Indian side the routes to Tibet and Ladakh follow the levels of Himalayan valleys with no remarkably steep gradients till they near the approach to the water-divide. The slope then steepens with the ascending curve to the summit of the pass, from which point it falls with a comparatively gentle gradient to the general level of the plateau. The Zoji La, the Kashmir water-divide between the Jhelam and the Indus, is a prominent case in point, and all the passes from the Kumaon and Garwhal hills into Tibet exhibit this formation in a marked degree. Taking the average elevation of the central axial line of snowy peaks as 19,000 feet, the average height of the passes is not more than 10,000 owing to this process of cutting down by erosion and gradual encroachment into the northern basin.

Trans-Himalaya.

In comparison with the extent of geographical information which has been gained in the trans-frontier regions of the north-west of India, that which has been acquired during the period 1875–1900 about the Himalayan regions is small. The trans-Himalayan mountains about the head of the Gilgit valley, the sources of the Oxus, of the Kunar (or Chitral) river, and of the rivers of the Kashgar depression, have all been mapped, their glaciers and snowfields explored, and the difficult tracks and passes which intersect them examined; but in the Himalayan region, between the Indus and the Brahmaputra, it is doubtful if we know of a single new pass or mountain peak. From the western frontier of Nepal bordering Kumaon to Sikkim, for a distance of 180 miles along the length of the Nepal state, no fresh information has been gathered. Then Sikkim intervenes, and here for a short space we have extended geographical reconnaissance into surveys; but beyond Sikkim eastwards through Bhutan to the wild Assamese border hills we have nothing new to

record—not a new pass opened, nor a rudimentary exploration accomplished. This is due partly to the jealous watchfulness of the Nepalese authorities against the intrusion of strangers, which is maintained with rather increasing vigilance than otherwise, and to the wild and savage nature of the Assamese border tribes, who have not as yet been touched by civilizing influences. Consequently much of the Himalaya is still to us a region of conjecture, but of conjecture which is based on most careful study of neighbouring districts.

Glaciers. The northern tributaries of the Gilgit river, which joins the Indus near its south-westerly bend towards the Punjab, take their rise from a glacier system which is probably unequalled in the world for its extent and magnificent proportions. Chief amongst them are the glaciers which have formed on the southern slopes of the Muztagh mountains below the group of gigantic peaks dominated by Mount Godwin-Austen (28,278 feet high), the Golden Throne, and Masharbrum. The Biafo glacier system, which lies in a long narrow trough extending south-west from Nagar on the Hunza to near the base of the Muztagh peaks, may be traced for 90 miles between mountain walls which tower to a height of from 20,000 to 25,000 feet above sea-level on either side. The glaciers of the Himalaya have not yet been brought under systematic observation, but it is clear that there are no glaciers in the Himalaya to rival the trans-Indus group of the Muztagh. Griesbach's investigations of the chief glaciers of the Kumaon group show them to be of great extent. Nearly all the high valleys of the Himalaya possess glaciers. Near the Niti Pass leading from Almorá into Tibet there is a glacier 8 miles long; and Nanda Devi, one of the best known of the Central Himalayan group of snowy mountains, is surrounded by them. A glacier on the north side of Nanda Devi is 14 miles in length. The Gangotri group of peaks heading the Ganges sources are all surrounded with glaciers. Griesbach points out that the glaciers of the Central Himalaya are receding, and that they once extended to a much lower level than at present. This gradual diminution of glacial surface is equally apparent in trans-Himalayan regions.

Mountain scenery. Much has been written about the impressiveness of Himalayan scenery, and there is no need to repeat the observations of travellers who have described the countless phases of mountain landscape that are to be found within so vast a region subject to such variations of climatic influence. It is but lately, however, that any adequate conception of the magnitude and majesty of the most stupendous of the mountain groups which mass themselves about the upper tributaries and reaches of the Indus has been presented to us in the works of Younghusband, Conway, and Tanner. It is not in comparison with the picturesque beauty of European Alpine scenery that the Himalaya appeals to the imagination, for amongst the hills of the outer Himalaya—the hills which are known to the majority of European residents and visitors—there is often a striking absence of those varied incidents and sharp contrasts which are essential to picturesqueness in mountain landscape. Too often the brown, barren, sun-scorched ridges are obscured in the yellow dust haze which drifts upwards from the plains; too often the whole perspective of hill and vale is blotted out in the gray mists that sweep in soft, resistless columns against these southern slopes, to be condensed and precipitated in ceaseless monotonous rainfall. Few Europeans really see the Himalaya; fewer still are capable of translating their impressions into language which is neither exaggerated nor inadequate.

Some idea of the magnitude of Himalayan mountain construction —a magnitude which the eye totally fails to appreciate—may, however, be gathered from the following table of comparison of the absolute height of some peaks above sea-level with the actual amount of their slopes exposed to view:—

Relative Extent of Snow Slopes Visible.

Name of Mountain.	Place of Observation.	Height above sea.	Amount of Slope exposed.
Everest or Gaurisankar	Dewanganj . . .	29,000	8,000
,, ,,	Sandakphu . . .	,,	12,000
K_2 or Godwin-Austen .	Between Gilgit and Gor, 16,000 feet .	28,278	
Pk. XIII. or Makalu .	Purnea, 200 feet . .	27,800	8,000
,, ,, .	Sandakphu, 12,000 feet	,,	9,000
Nanga Parbat . .	Gor, 16,000 feet . .	26,000	23,000
Tirach Mir . . .	Between Gilgit and Chitral, 8000 feet .	25,400	17–18,000
Rakapushi . . .	Chaprot (Gilgit), 13,000 feet	25,560	18,000
Kanchinjunga . .	Darjiling, 7000 feet .	28,160	16,000
Mont Blanc . . .	Above Chamounix, 7000 feet	15,781	11,500

It will be observed from this table that it is not often that a greater slope of snow-covered mountain side is observable in the Himalaya than that which is afforded by the familiar view of Mont Blanc from Chamounix.

As regards the scenery surrounding the highest mountain in the world, Tanner says that the finest view of it which is obtainable from British territory is that which may be gained from Sandakphu, 35 miles from Darjiling. "The outline of Everest is rather tame, though fairly sharp, and a long snowy slope rests on its north-east flank. Peaks of 22,000 feet and thereabouts encircle its southern base, and below them are seen many dark mountain masses without snow. From due south, near the Kosi river in the Bhagalpur district, Everest is by no means a marked feature in the landscape; although from a near point of view its face is wild, and the cliff must be very lofty. . . . Though rising to a height of 29,000 feet, it only towers 12,000 feet above its fellows, and is thus relatively commonplace." He further points out that the Tibetans probably refer to Peak T 45 of the Indian Survey to the north-west of Everest, which rises to 27,000 feet, when they claim a higher peak than Everest. Its comparatively isolated position would produce the impression of greater altitude.

Kanchinjunga. For the picturesque beauty of its natural setting in the midst of tropical mountain scenery, no less than for grandeur of outline and profound impression of majestic predominance, there is probably no rival in the world to Kanchinjunga as seen from Darjiling. Here the forest splendours of the south combine with the ice-bound majesty of the north, and the two are linked by 16,000 feet of cloud-woven wreaths resting on the successive steps of the grandest mountain staircase that nature has ever fashioned.

Hill stations. The development of the "hill stations" of the Himalaya is naturally a point of interest in connexion with the general economic progress of India. Great efforts have been made since 1875 to render these stations, or towns, more accessible from the plains, with the result of an increasing population during those months of the year when the heat of the plains drives Europeans to the cool atmosphere of the mountains. It does not appear that the fixed and permanent population of hill stations is largely on the increase, although there is a distinct tendency towards native concentration in the neighbouring villages, and a visible spread of local cultivation in adjacent valleys. No marked increase of European colonists in the Himalaya, east of Kashmir, is recognizable, although the growing intermittent condensation of official society in the hill stations has called for increased house accommodation for temporary occupation. Indeed, the habitations of many of those European settlers who existed in days when communication with Europe was a matter of months now know them no more, and as a rule they have not been reoccupied. In the sheltered valley of Kulu, and on the outer slopes below Darjiling, fruit plantations and tea cultivation have been largely developed under European management; but with few exceptions the successful prosecution or agriculture does not lead to permanent settlements in the Himalaya. But the increased facilities for exchanging the close sultry atmosphere of the Indian plains in summer for the more invigorating (though frequently more humid) climate of "the hills" have developed a temporary European population of thousands in places (as in Simla) where there used to be hundreds not so very long ago, and have demanded still further efforts towards facilitating communications.

Mountain railways. At Darjiling a mountain railway of 51 miles in length already connects that station with the Bengal railway system, but this is the only hill station of the Himalaya which in the year 1900 enjoyed such facilities of approach. Railway projects are already sanctioned for connecting Srinagar in Kashmir with the Punjab, and Simla with the head of the Delhi-Kalka line; and the road to Mussoorie will be shortened by a line which will connect Dehra-Dun at the foot of the Mussoorie hills with the sanitarium on their summits. These short local mountain lines would have been constructed earlier had the trade from the hill regions to the plains been sufficient to justify them, but trade with the interior across the Himalayan passes has shown little signs of development. Trade from High Asia across the group of passes which head the rivers of Kumaon and Garwhal, as well as that by the Sutlej river route through Simla, has rather diminished than increased of late years. In Kashmir alone there has sprung up a considerable local traffic (chiefly in fruit), and between Tibet and Kashmir *viâ* Ladak there seems to be promise for the future.

Authorities.—Our old authorities on the Himalaya (notably the Stracheys, Hooker, and Blanford) are still the best, but we have had a good many popular contributions to the subject since 1875, amongst which the following are the best known:—Drew. *Jammu and Kashmir.* London, 1875.—Leitner. *Dardistan.*—Biddulph. *Tribes of the Hindu Kush.* Calcutta, 1880.—Lydekker. "Geology of Kashmir, &c." Vols. xiii. and xiv. *Geological Survey of India.*—Godwin-Austen. "Mountain Systems of the Himalaya." Vols. v. and vi. *Proc. R. G. S.*,

1883-84.—UJFALVY. *Aus dem westlichen Himalaya.* Leipzig, 1884.—TANNER. "Our Present Knowledge of the Himalaya." Vol. xiii. *Proc. R. G. S.*, 1891.—GRIESBACH. "Geology of Central Himalaya." *Geological Survey Memoirs.* Calcutta, 1891.—OLDHAM. "The Evolution of Indian Geography." Vol. iii. *Jour. R. G. S.*—LAWRENCE, W. *Kashmir.* Oxford, 1895.—CONWAY. *Climbing and Exploring in the Karakoram.* London, 1898. (T. H. H.*)

Hindley, a township in the Ince parliamentary division of Lancashire, England, 2 miles east-south-east of Wigan, on the Lancashire and Yorkshire and the London and North-Western Railways. It has a free library and museum. Area of township (an urban district), 2611 acres. Population (1881), 14,715; (1901), 23,504.

Hindu Kush, a range of mountains, throughout 500 miles of its length, from its roots in the Pamir regions till it fades into the Koh-i-Baba to the west of Kabul, forming the water-divide between the Kabul and the Oxus basins, and, for the first 200 miles, reckoning westwards, the southern boundary of Afghanistan. It may be said to spring from the head of the Taghdumbash Pamir, where it unites with the great meridional system of Sarikol stretching northwards, and the yet more impressive mountain barrier of Muztagh, the northern base of which separates China from the semi-independent territory of Kanjut. The Wakhjir pass, crossing the head of the Taghdumbash Pamir into the sources of the river Hunza, almost marks the tri-junction of the three great chains of mountains. As the Hindu Kush strikes westwards, after first rounding the head of an Oxus tributary (the Ab-i-Panja, which Curzon considers to be the true source of the Oxus), it closely overlooks the trough of that glacier-fed stream under its northern spurs, its crest at the nearest point being separated from the river by a distance which cannot much exceed 10 miles. As the river is here the northern boundary of Afghanistan, and the crest of the Hindu Kush the southern boundary, this distance represents the width of the Afghan kingdom at that point.

Physiography.—For the first 100 miles of its length the Hindu Kush is a comparatively flat-backed range of considerable width, permitting the formation of small lakes at intervals on the crest, and possessing no considerable peaks. It is crossed by many passes, varying in height from 12,500 feet to 17,500 feet, the lowest and the easiest being the well-known group about Baroghél, which has from time immemorial offered a line of approach from High Asia to Chitral and Jalalabad. As the Hindu Kush gradually recedes from the Ab-i-Panja and turns south-westwards it gains in altitude, and we find prominent peaks on the crest which measure more than 24,000 feet above sea-level. Even here, however, the main central water-divide, or axis of the chain, is apparently not the line of highest peaks, which must be looked for to the south, where the great square-headed giant called Tirach Mir dominates Chitral from a southern spur. For some 40 or 50 miles of this south-westerly bend, bearing away from the Oxus, where the Hindu Kush overlooks the mountain wilderness of Badakshan to the west, the crest is intersected by many passes, of which the most important is the Dorah group (including the Minján and the Mandal), which rise to about 15,000 feet, and which are, under favourable conditions, practicable links between the Oxus and Chitral basins.

Kafiristan Section.—From the Dorah to the Khawák pass (or group of passes, for it is seldom that one solitary line of approach only is to be found across the Hindu Kush), which is between 11,000 and 12,000 feet in altitude, the water-divide overlooks Kafiristan and Badakshan. Here its exact position is matter of conjecture. It lies amidst a wild, inaccessible region of snow-bound crests, and is certainly nowhere less than 15,000 feet above sea-level. There is a tradition that the great Timur attempted the passage of the Hindu Kush by one of the unmapped passes hereabouts, and that, having failed, he left a record of his failure engraved on a rock in the pass.

Passes.—The Khawák, at the head of the Panjshir tributary of the Kabul, leading straight from Badakshan to Charikar and the city of Kabul, is now an excellent khafila route, the road having been engineered under the Amir's direction, and it is said to be available for traffic throughout the year. From the Khawák to the head of the Ghorband (a river of the Hindu Kush which, rising to the north-west of Kabul, flows north-east to meet the Panjshir near Charikar, whence they run united into the plains of Kohistan) the Hindu Kush is intersected by passes at intervals, all of which were surveyed, and several utilized, during the return of the Russo-Afghan Boundary Commission from the Oxus to Kabul in 1886. Those utilized were the Kaoshán (the "Hindu Kush" pass *par excellence*), 14,340 feet; the Chahardar (13,900 feet), which is a link in one of the Amir of Afghanistan's high roads to Turkestan; and the Shibar (9800 feet), which is merely a diversion into the upper Ghorband of that group of passes between Bamián and the Kabul plains which are represented by the Irák, Hajigak, Unai, &c. About this point it is geographically correct to place the southern extremity of the Hindu Kush, for here commences the Koh-i-Baba system into which the Hindu Kush is merged.

General Conformation.—The general conformation of the Hindu Kush system south of the Khawák, no less than such fragmentary evidence of its rock composition as at present exists to the north, points to its construction under the same conditions of upheaval and subsequent denudation as are common to the western Himalaya and the whole of the trans-Indus borderland. Its upheaval above the great sea which submerged all the north-west of the Indian peninsula long after the Himalaya had massed itself as a formidable mountain chain, belongs to a comparatively recent geologic period, and the same thrust upwards of vast masses of Cretaceous limestone has disturbed the overlying recent beds of shale and clays with very similar results to those which have left so marked an impress on the Baluch frontier. Successive flexures or ridges are ranged in more or less parallel lines, and from between the bands of hard, unyielding rock of older formation the soft beds of recent shale have been washed out, to be carried through the enclosing ridges by rifts which break across their axes. The Hindu Kush is, in fact, but the face of a great upheaved mass of plateau land lying beyond it northwards, just as the Himalaya forms the southern face of the great central tableland of Tibet, and its general physiography, exhibiting long, narrow, lateral valleys and transverse lines of "antecedent" drainage, is similar. There are few passes across the southern section of the Hindu Kush (and it should be noted that this section is, from the politico-geographical point of view, more important to India than the whole Himalayan system) which have not to surmount a succession of crests or ridges as they cross from Afghan Turkestan to Afghanistan. The exceptions are, of course, notable, and have played an important part in the military history of Asia from time immemorial. From a little ice-bound lake called Gaz Kul, or Karambar, which lies on the crest of the Hindu Kush near its northern origin at the head of the Taghdumbash Pamir, two very important river systems (those of Chitral and Hunza) are believed to originate. The lake really lies on the watershed between the two, and is probably a glacial relic. Its contribution to either infant stream appears to depend on conditions of

overflow determined by the blocking of ice masses towards one end. It marks the commencement of the water-divide which primarily separates the Gilgit basin from that of the Yashkun, or Chitral, river, and subsequently divides the drainage of Swat and Bajaor from that of the Chitral (or Kunar). The Yashkun-Chitral-Kunar river (it is called by all three names) is the longest affluent of the Kabul, and it is in many respects a more important river than the Kabul. Throughout its length it is closely flanked on its left bank by this main water-divide, which is called Moshabar or Shandur in its northern sections, and owns a great variety of names where it divides Bajaor from the Kunar valley. It is this range, crowned by peaks of 22,000 feet altitude and maintaining an average elevation of some 10,000 feet throughout its length of 250 miles, that is the real barrier of the north—not the Hindu Kush itself. Across it, at its head, are the glacial passes which lead to the foot of the Baroghél. Of these Darkot, with a glacial staircase on each side, is typical. (See Gilgit.) Those passes (the Kilik and Mintaka) from the Pamir regions, which lead into the rocky gorges and defiles of the upper affluents of the Hunza to the east of the Darkot, belong rather to the Muztagh system than to the Hindu Kush. Other passes across this important water-divide are the Shandur (12,250 feet), between Gilgit and Mastuj; the Lowarai (10,450 feet), between the Panjkora and Chitral valleys; and farther south certain lower crossings which once formed part of the great highway between Kabul and India.

Chitral.—Deep down in the trough of the Chitral river, about midway between its source and its junction with the Kabul at Jalalabad, is the village and fort of Chitral. The village is insignificant, and the fort derives its notoriety from the siege of 1895, when it proved to be defensible with difficulty against an undisciplined highland rabble who were without artillery. Facing Chitral, on the right bank of the river, and extending for some 70 miles from the Hindu Kush, is the lofty snow-clad spur of the Hindu Kush known as Shawal, across which one or two difficult passes lead into the Bashgól valley of Kafiristan. This spur carries the boundary of Afghanistan southwards to Arnawai (some 50 miles below Chitral), where it crosses the river to the long Shandur watershed. South of Arnawai the Kunar valley becomes a part of Afghanistan (see Kunar). Chitral can be reached either by the long circuitous route from Gilgit, involving 200 miles of hill roads and the passage of the Shandur pass (12,250 feet), or (more directly) from the Peshawar frontier at Malakand by 100 miles of route through the independent territories of Swat and Bajaor, involving the passage of the Lowarai (10,450 feet). It is held at present by a small force as a British outpost. The district of Chitral is called Kashkar (or Kashgar) by the people of the country; and as it was once under Chinese domination, and was regarded as a Buddhist centre of some importance by the Chinese pilgrims in the early centuries of our era, it is possible that it then existed as an outlying district of the Kashgar province of Chinese Turkestan, where Buddhism once flourished in cities that have been long since buried beneath the sand-waves of the Takla Makan. The aboriginal population of the Chitral valley is probably to be recognized in the people called Kho (speaking a language called Khowar), who form the majority of its inhabitants. It is from this Kho community that Sir H. Yule considered it likely that the ancient classical name of Khoaspes for the river of Chitral was derived. Upon the Kho a people called Ronas have been superimposed. The Ronas, who form the chief caste and fighting race of the Chitral districts, originally came from the north, but they have adopted the language and fashions of the conquered Chitrali. Chitral may be regarded as an outlying branch of the Gilgit political agency, which is itself a branch of Kashmir administration, its political status being "independent." The value of Chitral as an outpost of British India may be best gauged by its geographical position. It is about 100 miles (direct map measurement) from the outpost of Russia at Langar Kisht on the river Panja, with the Dorah pass across the Hindu Kush intervening. The Dorah may be said to be about half-way between the two outposts, and the mountain tracks leading to it on either side are rough and difficult. The Dorah, however, is not the only pass which leads into the Chitral valley from the Oxus. The Mandal pass, a few miles south of the Dorah, is the connecting link between the Oxus and the Bashgól valley of Kafiristan; and the Bashgól valley leads directly to the Chitral valley at Arnawai, about 50 miles below Chitral. Nor must we overlook the connexion between north and south of the Hindu Kush which is afforded by the long narrow valley of the Chitral (or Yashkun) itself, leading up to the Baroghél pass. This is the route which was once made use of by the Chinese for purposes of pilgrimage, if not for invasion. Access to Chitral from the north is therefore but a matter of practicable tracks, or passes, in two or three directions, and the measure of practicability under any given conditions can best be reckoned from Chitral itself. By most authorities the possibility of an advance in force from the north, even under the most favourable conditions, is considered to be exceedingly small; but the tracks and passes of the Hindu Kush are only impracticable so long as they are left as nature has made them. (See Chitral.)

Our information about the Hindu Kush and Chitral is now comparatively exact. The Russo-Afghan Boundary Commission of 1884 and the Chitral Expedition of 1895 opened up a vast area for geographical investigation, and the store of information collected is to be found in the reports and gazetteers of the Indian Government. The following are the chief recent authorities:—Report of the Russo-Afghan Boundary Commission, 1886; Report of Lockhart's Mission, 1886; Report of Asmar Boundary Commission, 1895; Report of Pamir Boundary Commission, 1896. J. Biddulph. *Tribes of the Hindu Kush.* Calcutta, 1880.—W. M'Nair. "Visit to Kafiristan." Vol. vi. *R. G. S. Proc.*, 1884.—F. Younghusband. "Journeys on the Pamirs, &c." Vol. xiv. *R. G. S. Proc.*, 1892.—Colonel Durand. *Making a Frontier.* London, 1899.—Sir G. Robertson. *Chitral.* London, 1899.

(T. H. H.*)

Hindu Law.—The Hindu law is that body of law which is administered by the courts of British India when they are dealing with Hindus. It is not a territorial law applicable to all persons in British India, but a personal law applicable to Hindus only. And even for Hindus the Hindu law which is administered to-day does not cover the whole field of jurisprudence. There are many laws, some made by the British Parliament, some by the legislative bodies in India, and some which have grown up under the decisions of the courts, which are applicable to Hindus as well as to other British subjects in India.

The extent to which Hindu law is administered by the British courts in India, and the circumstances by which that extent has been determined, can only be explained by a short recapitulation of the events which led to these courts being established. Prior to 1771 the only British courts in India were those in Calcutta, Bombay, and Madras, established by royal charter and administering English law. In 1772, Warren Hastings, as Governor-General in council, acting, not under any authority derived from the British Government, but under the authority conferred upon the East India Company by the Mogul emperor, drew up a series of regulations for the administration of civil justice in Bengal, Behar, and Orissa. At that time the

law which prevailed in those districts in civil matters was as regards Hindus the Hindu law, as regards Mahommedans the Mahommedan law. The criminal law as regards all persons was the Mahommedan law, but jurisdiction in criminal matters was reserved by the emperor to his own officers, and did not pass to the East India Company until later. The form in which the authority of the emperor was granted was that of appointing the East India Company to be the "Dewan," or chief civil officer, in Bengal, Behar, and Orissa. This authority was, of course, exercised by the Company through the Governor-General in council. What were the exact limits of this authority it would not be very easy to determine, for though in theory the East India Company were the servants of the emperor, all the substantial power lay with the Company, and probably Hastings did not consider very closely what the exact limits of his authority were. What he actually announced in the Regulations by which he constituted the courts in the above districts, was that "in all suits regarding inheritance, marriage, caste, and other religious usages and institutions, the laws of the Koran with respect to Mahommedans and those of the Shasters with respect to Gentoos [*i.e.*, Hindus] shall be invariably adhered to." What law was to be applied in other cases the Regulations did not say, but it must be remembered that the topics of litigation at that time were very few.

Shortly after this, namely, in 1773, the Supreme Court was established in Calcutta under the authority of Parliament. There arose out of this a conflict between the Governor-General in council and the Supreme Court, on account of the latter claiming jurisdiction outside Calcutta, to which the officers of the East India Company refused to submit. This dispute was settled by the statute 21 Geo. III. c. 70, which confined the jurisdiction of the Supreme Court to Calcutta, and declared that the "inheritance and succession to lands, rents, and goods, and all matters of contract and dealing between party and party, shall be determined in the case of Mahommedans by the laws and usages of the Mahommedans, and in the case of Gentoos [*i.e.*, Hindus] by the laws and usages of Gentoos." In matters of contract the native laws have never been much regarded, and, except where any special custom can be proved, the whole matter is now governed by the Contract Act. The old legislative enactments have also been superseded. By Act 111 of 1887, § 37, the law to be administered in the civil courts in Bengal, the North-West Provinces, and Assam is laid down in these terms:—"Where in any suit or other proceeding it is necessary for a civil court to decide any question regarding succession, inheritance, marriage, or caste, or any religious usage or institution, Hindu law in cases where the parties are Hindus shall form the rule of decision, except in so far as such law has by legislative enactment been altered or abolished"; and there are statutory provisions in similar terms for other parts of India. The interpretation put upon the provisions of the Indian Regulations quoted above, the British Act of Parliament, and the later Indian Acts have been substantially the same.

Sources of Hindu Law.—The Hindu law is in theory of divine origin, and therefore unchangeable by human authority. Ask a Hindu where his law is to be found, and he will reply "In the Shasters." The Shasters are certain books supposed to be divinely inspired, and all of great antiquity. They contemplate a state of society very unlike that of the present day, or that of many centuries back. It follows that these sacred writings, whilst they leave many of the legal requirements of the present day wholly unprovided for, contain many provisions which no Hindu even would now think of enforcing. Consequently, in spite of the theory, the law had to be changed. Legislation, which with us is the most potent as well as the most direct instrument of change, has had scarcely any effect on the Hindu law. Probably it never entered into the head of any Hindu before British rule was set up in India that any human agency could be entrusted with the power of making or changing the law; and although both the Indian Legislatures and the British Parliament have full power to legislate for Hindus upon all matters without any exception, they have, in fact, hardly ever exercised this power as regards the Hindu law. Custom is a less direct instrument of change than legislation, and operates more slowly and secretly, but its influence is very great. The custom which supplants the sacred law may indeed be as old as or older than the sacred law, and its existence may be due to the divinely inspired law having failed to displace it; or the habits and necessities of the people may have engrafted the custom upon the sacred law itself. In either view there has been no difficulty in accepting custom where it varied from the sacred law. Indeed, the sacred books themselves recognize to some extent the operation of custom. Thus we find it said in the Laws of Manu (viii. 4, 1), "the king who knows the sacred law must inquire into the laws of castes, of districts, of guilds, and of families, and thus settle the peculiar law of each." It is to the influence of custom that the divergence between the Hindu law of to-day and that of the Shasters is largely due. Another method by which law is developed, and one more subtle still, is interpretation; and it is one which in skilful hands may be used with considerable effect. Without any dishonesty, people very often find in the language of the law words sufficiently vague and comprehensive to cover the sense which they are looking for. The action of interpretation upon Hindu law differs accordingly as it took place before or after the British occupation. Formerly the only persons whose interpretation was accepted as authoritative were the writers of commentaries. But the Indian courts are very sparing in accepting modern commentaries as authoritative, though nevertheless they carefully record their own interpretations of the law, and these are always treated as authoritative. It follows, from the very nature of the influences thus brought to bear upon law, that not only have the sacred books been departed from, but that different results have been arrived at in different parts of India. The differences have led recent writers to speak of five schools of Hindu law, called respectively the Benares school, the Bengal or Gauriya school, the Bombay school or school of Western India, the Dravida school or school of Southern India, and the Mithila school—the district last named being a very small one to the south of and adjoining Nepal. But it would be a great mistake to suppose that the differences between these so-called schools are comparable to each other in importance. As will appear presently, it would be much more correct to speak of two schools, that of Benares and that of Bengal—the other three being subdivisions of the first.

Sacred Books.—It will be convenient to give a short description of those of the sacred books which are actually in use in the Indian courts when they desire to ascertain the Hindu law. Of these by far the first in importance, as well as the first in date, is the one which we call the Laws of Manu. It has been translated by Professor Buhler, and forms vol. xxv. of the "Sacred Books of the East," edited by Professor Max Müller. If we examine it, we find that only about one-fourth of the book deals with matters which we should call legal, the rest being concerned with topics either purely religious or ceremonial. And of these topics only one, that relating to partition of family property, belongs to that portion of

the Hindu law which is administered in the courts, and, as one would expect, what is said on this topic has been largely departed from under the influences above described. Very little is known as to the date of the Laws of Manu. They are probably much older than their present form, which Buhler places somewhere between 200 B.C. and A.D. 200. Of more interest than the exact date is the state of society which they disclose. The tribal and nomadic stage had passed away. Society had so far settled down as to possess a regular form of government under a king. The people were divided into four great castes, representing religion, war, commerce and agriculture, and servitude. Justice is spoken of as administered by the king. Provision is made for the recovery of debts and the punishment of offences. There are rules relating to the pasture of cattle, trespass by cattle, and the enclosure of cultivated fields. There was evidently considerable wealth in the shape of horses, carriages, clothes, jewellery, and money. There is no mention of land in general as the subject of permanent private property, though no doubt the homestead and the pasture land immediately adjoining were permanently owned.

The (so-called) Smriti of Yajnavalkya was, no doubt, a work of considerable importance in its day, and is still sometimes referred to. It shows a somewhat more advanced state of society than the Laws of Manu. The occupier of land has a firmer hold upon it, and there seems to be even a possibility of transferring land by sale. The date of it has not been fixed, but it is thought to be later than the Laws of Manu.

The Smriti of Narada belongs to a still later period, perhaps to the 5th or 6th century of our era. It goes more into detail than the other two books just mentioned.

But far more important for practical purposes than these sacred books are the commentaries. These are not sacred. The most important of them all is that known as the Mitacshara. The author of it was named Vijnaneswara. His work is a commentary on the Smriti of Yajnavalkya, and it is supposed to have been written in the latter half of the 11th century. Only a portion of it is used by the law courts—that portion which relates to the partition of family property. It is easy to see that in the eight or ten centuries which had elapsed since the date of the Laws of Manu, society had considerably advanced, and that the law has undergone great changes. The Mitacshara is an important authority for Hindus all over India, and in the greater part its authority is supreme. But there is one very important exception. In the district which is sometimes called Bengal Proper (from its correspondence with the ancient kingdom of Bengal, of which Gaur was the capital), and may be roughly described as the valley of the Ganges below Bhagalpur, the prevailing authority is a treatise called the Dayabhaga. It is, like the Mitacshara, as its name imports, a treatise on partition. The author of it was Jimutavahana. There does not appear to be any more distinct clue to its date than that this author wrote after the 12th century and before the 16th. The very important points of difference between the two commentaries will be stated hereafter. In Western India there is a commentary of authority called the Vyavahara Mayukha. It belongs to the 16th century. Generally its authority is secondary to that of the Mitacshara, but in Gujrat its authority is to some extent preferred. In the south of India the Smriti Chandrika is a work of importance. It belongs to the 13th century. It generally follows the Mitacshara, but is fuller on some points. The Vivada Chintamani is used in the small district of Mithila. It is said to belong to the 15th century.

The Joint Family.—The joint family is by far the most important institution of Hindu society, and it is only through the joint family that we can form a proper conception of the Hindu law. It is the form in which the patriarchal system has survived in India. There is nowhere in Hindu literature, ancient or modern, a description of it as it has existed at any time. In its general features it has always been too universal and too well known to be described. In the Laws of Manu we find very little about it, but what we do find is of great interest. The subject is taken up with reference to a question which in every patriarchal system imperatively requires an answer. What is to be done when a break-up of the family is threatened by the death of the common ancestor? Upon this subject the author of the Laws of Manu says in chap. ix. v. 104: "After the death of the father and the mother, the brothers being assembled, may divide among themselves in equal shares the paternal estate, for they have no power over it while the parents live." Then in v. 105, "or the eldest son alone may take the whole paternal estate; the others shall live under him just as they lived under the father." And in v. 111, "Either let them thus live together, or apart if each desires to gain spiritual merit, for by their living separate merit increases, hence separation is meritorious."

We may put aside what is said about the mother, which is probably a survival of polyandry, and is now obsolete, and fix our attention upon three important points:—(1) Authority is attributed to the father during his life; (2) the same absolute authority is attributed to the eldest son upon the father's death, if the family remains undivided; (3) the sons are at liberty, are indeed recommended, to divide the property. Now, though there may be doubts as to how far this type of family was at any time the universal one, there cannot be any doubt that in those early times it largely prevailed, and that the modern Hindu joint family is directly derived from it. Moreover, it must be remembered that what is here discussed is not ownership, but managership. If the family remained undivided, the eldest son did not take the family property as owner; he only became the uncontrolled manager of it. So far as there was any notion of ownership of the family property, and it was in those early times quite rudimentary, it was in the nature of what we call corporate ownership. The property belonged not to the individual members of the family collectively, but to the family as a whole; to use a modern illustration, not to the members of a family as partnership property belongs to partners, but as collegiate property belongs to fellows of a college. Probably, however, in early times it never occurred to any one to look very closely into the nature of ownership, for until the question of alienation arises the difference between managership and ownership is not of very great importance; and this question did not arise until much later. When and under what circumstances Hindus first began to consider more carefully the nature of ownership we have no means of ascertaining. But we have very clear evidence that there was at one time a very warm controversy on the subject. Each of the two leading commentaries on Hindu law, the Mitacshara and the Dayabhaga, opens with a very long discussion as to when and how a son becomes entitled to be called an owner of the family property. Two conflicting theories are propounded. One is that the sons are joined with the father in the ownership in his lifetime; the other is that they only become owners when he dies, or relinquishes worldly affairs, which, according to Hindu ideas, like taking monastic vows, produces civil death. The author of the Mitacshara adopts the first of these views; the author of the Dayabhaga adopts the second;

and this radical difference led to the great schism in the Hindu law. It follows that, according to the Dayabhaga view, the sons not being owners, the father is sole owner. He is both sole owner and uncontrolled manager. According to the Mitacshara view the father and the sons together are the owners, not as individuals, but as a corporation. But even this is not inconsistent with the father retaining his absolute control as manager. How far he has done so will be considered presently.

Hitherto, for the sake of simplicity, the position of father and son has alone been considered; but now take the case of several brothers living together with sons and grandsons. What is the nature of the ownership in this case, and in whom is it vested? Neither in the Dayabhaga nor in the Mitacshara is this question discussed directly, but each of these commentaries discloses the answer which its author would give to this question. According to the Mitacshara, of however many different branches, and of however many different members, a family may consist, they all form a single unity or corporation to which the family property belongs. Not that this is asserted in so many words; there is probably no Sanskrit word corresponding at all nearly to our word corporation. But this is the only language in which a modern lawyer can describe the situation. The members of the family are not partners; no one can separately dispose of anything, not even an undivided share. It is quite otherwise under the Dayabhaga. The property belongs to the members of the family, not as a corporation, but as joint owners or partners. Each is the owner of his undivided share; but not all the members of the Dayabhaga family have a share in the ownership; the sons whose fathers are alive are entirely excluded: the owners are those members of the family of any age who have no direct living ancestor.

This was the nature of family ownership in its two principal forms, but the possibility that an individual member of the family could have something exclusively his own is clearly recognized in the Laws of Manu. Thus in chap. ix. v. 206, it is said, "Property acquired by learning belongs solely to him to whom it was given, likewise the gift of a friend, a present received in marriage, or with the honey mixture." And again in v. 208, "What the brother may acquire by his labour without using the patrimony, that acquisition made solely by his own effort he shall not share, unless by his own will, with his brothers"; and these texts, as we shall see presently, are still of practical application. Nowhere has a strict family system prevailed without some analogous measure of relief. In Rome we find the *peculium*. In England, as late as the 13th century, lawyers speak of the *allod*, or ancient inalienable family domain, sometimes called *hereditas*, side by side with the *questum*, or acquired property. And Sir Henry Maine considers that there is something analogous in the ancient Brehon law (see *Early History of Institutions*, p. 110).

The modern Hindu joint family is a community the members of which are all descended from a common ancestor, and the wives and unmarried daughters of those who are married. Perhaps the wives and daughters might more correctly be said to belong to the family than to be members of it. In its complete form the family is said to be joint in food, worship, and estate; and notwithstanding the divergence between the Mitacshara and Dayabhaga systems, the main external features of such a family are the same all over India. Every Hindu family has a common home. This does not mean that there is a single house in which all the members of the family continuously reside, but there is one house where the family gods remain, where the wants of all the members of the family are provided for, where the family worship is conducted, and to which every member of the family is at any time at liberty to resort. This is the real home of a Hindu. Any other residence, however long it may last, is looked upon as temporary. Here also the wives and children remain whilst the men are employed at a distance. With regard to the enjoyment of the family property there is no distinction, except such as the members of the family themselves choose to make. Everything is enjoyable in common. This is the same all over India. It is very necessary to distinguish between ownership and enjoyment. Although the ownership of the family property under the Mitacshara differs very materially (as explained above) from that under the Dayabhaga, the enjoyment in both cases is the same. There is one common fund out of which the wants of the family are supplied. No one is dependent upon his own contribution to the family fund. No one member can say to another, "You have consumed more than your share, and you must make it good." On the other hand, whatever is earned goes into the common stock. Though separate acquisition is possible, it is exceptional, and there is always a presumption that the earnings of all the members belong to the common fund, so that if any member claims property as self-acquired he must establish his assertion by evidence as to how he acquired it, and that he did so "without using the patrimony." The accounts of the family are kept by the manager, who is usually the eldest male, and he also generally manages the property. But he is assisted and controlled by the other members of the family. No separate account is kept of what each member contributes or receives. The expenditure on behalf of the various members of the family is scarcely ever equal, but this inequality creates no debt between the members of the family. If any one is dissatisfied he can protest, and if his protest is not listened to, there is only one remedy—he can demand a partition. The powers of the manager are those of an agent: it is very rare to find them formally expressed, and they must be gathered from the usual course of dealing, either amongst Hindus generally, or in the particular family to which the manager belongs; and it is the custom for all the adult male members of the family to be consulted in matters of serious importance. The alienation of land is always looked upon as a matter of special importance, and, except in cases of urgent necessity, requires the express assent of all the members of the family.

Partition.—If any member of a Hindu family who is one of the co-owners wishes for a partition, he can demand one, there never having been any compulsion on the members of a Hindu family to live in common. Of course in a Dayabhaga family there can only be a partition as between brothers, or the descendants of brothers; between a father and his sons there can be no partition, the sons not being owners. The father may, if he chooses to do so, distribute the property amongst his sons, and he sometimes does so; but this is a distribution of his own property, and not a partition. The father can distribute the property as he pleases. But the absolute power of the father in this respect has only been recently established. It used to be thought that, if the father made a distribution, he must give to each of his sons an equal share. It is now settled that the father is absolute. Under the Mitacshara, the ownership being vested in the father and sons, there can be a partition between father and sons, and the sons can always insist that, if a partition is made, their rights shall be respected. Whether, under the Mitacshara law, the sons have the right to demand a partition in opposition to their father has been much

disputed. It is now generally considered that the sons have such a right.

In modern times if a partition takes place everything belonging to the family in common must be divided, even the idols. If there is only one idol, then each member of the family will be entitled to a "turn of worship," as it is called. It is, however, open to the members of the family to make any special arrangements either for retaining any portion of the property as joint, or as to the mode of carrying out of the partition, provided they can all agree to it. It is remarkable that in the Laws of Manu no such complete partition as can now be required is prescribed. A list of articles is given of considerable importance of which no partition could be claimed. In chap. ix. v. 219, it is said, "A dress, a vehicle, ornaments, cooked food, water, and female slaves, property destined for pious uses and sacrifices, and a pasture ground" are all declared to be indivisible. Land and the right of way to the family house were also at one time indivisible. These things, therefore, must have been used in common after partition had taken place, which looks as if the family were not entirely broken up; and it is possible that they inhabited several houses within the same enclosure, as is sometimes seen at the present day. It is not always easy to subdivide property amongst the sharers, especially where they are numerous; and cases occur where a better division could be made by selling the whole or a portion of the property, and dividing the proceeds. This could always be done with the consent of all the sharers; and now by Act IV. of 1893 of the Governor-General in council it can be done with the consent of a moiety in value of the sharers.

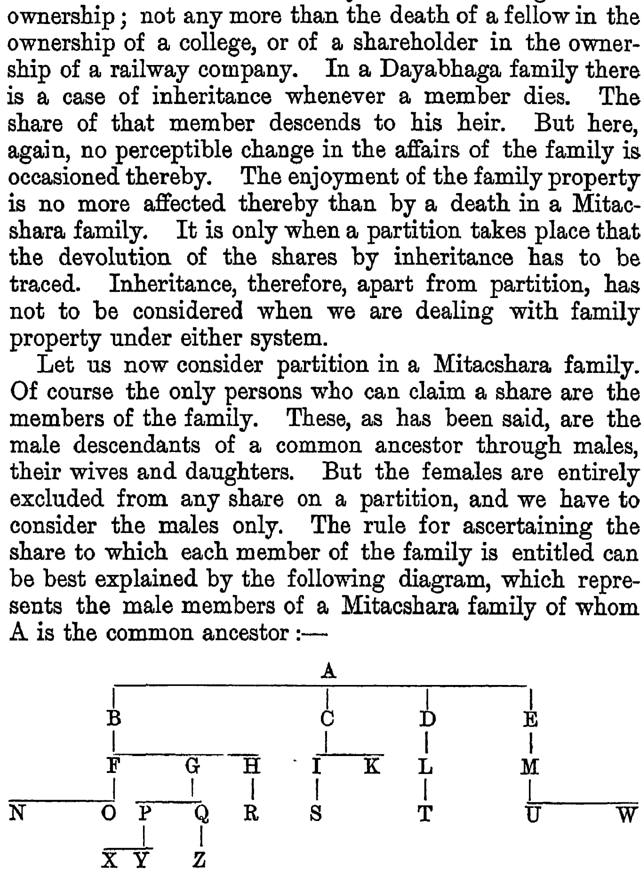
Rulers in India are apt to look upon their territories as private property, but there is no instance on record of the succession to the throne being considered as partible. On the contrary, in the families which now represent the small mediatized princes, the family property is frequently, by a special custom, considered to be impartible. The property descends to the eldest male, the younger members of the family getting allowances, generally in the form of temporary assignments of portions of the family property.

Persons who in ordinary circumstances would be entitled to claim a share in the family property may be disqualified from doing so by certain specified imperfections. According to the Laws of Manu (ix. 201), "Eunuchs, outcasts, persons born blind or deaf, madmen, and such as have lost the use of a limb," are excluded. According to Yajnavalkya, a person afflicted with an incurable disease is excluded. The leaning of the courts is against such exclusions. Outcasts have been relieved by Act XXI. of 1850, which expressly repeals the disqualification; and probably the only disease which would now exclude is the worst form of leprosy. Persons so excluded are not left unprovided for. Though excluded from partition, they can always claim a suitable maintenance.

Of course only the family property can be divided, and if any of the members make a claim on the ground of self-acquisition to exclude anything from partition, this claim must be considered; and if it is upheld, that portion of the property must be excluded from partition. These claims sometimes give rise to a good deal of litigation, and are not always easy to determine. It must be borne in mind, however, that self-acquired property becomes family property as soon as it has once descended. Thus if a man by a separate trade earns Rs.10,000, and dies leaving two sons and the son of a third son, these persons form a joint family, and the Rs.10,000 is family property. So also family property which has been partitioned remains family property still. Thus if A, a bachelor, gets on partition a piece of land and afterwards marries and has sons, under the Mitacshara law the father and sons form a joint family as soon as the sons are born, and to this family the land belongs.

Inheritance.—When we come to deal with the question of what shares are taken on partition, it is convenient to follow the example of the Hindu commentators, and to treat the subject of inheritance in conjunction with it. The relative importance of these two subjects has not always been perceived, particularly by the early English writers on Hindu law. Colebrooke, the learned and accomplished translator of the Mitacshara and the Dayabhaga, published the two treatises together in one volume which he called *The Law of Inheritance.* But these treatises, although they deal incidentally with inheritance, are both described by their authors as treatises on partition only; and this, no doubt, is because the subject of inheritance, apart from partition, is of comparatively small importance. Inheritance is the transfer of ownership which occurs at and in consequence of a death. It follows from this that in a Mitacshara joint family there is no inheritance. The death of a member of the family makes no change in the ownership; not any more than the death of a fellow in the ownership of a college, or of a shareholder in the ownership of a railway company. In a Dayabhaga family there is a case of inheritance whenever a member dies. The share of that member descends to his heir. But here, again, no perceptible change in the affairs of the family is occasioned thereby. The enjoyment of the family property is no more affected thereby than by a death in a Mitacshara family. It is only when a partition takes place that the devolution of the shares by inheritance has to be traced. Inheritance, therefore, apart from partition, has not to be considered when we are dealing with family property under either system.

Let us now consider partition in a Mitacshara family. Of course the only persons who can claim a share are the members of the family. These, as has been said, are the male descendants of a common ancestor through males, their wives and daughters. But the females are entirely excluded from any share on a partition, and we have to consider the males only. The rule for ascertaining the share to which each member of the family is entitled can be best explained by the following diagram, which represents the male members of a Mitacshara family of whom A is the common ancestor:—



The whole family may be considered as forming one group, which may conveniently be called the group A; and it is evident on inspection that the family may be subdivided into a number of smaller groups each similarly organized, each group consisting of a man and his own male descendants. Thus besides the group A we have the group B, consisting of B and his descendants; the group C, consisting of C and his descendants; and so on. A group may die out altogether, as if U and W were to die childless, E and M being already dead. The rule of partition proceeds upon the supposition—not an unnatural one—that a family, when it breaks up, separates always into groups, and that the shares are moulded accordingly. For example, suppose that when the partition is made the surviving members of the family are N, O, S, T, X, Y, Z;

then to find the shares we must go back to the common ancestor and reconstruct the pedigree. There were at first four groups, but at some time, it is immaterial when, by the death of E and all his descendants the groups have been reduced to three; hence the first step is to divide the property into three equal parts, assigning one to each group. The group B was originally represented by three smaller groups, but now by only two, the groups F and G, and to each of these we assign $\frac{1}{2}$ of $\frac{1}{3}$, or $\frac{1}{6}$. And, of the $\frac{1}{6}$ assigned to the group F, N will get $\frac{1}{12}$ and O will get $\frac{1}{12}$. The other $\frac{1}{6}$ is divided between the groups P and Q, each group getting $\frac{1}{12}$. Then in the group P, X and Y will each get $\frac{1}{24}$, while Z, as the sole representative of the group Q, will get $\frac{1}{12}$. It may be noted in passing that this principle of division survives in the succession *per stirpes* of which we find so many examples in other systems of law which had their origin in the patriarchal system. By a similar process we should find that S and T each got $\frac{1}{3}$ of the property, they being the sole representatives of the groups C and D respectively. For the sake of simplicity we have taken a case where no example occurs of a father and son being both alive at the time of partition. But suppose P to be alive in addition to the persons mentioned above; then the group P gets $\frac{1}{12}$, and that group consists of three persons, P, X, and Y. There is no precise rule as to how the partition was to be made in such a case in the older Hindu law, and it is rarely that a partition takes place between father and sons, but if there should be one it is always assumed that the shares are equal, *i.e.*, in the case under consideration each would take $\frac{1}{36}$.

Turning now to a Dayabhaga family, we find that the property is vested, not in the family as a whole, but in certain individual members of it—that is to say, in those male members of the family who have no ancestor alive. And inasmuch as the undivided share of each member is his own, it follows that at his death inheritance will operate, and it goes to his heirs. In order, therefore, to find what share each member takes on partition under the Dayabhaga, we must inquire into the history of the family and ascertain what share has become vested in each member of the family by the ordinary rules of inheritance. The rules of inheritance, as laid down in the Dayabhaga, are not very dissimilar to those which we find in other parts of the world. Everywhere we find that a man's property is taken by his nearest relatives, but there are differences in the way in which proximity is reckoned. Everywhere, also, there is a preference given to males and the relatives through males over females and the relatives through females, but there are differences in the extent to which this preference is carried. The relatives of a man through males are called his agnates; the relatives of a man through females are called his cognates. In the Hindu law as at present administered there is no primogeniture, and a decided preference of males over females, and of agnates over cognates. With regard to the question of proximity, the Dayabhaga lawyers deal with the matter in a very curious way. All Hindus, as is well known, offer some sort of sacrifice to their deceased relatives, and the person by whom the sacrifice is to be offered as well as the nature of the offering are very carefully prescribed. These sacrifices are said to confer a "spiritual benefit" upon the deceased, and this spiritual benefit is greater or less according to the nature of the offering and the person who offers it. Now the Dayabhaga lawyers say that the person whose offering confers the greatest spiritual benefit is entitled to succeed as heir. This being the theory, we must see what rules govern in India the offering of sacrifices to the dead.

The most important offering is that of the pinda, or rice cake, and the persons who are entitled to make this offering to the deceased are called his sapindas. The offering next in importance is that of the lepa, or fragments of the cake, the crumbs as we might call them, and the persons who make this offering are called sakulyas. The offering of least importance is the simple libation of water, and persons connected by this offering are called samonadacas. But who are sapindas, sakulyas, and samonadacas respectively, and of each class whose offering is most efficacious? Practically we shall find that this question is solved by rules of consanguinity not unlike those which we meet with elsewhere. First of all come the sons; their offering is most efficacious, so that they are the nearest heirs and all take equally. Then come the sons' sons; then the sons' sons' sons. Here we break off. The line of inheritance is not continued beyond the great-grandsons. There are other cases in which, as we shall see, there is a similar break when we get three degrees away from the propositus: nor is this peculiarity confined to the Hindu law. We find traces of a similar break in the Roman and in the Teutonic law. After the great-grandson comes the widow. It is difficult to establish her claim on the ground of spiritual benefit, and it rests upon authority rather than principle. The opinions of ancient writers on the subject are very conflicting. They are set forth at great length in the Dayabhaga, with a conclusion in favour of the widow. Probably the intrusion of the widow is connected with the fact that she could in early times by cohabitation with a brother, and in later times by adoption, procure an heir to her sonless husband. Next to the widow come the daughters, and then the daughters' sons. Their position, again, may be referred to the notion which prevailed in early times, that a Hindu who had no son of his own might take one of his daughters' sons and make him his own. Then comes the father, then the mother, then the brothers, then the brothers' sons, and then the brothers' sons' sons. The sisters are excluded, but their sons succeed after the brothers' sons' sons; then come the brothers' daughters' sons. Then, leaving this generation, we go a step backward, and proceed to exhaust the previous generation in precisely the same way. It is only necessary to enumerate these in their order:—father's father, father's mother, father's brothers, father's brothers' sons, father's brothers' sons' sons, father's sisters' sons, father's brothers' daughters' sons. Then going another step backwards we get father's father's father, father's father's mother, father's father's brothers, father's father's brothers' sons, father's father's sisters' sons, father's father's brothers' daughters' sons.

So far the line of succession is confined either strictly to male agnates, or to persons who may restore the broken line of male agnate relationship. But at this point, under the Dayabhaga, instead of exhausting the male agnates still further, as we might expect, we turn now to the cognates, *i.e.*, the relatives of the deceased through the mother. It is said that these are also in some way sapindas. They are generally called bandhus. There is some difficulty in finding out the order in which they succeed, and since it is rare that an heir has to be sought outside the father's family, the question has not been much discussed. The question would have to be decided by the religious doctrine of spiritual benefit, and it is not improbable that Hindus who are accustomed to keep up the sacrifices which confer the benefit would be able to say whose sacrifice was most efficacious. When all the sapindas both on the father's and mother's side are exhausted, we then go to the sakulyas, and practically these are found by continuing the enumeration of agnates upon the same principle as that already indicated through three generations lower and three generations higher. On failure of the sakulyas we should have to fall back upon the samonadacas, but probably all that can be said with

certainty is that the sakulyas and samonadacas between them exhaust entirely the male agnates of the deceased. Where there are several persons whose offerings are equally efficacious, *i.e.*, who stand in the same relationship to the deceased, they all take: the male descendants *per stirpes*, and the other relatives of the deceased *per capita*.

These, then, are the rules which govern the ascertainment of the shares of the members of a family on a partition. Neither in a Mitacshara family nor in a Dayabhaga family have they any effect so long as the family remains joint: it is partition, and partition only, which brings them into play, and it is to this event rather than death that Hindu lawyers attach the greatest importance. Nevertheless all property in India is not joint property. Under the Mitacshara as well as under the Dayabhaga separate property may be acquired, and then, of course, we have true inheritance, for which the law must provide. So far as regards the Dayabhaga, the rules which govern the inheritance of separate property are (as we should expect) precisely the same as those which govern the inheritance of a share, and it is therefore unnecessary to restate them. But it remains to lay down the rules of inheritance for separate property under the Mitacshara law. They are not based by Mitacshara writers upon any religious principle, as under the Dayabhaga, yet the result is not widely different. First come the sons, then the sons' sons, and then the sons' sons' sons. Then the widow, whose right has been disputed, but was long ago established; then the daughters, and then the daughters' sons. After these come the parents, and it is peculiar that of these the mother comes before the father, then the father's sons, and then the father's sons' sons. Then we go back to the preceding generation, and follow the same order—the father's mother, the father's father, the father's father's sons, the father's father's sons' sons. After this we go back another generation, and again follow the same order—father's father's mother, father's father's father, father's father's brother, father's father's brother's son. From this point the statements of Hindu lawyers as to the order of succession are very scanty and vague. One thing is certain, that under the Mitacshara law no cognates (relations through females) are admitted until all the agnates (relations through males) are exhausted.

Wills.—So far we have considered intestate succession only, and the power of testamentary disposition is unknown to the true Hindu law. It was introduced by the decisions of the British courts of justice. By a will is meant a declaration by a man of his wishes as to the disposition of his property after his death, taking no effect during his life. A will is therefore by its very nature revocable. The general question whether a Hindu could dispose of his property by will arose in Bengal when Hindus began to attempt to dispose of their property after their death according to the English method. At that time there was a doubt whether the father was so completely absolute that he could dispose of his property to the exclusion of his sons, even in his lifetime. As soon as it was settled that he could do so, it was assumed that he could also make a will. It seems never to have been asked why it was that up to this time no Hindu had ever made a will, or to question the radically false assumption that the power of alienation *inter vivos* and the power of testamentary alienation necessarily go together. A long series of decisions confirmed by the legislature has, however, established that a Hindu in modern times can dispose of any property of which he is the sole owner. In other words, a Hindu can dispose by will of his self-acquired property, and under the Dayabhaga a Hindu can dispose by will of his share in family property. But the courts which created the testamentary power have also limited it to disposition in favour of persons living at the time of the testator's decease, thus avoiding many of the fanciful dispositions of property to which testators in all countries are so prone. But, curiously enough, this restriction, salutary as it is, has also been based on the notion that a testamentary disposition is a gift from the testator to the object of his bounty.

Debts.—In almost all countries at an early stage of civilization some legal provision exists by which debtors can be compelled by their creditors to pay their debts, and by which, if they fail to do so, their property can be seized and applied to this purpose. But the extent to which this can be done varies very considerably. So long as the family system exists in its primitive vigour it acts as a protection to the family property against the extravagance of a single member, and we often find that even when the family system has almost, or completely disappeared, there is an unwillingness to deprive the future representatives of the family of their land and houses. Doubts, too, have arisen as to whether the same right which a creditor has against his living debtor can be exercised after the debtor's death against those who have succeeded to his property. In India these two considerations have been deeply affected by a principle enunciated by Hindu lawyers (traces of which we find in many Eastern countries), that a man who dies in debt suffers cruel tortures in a future state, and that it is the imperative duty of his own immediate dependants to deliver him from these tortures by discharging his liabilities. Whether this should be looked upon as a legal, or only as a purely religious duty, might be questionable: the courts have seized upon it as a basis for laying down in the broadest manner the just rule that those who take the benefit of succession must take the burdens also. The subject is one which has caused a great deal of litigation in India, and whilst some points have been clearly settled, others are still being slowly worked out. As the matter stands at present, it may be safely said that all separate property is liable for the debts of the owner, both in his lifetime and after his death in the hands of his heirs. The same may be said of the share in the family property of the member of a Dayabhaga family, of which share he is the owner. So also the family property under both the Dayabhaga and Mitacshara is liable, as a whole, for the debts incurred on behalf of the family as a whole. As regards the question of the liability of the family property for the separate debts of the members of a Mitacshara family, the courts have held that the sons must pay their father's debts. Of course illegality would be an answer to the claims of the creditors against the heirs, just as it would be an answer to the claim against the original debtor; but there is some authority for saying that a debt contracted for an immoral though not an illegal purpose would not be enforced against the heir. According to modern decisions also, if judgment and execution on a separate debt are obtained against the member of a Mitacshara family, the share which would fall to him upon a partition may by process of law be set apart and sold for the benefit of the creditor.

Maintenance.—The doctrine of what is called maintenance plays an important part in the Hindu law, and, as we shall see, it modifies considerably the rigour of the Hindu law in excluding from the succession females or persons suffering from mental or bodily infirmity. The right of maintenance under the Hindu law is the right which certain persons have to be maintained out of property which is not their own. The persons who in certain circumstances have this right are sons, widows, parents, and unmarried daughters and sisters. The claim of the widow arises at the death of her husband; of a child at the death of its parent, and so forth. The claim is not for a bare subsistence only, but to such a provision as is suitable to the claimant having

regard to his or her position in life. Of course the sons are generally heirs, and an heir can have no claim to maintenance; but a son excluded by any mental or bodily defect would have a right to maintenance. The girls are generally married in infancy, and after marriage they have no claim to maintenance from their own family. The most frequent claim is by the widow; and it is a very important one, because she can sometimes, through the assertion of this claim, put herself almost in the position of an heir. If a Hindu under the Dayabhaga dies leaving sons and a widow, the widow is entitled to maintenance, and whilst the family remains joint she can claim to be suitably maintained, in the family if she remains in her husband's house, or out of it if she goes elsewhere. But if a partition takes place she is entitled to have a share equal to that of the sons set aside for her use. She can even, if she thinks that the sons do not treat her properly, apply to the court to compel the sons to give her a separate share. This, of course, gives her a very strong position. Whether in a Mitacshara joint family the widow enjoying maintenance can in any case claim a share on partition is doubtful.

Women's Property.—In some respects, and as regards some kinds of property, the ownership of women under the Hindu law differs from that of men. These differences depend on the source from which the property is derived. If a woman has inherited property from a male, or as a gift by her husband, or has obtained it as a share on partition, she does not own it in the same way as a man would do; she obtains only a kind of restricted ownership. She has the full enjoyment and management of it, but she cannot sell it, or give it away, or dispose of it by will; and at her death it goes, not to her heirs, but to the heirs of the person from whom she obtained it; her ownership simply comes to an end. If she obtained it by inheritance from a male, it will go on her death to the heirs of that male; if as a share on partition, it will be divided amongst the other sharers; if as a gift from her husband, to the heirs of the husband. As regards property otherwise obtained she is in the same position as any other owner, but the rules of inheritance applicable to it are somewhat peculiar. It would be a mistake to look upon the restricted ownership of a woman as what the English lawyers call a life estate. There is no such thing as a remainder or reversion. The whole estate is vested in her. If we endeavoured to describe the position of affairs at her death in the technical language of the English law of real property, it would be more correct to say that there was a shifting use. The restriction on alienation is sometimes removed where there is a danger that the property might otherwise be lost, as, for example, when the property is likely to be sold for non-payment of Government revenue, in which case a portion may, if necessary, be sold by the woman so as to save the remainder. So also a woman who has no other means of maintaining herself, or of providing for the performance of religious duties which are incumbent upon her, may sell so much of the property as will produce the necessary funds. It would be difficult for a purchaser to know whether he would be safe in purchasing from a widow selling under necessity, and more difficult still to preserve evidence of the necessity in case the necessity were disputed. Of course the woman herself could not dispute the validity of the sales, but those who take after her might do so. Consequently it is not unusual to obtain the concurrence of the person who at the time of the purchase is entitled to succeed if the widow were dead, and it has been held that, if this person concurs in the sale, no one else can dispute it on the ground that it was unnecessary.

Husband and Wife.—The subject of marriage is dealt with at considerable length in the Laws of Manu, and it is clear that, as originally conceived, marriage under the Hindu law consisted in nothing more than the mere possession of the woman, however obtained, by the man with the intention of making her his wife. Eight kinds of marriage are enumerated, and to each kind is assigned a separate name. The first four kinds are merely different forms of gift of the girl by her father to the husband. The other four kinds are—obtaining possession of a girl by purchase, fraud, ravishment, or consent of the girl herself. But the simple gift of the girl by her father without any bargain or recompense was even then considered the most reputable form of marriage, and it is now the only one in common use amongst orthodox Hindus. The sale of the daughter was even in those early times stigmatized as disgraceful, but it was valid; and even now, if there were an actual transfer of the girl by the father, it is scarcely probable that the courts would inquire whether any inducement was given for the transfer. The transaction takes place entirely between the father of the girl and the future husband; the girl has nothing to do but to obey. If the girl has no father, then it will be the duty of her nearest male relatives to dispose of her in marriage. If, however, the girl is not married when she attains puberty (which is very rare) then she may choose a husband for herself. The father cannot dispose of his son in marriage as he can of his daughter, nor is anything said about his consent in the matter; though in the case of a very young boy there can be no doubt that the consent of one or both parents is obtained. The marriage of very young boys is very common, and is certainly valid.

The ceremonies which precede and accompany a marriage are very numerous. By far the most important is that which consists in the bridegroom taking the bride's hand and walking seven steps. Amongst Hindus generally the performance of this ceremony following upon a betrothal would be treated as conclusive evidence of a marriage, whilst the omission of it would, amongst orthodox Hindus, be almost conclusive that no marriage had yet taken place. But still any particular customs of the tribe or caste to which the parties belonged would always be considered, and it cannot be said that the completion or non-completion of this ceremony is universally conclusive as to the existence of a marriage. There may be communities of Hindus which require something more than this; there are certainly some which require something less, and others which require something altogether different. There are lower castes in some parts of India calling themselves Hindus in which the only ceremony accompanying a marriage is giving a feast to which the members of the two families are invited.

The marriage of Hindus is complete without consummation; and as girls are almost invariably married before the age of puberty, and sometimes long before, consummation is generally deferred, it may be, for several years. But all this time the parties are husband and wife, and if the husband dies the child becomes a widow. The condition of these child widows in India is certainly not an enviable one, for practically they can never hope to marry again. Whether the second marriage would be lawful was a disputed point in Hindu law, until an Act of the Indian Legislature (Act XV. of 1860) declared in favour of the opinion that the widow might remarry. But the social prejudice against remarriage is still very strong, and such a marriage rarely takes place. If the widow has inherited any property from her husband, she loses it by contracting a second marriage. There is no legal restraint upon the number of wives that a Hindu may marry, but polygamy is not practised so largely as is sometimes supposed.

Members of the three higher castes are forbidden to marry a woman of the same *gotra* as themselves. Literally a *gotra* means a cattle-yard, and the prohibition is con-

sidered to exclude marriage between all those who are descended from the same male ancestor through an uninterrupted line of males. This rule is said not to apply to Sudras. But there is another rule which applies to all Hindus, and prohibits the marriage of a man with a girl descended from his paternal or maternal ancestors within the sixth degree. The working out of the rule is a little peculiar, but the result is to give a rather wide rule of exclusion of both agnates and cognates. There is, however, this important exception to these rules of exclusion—that if a fit match cannot otherwise be procured, a man may marry a girl within the fifth degree on the father's side and the third on the mother's. Practically this reduces the limit of exclusion to that last stated, because no one but the parties themselves with whom the choice rested could say whether or no any other suitable wife was available to the husband.

A Hindu must also marry within his caste: a Brahmin must marry a Brahmin, a Rajput must marry a Rajput, and a Sudra must marry a Sudra. Whether there are any other representatives of the four original castes is very doubtful, and even the claim of the Rajputs to represent the military caste is disputed. Still the rule of prohibition is so far clear. But there are innumerable subdivisions of Hindus which are also called castes, and as a matter of fact these minor castes do not intermarry. How far such marriages would be lawful it is difficult to say. The matter is entirely one of custom. The ancient Hindu law furnishes no guide on the subject, because under the ancient law the intermarriages of persons of different castes, even the highest, though they were considered undesirable, were recognized as legal. Modern Hindus seem disposed to deny the validity of marriages between persons of different castes in either sense of the term.

Divorce, in the sense of a rupture of the marriage tie, is not known to the true Hindu law. But unchastity deprives a wife of all her rights except to a bare maintenance, and this without any legal proof. She cannot succeed her husband as his heir, and of course she cannot remarry. A little confusion has been caused by the fact that a Hindu husband sometimes goes through a private ceremony which is erroneously called a divorce. But this is only done in order more effectually to bar an unchaste wife from succeeding to his property. Some very low castes are, however, said to allow a husband to divorce his wife, and even to allow the divorced wife to marry again. The single case in which a Hindu marriage can be dissolved by a court of law is by a proceeding under Act XXI. of 1860, which was passed to meet the difficulties which arise when one of the parties to a Hindu marriage becomes a Christian. In this case, if the convert after deliberation during a prescribed time refuses to cohabit any longer with the other party, the court may declare the marriage tie to be dissolved, and a woman whose marriage has been thus dissolved is declared capable of marrying again.

Suttee.—An interesting chapter in the history of the modern development of Hindu law is that of the practice of what we call Suttee, though, properly speaking, the native term (*Sati*) denotes, not a practice, but a person, *i.e.*, a faithful wife. The practice in question is that of the widow burning herself with her husband when his body is burned after his death. This, according to Hindu ideas, is a laudable act of devotion on the part of the widow, and when Great Britain first began to administer the law in India it was not uncommon. The new-comers had not as yet taken upon themselves the responsibility of altering the law, but, of course, British officers did what they could to discourage the practice, and especially to prevent any pressure being put upon the widow to perform the sacrifice. They could also take advantage of any circumstance which would render the case an improper one for the performance of the sacrifice, as, for example, that compulsion had been put upon the widow, or that the burning did not take place with the body of the husband. But if the proceedings were according to Hindu notions regular, it was contrary to the principles on which the Governor-General then acted to interfere, and British officers had frequently to stand by, and, by not interfering, to give a sort of sanction to the sacrifice. When later the servants of the East India Company began to assume a more direct responsibility for the government of the country, many suggestions were made for legislative interference. But, acting on the salutary principle that it was unwise to interfere in any way with the religion of the people, the Government abstained from doing so. In the meantime a considerable body of opinion against the practice had grown up amongst Hindus themselves, and at length the Government thought it safe to interfere. By Regulation XVII. of 1829 widow-burning was declared to be a criminal offence. The measure produced no serious opposition. There was hardly a single prosecution under this Regulation; and from this time the practice of widow-burning has entirely disappeared from that part of India which is under British rule.

Father and Son.—There are certain peculiarities in the relation of father and son in India which have given rise to the suggestion that there is no relationship between sonship and marriage, and that the notion of sonship in India is founded entirely on that of ownership—ownership of the mother and a consequent ownership of the child. But the arguments by which this view is supported do not appear to be sufficient. The rights of a father over his son, and of a husband over his wife, are, it is true, so far like the rights of ownership that both are in the nature of rights *in rem*—that is, they are available against any person who infringes them; but it is contrary to established usage to speak of rights over a free person as rights of ownership, and no one is prepared to say that the wife or child are slaves of the father. There is no reason for abandoning in India the ordinary view, that sonship depends on marital cohabitation between the father and mother. There are undoubtedly in certain special and exceptional cases methods of acquiring sons otherwise than by marital cohabitation. But these contrivances can only be resorted to when there is no son by marriage, and the fiction which, as we shall see, is resorted to to conceal the true nature of these contrivances, would be entirely meaningless, as would most of the rules which regulate them, if sonship in general was based entirely on ownership. There were at one time more contrivances than there are now for supplying the want of male issue by marriage. At one time a son could be begotten for a man who was dead by cohabitation of his widow with a member of his family, or perhaps even with a stranger. This is generally looked upon as a survival of polyandry. But this practice, though alluded to in the Laws of Manu as still subsisting, is now entirely obsolete. So there was a custom at one time by which a father could appoint a daughter to raise up male issue for him. The head of the family could also, if he had no son born in wedlock, accept as his own any child born in his house whose mother was not known or not married. So he could accept as his own the son of his wife born before marriage, or the son of his concubine. In the three last cases he may have been, and probably was, himself the father. But none of these contrivances for procuring a son is now in use. The only contrivance now employed for procuring a son, in the absence of one born in wedlock, is by taking into the family the son of another man who is willing to part with him. This is called adoption. There are two kinds of adopted sons: one called dattaka, and the other kritrima. The former

is in use all over India; the latter only in Mithila. The following rules apply to the dattaka born of adoption:—A man can only adopt who is without issue capable of inheriting his property, of performing the funeral ceremonies for himself, and of making the necessary offerings to his ancestors. A woman cannot adopt. But by the authority of her husband, and acting on his behalf, she may select a son and receive him into the family. A man can adopt a son without his wife's assent; nevertheless, the son when adopted becomes the son of both parents.

Hindus consider it a grievous misfortune that the line of male descent should be broken. The due performance of the sacrificial offerings to the dead is thereby interrupted. Probably this explains the great latitude given in some parts of India to the widow to adopt a son on behalf of her husband in case he has died sonless. There is a text which says, "Nor let a woman give or accept a son unless with the assent of her lord." But the lawyers of Western India do not consider that any express permission to adopt is necessary, and take it for granted that she always has that permission. In Southern India, also, the widow may adopt without express permission, but the sapindas must give their sanction to make the adoption valid. Elsewhere the words have received their natural interpretation, namely, that the husband must in some way indicate his intention that his widow should have authority to adopt. The only person to whom an authority to adopt can be given is the wife or widow; and no widow can be compelled to exercise her power to adopt if she does not wish to do so. The father has absolute power to give away his son in adoption even without the consent of his wife. But her consent is generally asked and obtained before the son is given. After the father's death the widow may give a son in adoption. The rule which in former times rendered it necessary that the nearest male sapinda should be adopted is obsolete, and the adoption of a stranger is valid, although nearer relatives otherwise suitable are in existence. A man may adopt any child whose mother he could have married if she had been single; if he could not have done so, then he cannot adopt her child. The reason given in the text is that the adopted son must bear the resemblance of a son. This recalls the *dictum* of the Roman law—*adoptio naturam imitatur*. The adopted son and the adopting father must be of the same caste. The period fixed for adoption by the three higher castes is before the ceremony of upandyana, or investiture of the child with the thread which these castes always wear over the left shoulder. For Sudras, who have no thread, the period is prior to the marriage of the child. There has been much difference of opinion as to whether an only son can be given and received in adoption. It is now settled that the texts which discountenance this adoption do not constitute a prohibition which the law will enforce.

There is sometimes a difficulty in ascertaining whether or no an adoption has actually taken place. There must be a final giving and receiving of the child in adoption, and for Sudras nothing more is required. For the twice-born classes it is not finally settled whether any religious ceremony is actually necessary in order to render the adoption valid. But some religious ceremony in almost all cases accompanies the adoption, so that the absence of any such ceremony will always raise a suspicion that the adoption, though it may have been contemplated and some steps taken towards it, had not been finally completed. If an adoption were in itself invalid, no acquiescence and no lapse of time could make it valid—just as an invalid marriage could not be similarly validated. But acquiescence by the family would be strong evidence of the validity of an adoption, and the rules of limitation by barring any suit in which the question could be raised might render the adoption practically unassailable.

The kritrima adoption is altogether different; although the adopted son performs the ceremonies for his adopting father's family, and has a right to succeed, he is nevertheless not cut off from his own family. A person of any age may be adopted, and he must be old enough to be able to consent to the adoption, as without this consent it cannot take place. In this form a female can adopt, and no ceremonies are required.

AUTHORITIES.—J. D. MAYNE. *Hindu Law.* London, 1892. —COLEBROOKE'S *Treatises on the Hindu Law of Inheritance.* Calcutta, 1810.—STOKES'S *Hindu Law Books.* Madras, 1865. —WEST and BUHLER. *A Digest of the Hindu Law of Inheritance.* Bombay, 1878.—JOGENDRA NATH BHATTACHARYA. *A Commentary on Hindu Law.* Calcutta, 1894.—RAJKUMAR SARVADHIKARI. *Principles of the Hindu Law of Inheritance.* Calcutta, 1882.—GOOROODASS BANERJEE. *The Hindu Law of Marriage and Stridhana.* Calcutta, 1896. (W. MA.)

Hindustan. See INDIA.

Hingham, a town of Plymouth county, Massachusetts, U.S.A., on Massachusetts Bay, contains the villages of Hingham Centre and South Hingham. Population (1890), 4564; (1900), 5059, of whom 969 were foreign-born.

Hiogo, or HYOGO, a Japanese town, situated in 34° 41′ N. and 135° 11′ E., in the province of Settsu, on the western shore of the bay of Osaka, adjoining the foreign settlement of Kobe. The growth of its prosperity has been very remarkable. Its population, including that of Kobe, was 135,639 in 1891, and 215,780 in 1898, and it thus stands fifth on the list of Japan's towns, being preceded only by Tôkyô, Osaka, Kyôtô, and Nagoya. From the following figures the development of Kobe's foreign trade may be seen:—

	Exports.	Imports.	Total.
1884	£1,180,490	£1,391,166	£2,571,656
1889	3,300,576	4,226,514	7,527,090
1894	3,679,764	7,113,813	10,793,577
1899	7,532,088	12,028,952	19,561,040

This increase—nearly eightfold in fifteen years—has not been confined to a few staples of commerce, but has been spread over almost the whole trade, especially silk and cotton fabrics, floor-mats, straw-plaits, matches, and cotton yarns. Kobe owes much of its prosperity to the fact that it serves largely as the shipping port of Osaka, which has become the chief manufacturing town in Japan. The citizens of Osaka, however, are engaged upon a large work of harbour construction, which, when completed, will probably divert a considerable part of the business now flowing to Kobe. But Kobe now ranks as the premier port of Japan. Its foreign community, however, has not grown in the same ratio, the figure at present—exclusive of Chinese—being only 1060 of all nationalities. Kobe is considered the brightest and healthiest of all the places assigned as foreign settlements in Japan, its pure dry air and granite subsoil constituting special advantages. It is in railway communication with all parts of the country, and wharves admit of steamers of large size loading and discharging cargo without the aid of lighters. The area originally appropriated for a foreign settlement soon proved too restricted, and foreigners received permission to lease lands and houses direct from Japanese owners beyond the treaty limits, a privilege which, together with that of building villas on the hills behind the town, ultimately involved some diplomatic complications. Kobe has a good shipbuilding yard, and

commodious docks will soon be constructed in its immediate neighbourhood.

Hiogo's original name was Bako. Its position near the entrance of the Inland Sea gave it some maritime importance from a very early period, but it did not become really prominent until the 12th century, when Kiyomori, chief of the Taira clan, transferred the capital from Kyôtô to Fukuhara, in Hiogo's immediate neighbourhood, and undertook various public works for improving the place. The change of capital was very brief, but Hiogo benefited permanently from the distinction thus conferred on it. (F. BY.)

Hippolytus.—Hippolytus, a presbyter of the Church in Rome, was exiled to Sardinia in A.D. 235 with Pontianus, bishop of Rome. Eusebius (*H.E.* vi. 20) represents him as a bishop without mentioning his see. Apollinaris of Laodicea calls him "the most holy bishop of Rome." In the 4th century he was regarded, probably rightly, as a martyr, and the Roman Church commemorates him on 13th August, on which day his remains were buried on the Via Tiburtina. He was a writer of the first importance. In 1551 a marble statue of Hippolytus, now in the Vatican, was discovered. The figure is clad as a philosopher; the chair contains a list in Greek of his writings, and reproduces part of the cycle for calculating Easter which he invented. This was the first attempt made by the Church to calculate the date of Easter by a cycle. The exegetical works of Hippolytus embraced all, or nearly all, the Bible. The only book that remains is that on Daniel (Greek and Slavonic). Hippolytus favours allegory, but is more sober than the Alexandrine writers. He wrote against heathens (πρὸς ἕλληνας καὶ πρὸς Πλάτωνα); also a treatise to the Empress Julia Mammæa; against heretics (σύνταγμα πρὸς ἁπάσας τὰς αἱρέσεις); against Marcion, &c.; also on the incarnation (περὶ οἰκονομίας), on the origin of evil, and περὶ Χριστοῦ καὶ ἀντιχρίστου: the last still remains.

Hippolytus was a preacher, and some genuine fragments which remain apparently were homilies. He has been the subject of modern controversy. In 1842 books iv.–x. of a work (κατὰ πασῶν αἱρεσέων ἔλεγχος) were discovered. They were found to fit with a work known as the φιλοσοφούμενα, wrongly attributed to Origen. The whole must have had two more books, ii. and iii., which are still missing. Book i. attacks Greek philosophers, iv. treats of astrology. Books v.–x. contain accounts of Christian heresies, partly based on earlier authorities; ix. tells of dissensions at Rome, and is of peculiar interest. It accuses Callistus, the bishop, of teaching Sabellianism. This fact has made some Roman Catholics desirous of proving that the book is not by Hippolytus, while some Protestants assert that Hippolytus was a rival Roman bishop or anti-pope. Some have even suggested that the Roman Church canonized him in spite of his schism, because his name gave occasion to continue the heathen festival of Virbius. The truth lies between these extreme theories. The φιλοσοφούμενα is shown by abundant internal evidence to be by Hippolytus. It refers to his σύνταγμα, and is connected with his works on Antichrist and Noetus. The question as to the episcopate of Hippolytus is obscure. It is hard to accept the story that he was bishop of Pontus. This apparently arose in the 7th century from the fact that Pontus contained a church having his name. The *Liberian Catalogue*, A.D. 354, probably quoting a 3rd-century notice, calls Hippolytus a presbyter. This document makes it certain that he died as a presbyter and in union with the Roman see. It is possible that he did for a time exercise episcopal functions, and that Pontianus and he were exiled while rivals. Pontianus resigned his bishopric 28th September 235, and perhaps Hippolytus resigned his claim at the same time, and so was reconciled with the Church. Apparently they were both alive when Anteros was consecrated pope, 21st November 235. They probably died in Sardinia, and their relics were brought to Rome under Pope Fabian. The history of Hippolytus has been obscured by the fact that Pope Damasus, followed by the poet Prudentius (*Peristeph.* 11, 17), speaks of a Hippolytus who had supported the schism of Novatus c. A.D. 251. Damasus was either writing of another Hippolytus, or confused the story. (For the Church Order bearing his name see CANONS OF HIPPOLYTUS.)

See also G. KRÜGER, *History of Early Christian Literature* (English trans., published by Macmillan, 1897); EHRHARD U. MÜLLER in *Strassburger Theologische Studien* (Herder, Freiburg, 1900); BATIFFOL, *Anciennes Littératures Chrétiennes* (Paris, Lecoffre). (L. P.)

Hirado, an island belonging to Japan, $19\frac{1}{2}$ miles long and 6 miles wide, lying off the west coast of the province of Hizen, in 33° 15′ N. and 129° 25′ E. It is celebrated as the site of the original Dutch factory—often erroneously written Firando—and as the place where one of the finest blue-and-white porcelains of Japan (*Hirado-yaki*) was produced in the 17th and 18th centuries. The kilns are still active.

Hirosaki, a town in the province of Mitsinoku or Rikugo, North Nippon, Japan, 22 miles south-west of Aomori, on the route to Niigata. Population (1892), 28,000; (1898), 35,000. It is a very old place, formerly residence of a great daimio and capital of a vast principality, and still seat of a high court with jurisdiction over the surrounding provinces of Aomori and Akita. Like most places in North Nippon, it is built with continuous verandas extending from house to house, and affording a promenade completely sheltered from the snows of winter. Apples of fine flavour grow in the district, which also enjoys some reputation for its peculiar green lacquer-ware.

Hiroshima, a city and seaport of Japan, capital of the ken of like name in Central Nippon. In its general aspect it resembles Osaka, and is, next to that place and Hiogo, the most important commercial centre in the Inland Sea. Population (1892), 90,000; (1898), 122,000. The ken has an area of about 3000 square miles, with a population (1898) of nearly 1,500,000. Hiroshima is famous all over Japan owing to its association with the neighbouring islet of Itaku-Shima, "Island of Light," which is dedicated to the goddess Bentin and regarded as one of the three wonders of Japan. The chief temple dates from the year 587, and the island, which is inhabited largely by priests and their attendants, is annually visited by thousands of pilgrims. But the hallowed soil is never tilled, so that all provisions have to be brought from the surrounding districts.

Hirsch, Maurice de, BARON HIRSCH AUF GEREUTH, in the baronage of Bavaria (1831–1896), capitalist and philanthropist (German by birth, Austro-Hungarian by domicile), was born at Munich, 9th December 1831. His grandfather, the first Jewish land-owner in Bavaria, was ennobled with the *prädikat* "auf Gereuth" in 1818; his father, who was banker to the Bavarian king, was created a baron in 1869. The family for generations has occupied a prominent position in the German Jewish community. At the age of thirteen young Hirsch was sent to Brussels to school, but when seventeen years old he went into business. In 1855 he became associated with the banking house of Bischoffsheim & Goldschmidt, of Brussels, London, and Paris. He amassed a large fortune, which he increased by purchasing and working railway concessions in Austria, Turkey, and the Balkans, and by speculations in sugar and copper. While living in great splendour in Paris and London and on his estates in Hungary, he devoted much of his time to schemes for the relief of his Hebrew

co-religionists in lands where they were persecuted and oppressed. He took a deep interest in the educational work of the Alliance Israélite Universelle, and on two occasions presented the society with gifts of a million francs. For some years he regularly paid the deficits in the accounts of the Alliance, amounting to several thousand pounds a year. In 1889 he capitalized his donations and presented the society with securities producing an annual income of £16,000. On the occasion of the fortieth anniversary of the Emperor Francis Joseph's accession to the Austrian throne he gave £500,000 for the establishment of primary and technical schools in Galicia and the Bukowina. The greatest charitable enterprise on which he embarked was in connexion with the persecution of the Jews in Russia (see ANTI-SEMITISM). He gave £10,000 to the funds raised for the repatriation of the refugees in 1882, but, feeling that this was a very lame conclusion to the efforts made in Western Europe for the relief of the Russian Jews, he offered the Russian Government £2,000,000 for the endowment of a system of secular education to be established in the Jewish pale of settlement. The Russian Government was willing to accept the money, but declined to allow any foreigner to be concerned in its control or administration. Thereupon Baron de Hirsch resolved to devote the money to an emigration and colonization scheme which should afford the persecuted Jews opportunities of establishing themselves in agricultural colonies outside Russia. He founded the Jewish Colonization Association as an English society, with a capital of £2,000,000, and in 1892 he presented to it a further sum of £7,000,000. This enormous fund is now managed by delegates of certain Jewish societies, chiefly the Anglo-Jewish Association of London and the Alliance Israélite Universelle of Paris, among whom the shares in the association have been divided. The association, which is prohibited from working for profit, possesses large colonies in South America, Canada, and Asia Minor. Besides this great organization, Baron de Hirsch founded a benevolent trust in the United States for the benefit of Jewish immigrants, which he endowed with a sum of £493,000. His minor charities were on a princely scale, and during his residence in London he distributed over £100,000 among the local hospitals. It was in this manner that he disposed of the whole gross proceeds derived from his successes on the English turf, of which he was a lavish patron. He raced, as he said himself, "for the London hospitals," and in 1892, when his filly, La Flêche, won the Oaks, St Leger, and One Thousand Guineas, his donations from this source amounted to about £40,000. Baron de Hirsch married on 28th June 1855 Clara, daughter of Senator Bischoffsheim of Brussels, by whom he had a son and daughter, both of whom predeceased him. He died at Ogyalla, near Komorn, in Hungary, 21st April 1896. (L. W.)

Hirschberg, a town of Prussia, province of Silesia, 48 miles south-east of Görlitz by rail. The linen industry is now of minor importance, though it is still carried on, as are also the manufactures of yarn, paper, cement, cigars, cardboard, machinery and iron wares, and wood-carving. Here is the Riesengebirge Museum. Population (1885), 15,622; (1900), 17,867.

Hirson, a town in the arrondissement of Vervins, department of Aisne, France, 35 miles by rail north-east of Laon, on the Oise. It occupies an important strategic position close to the point of intersection of several railway lines, and not far from the Belgian frontier. For its defence there are a permanent fort and two batteries, near the railway junction. It is noted for basket-work, and there are manufactures of glass bottles, and iron and tin wares, and wool-spinning. The town had a communal charter in the 12th century. Population (1881), 4531; (1901), 7461.

Hissar, a town and district of British India, in the Delhi division of the Punjab. The town is situated on the Rajputana railway and Western Jumna canal, about 102 miles W.N.W. of Delhi. Population (1881), 14,138; (1891), 16,854. The municipal income in 1897–98 was Rs.30,043. It is now chiefly known for its cattle and horse fairs. The DISTRICT comprises an area of 5163 square miles, with a population in 1881 of 672,569, and in 1891 of 776,006, giving an average density of 150 per square mile. In 1901 the population was 781,575, showing practically no increase, whereas in the previous decade there had been an increase of 15 per cent. The land revenue and rates were Rs.10,23,852, the incidence of assessment being R.0–3–9 per acre; the cultivated area in 1896–97 was 380,671 acres, of which 180,204 were irrigated, almost entirely from government canals; the number of police was 681; the number of schools in 1896–97 was 141, with 4734 pupils, the proportion of boys at school to the male population of school-going age being 6·7 per cent., or little more than half the average for the province; the registered death-rate in 1897 was 45·31 per 1000. There are a printing-press, and nine factories for cleaning and pressing cotton. Hissar suffered severely in the recent famines. A section of the Rajputana railway, 147 miles in all, now traverses the district. There are 95 miles of metalled roads. The largest town is Bhiwani.

Hitchin, a market-town in the Hitchin parliamentary division of Hertfordshire, England, 32 miles north-north-west of London by rail. The grammar school (1632) has been reconstituted for boys and girls. George Chapman, the translator of Homer, was born here, as were also Sir Henry Bessemer in 1813 and Sir Henry Hawkins (Baron Brampton) in 1817. The most notable industry is the cultivation and distillation of lavender and peppermint. Area of urban district, 2624 acres. Population (1881), 8434; (1901), 10,072.

Hjelmar, a lake of Sweden, lies south-west from Lake Mälar, and 67 feet higher. Area of the lake, 185 square miles; of its drainage basin, 1625 square miles. Length of lake, nearly 40 miles; breadth, 2½ to 12 miles; depth, 59 feet. Its shores are flat, and subject to inundation. With the view of preventing this evil the level of the lake has been sunk 5¾ feet below its former mean level. This was effected by deepening the navigable channel through the lake (1878–84), by cleaning out the Hjelmar canal (1879–80) to 6¾ feet, and reconstructing the dam at the head of the Eskilstuna river and cleaning out that river (1880), and by draining the lake of Qvismare by means of a canal 12½ miles long, alongside the river Telje (one of the chief feeders of the lake), in 1879–87. By this means an area of 45,000 acres was won to cultivation.

Hkamti Lông (called Kantigyi by the Burmese, and Bor Hkampti by the peoples on the Assam side), a Shan state tributary to Burma, but at present beyond the administrative border. It lies between 27° and 28° N. and 97° and 98° E., and is bordered by the Mishmi country on the N., by the Patkoi range on the W., by the Hukawng valley on the S. and on the E., and indeed all round by various Chingpaw or Kachin communities. The country is little known. It was visited by T. T. Cooper, the Chinese traveller and Political Agent at Bhamo, where he was murdered; by the late General Woodthorpe and Colonel Macgregor in 1884, by Mr Errol Grey in the

following year, and by Prince Henry of Orleans in 1895. All of these, however, limited their explorations to the valley of the Mali-*hka*, the western branch of the Irrawaddy river. Hkamti has shrunk very much from its old size. It was no doubt the northernmost province of the Shan kingdom, founded at Mogaung by Sam Lông-hpa, the brother of the ruler of Kambawsa, when that empire had reached its greatest extension. The irruption of Kachins or Chingpaw from the north has now completely hemmed the state in, and the only hope of its Shan, or Tai, inhabitants of escape from extinction rests in support from the British Government. Lao Hkun, the present chief, has paid homage and tribute at Bhamo. Prince Henry of Orleans described it as "a splendid territory, fertile in soil and abundant in water, where tropical and temperate culture flourish side by side, and the inhabitants are protected on three fronts by mountains." According to him the Kiutze, the people of the hills between the Irrawaddy and the Salween, call it the kingdom of Moam. (J. G. SC)

Hoar.—The name of a father and two sons distinguished in American politics and jurisprudence. SAMUEL HOAR (1788–1856), like his two sons a graduate of Harvard, and trained to the practice of law, was for a generation a leading member of the Massachusetts bar, and served in the National Congress, 1835–37. In 1844, having been sent to Charleston, S.C., on a mission touching the treatment of free negroes in that port, he was forced by demonstrations of popular hostility to leave the city without completing his work. He married the daughter of Roger Sherman, the Connecticut statesman, and lived at Concord, Mass., where his two sons were born. The elder of these, EBENEZER ROCKWOOD HOAR (1816–1895), after attaining the highest judicial honours of his state, held for a short time (1869–70) the position of Attorney-General in the cabinet of President Grant, and was a member of Congress, 1873–75. The younger son, GEORGE FRISBIE HOAR (1826– ——), devoted himself to his profession at Worcester, with two short terms in the state legislature, till in 1869 he was elected to Congress by the Republicans. After two successive re-elections he declined to be again a candidate, and was thereupon, in 1877, chosen to represent Massachusetts in the Senate. Senator Hoar's legal learning gave him from the outset a high position among his colleagues. In 1891, upon the retirement of Senator Edmunds, he became Chairman of the Judiciary Committee, and this influential position he continued to hold whenever his party was in control. He has made a distinguished reputation in scholarship as well as in law and politics, and in 1895 he was President of the American Historical Association.

Hobart, the capital of Tasmania, in the south of the island, at the mouth of the river Derwent. It has been so called since the 1st of January 1881, when its name was changed from Hobart Town. It returns three members out of eighteen to the Legislative Council of the State, and six to the House of Assembly out of thirty-seven members. It has an incorporated area of 1270 acres, and its population in 1901 numbered approximately 34,604; namely, 25,076 in Hobart proper and 9528 in the remainder of the metropolitan area. The principal suburbs are Newton, Sandy Bay (Queensborough), Wellington, Glenorchy, Risdon, Bellerive, and Beltana. The total length of streets is 38 miles, and the annual value of ratable property £175,500; in 1899 the rates yielded a revenue of £33,360, and from other services the municipality obtained £10,242, making a total of £43,602. For public works the sum of £231,000 has been borrowed, against which there is a sinking fund, which at the beginning of 1899 amounted to £18,150. The water supply, which is under municipal control, is obtained from streams on Mount Wellington, and collected in reservoirs with a capacity of 120,000,000 gallons; the cost of constructing the works was £163,877. Gas is supplied by a private company, and the city is partly lighted with electricity, while electric tramways run through the main streets. It has four banks with branches and two public markets (one for fish), is well supplied with public baths, and has an efficient fire brigade, and is the seat of an Anglican bishopric and a Roman Catholic archbishopric; there are some thirty-five or forty churches of all denominations. Cemeteries now number only three, several old ones having been closed in recent years. The National Gallery contains some fine paintings, and in respect of parks and public spaces the city is exceptionally fortunate: the Queen's Domain, the principal park, has an area of 1000 acres; and there are also the Royal Society's Gardens, with an area of 25 acres; Franklin Square, a pleasant garden on the site of old Government House; Barrack Square, Prince's Square, which commands a beautiful view of the river and the lower part of the city; and Parliament House reserve, besides extensive recreation grounds at North Hobart, and a fine racecourse and a general recreation reserve at Risdon, close to the main line railway. The Theatre Royal is one of the best appointed theatres in the Commonwealth, and there are many halls where entertainments are sometimes given, and four clubs. The chief monuments in the city consist of statues of Sir John Franklin and Dr Crowther, the Meredith fountain, the Syme memorial, and, at the barracks, a column erected to the memory of the soldiers killed in the New Zealand war. Hobart Hospital is maintained by the Crown, and though hospitals generally and charitable institutions are not numerous, they are well equipped and sufficient for the wants of the city. At the Newton Charitable Institution the average daily number of inmates is about 470; and there are a boys' home, an industrial school for girls, and a Roman Catholic orphanage for girls. There are eight state schools, with 38 teachers and an average attendance of 1600; also a technical school and a large number of private schools, both primary and secondary. For the university, which was established in 1890, and is mainly supported by the state, the Government endowment in 1898 was £2900 out of a total revenue of £3436; it has three professors and four lecturers and 38 students, and up to the close of 1898 had conferred 129 degrees. During 1899, 265 vessels entered the port, with a tonnage of 383,354; in 1890 the number was 292 and the tonnage 273,494. Imports were valued at £682,498 in 1899, and exports at £846,342. During the fruit season Hobart is a place of call for the P. and O. Company and the Orient Company's boats, and a regular port of call for two other lines running between London and New Zealand. Several lines of steamers run to Sydney and Melbourne, and there is direct communication with New Zealand, whilst vessels are constantly plying all round the coast. As to its manufactures, there are three breweries, five tanneries, five sawmills, four jam factories, two steam flour-mills, two woollen mills, an important iron foundry, and many small engineering establishments. It is the centre of an important horticultural district, in which over 70,000 acres are under crops; of these about 9000 acres are devoted to orchards. The fruit export trade has reached very considerable dimensions; the production in 1899 was 364,000 bushels of apples, 33,738 bushels of pears, and 98,000 bushels of other kinds of fruit, and nearly all this was exported, chiefly to Sydney and London. (T. A. C.)

Hobart Pasha, Augustus Charles Hobart-Hampden (1822–1886), English naval captain and Turkish admiral, was born in Leicestershire on the 1st of April 1822, being the third son of the 6th Earl of Buckinghamshire. In 1835 he entered the Royal Navy and served as a midshipman on the coast of Brazil in the suppression of the slave trade, displaying much gallantry in the operations. In 1855 he took part, as captain of the *Driver*, in the Baltic Expedition, and was actively engaged at Bomarsund and Abo. In 1862 he retired from the navy with the rank of post-captain; but his love of adventure led him, on the outbreak of the American Civil War, to participate in that struggle in the character of blockade-runner. In command of a swift cruiser he succeeded in eluding no less than eighteen times the ironclad blockade squadron of the North, conveying war material to Charleston and returning with a cargo of cotton. In 1867 Hobart entered the Turkish service, and was immediately nominated to the command of that fleet, with the rank of "Bahrie Limassi" (rear-admiral). In this capacity he performed splendid service in helping to suppress the insurrection in Crete, and was rewarded by the Sultan with the title of Pasha (1869). In 1874 Hobart, whose name had, on representations made by Greece, been removed from the British Navy List, was reinstated; his restoration did not, however, last long, for on the outbreak of the Russo-Turkish war he again entered Turkish service. In command of the Turkish squadron he completely dominated the Black Sea, blockading the ports of South Russia and the mouths of the Danube, and paralysing the action of the Russian fleet. On the conclusion of peace Hobart still remained in the Turkish service, and in 1881 was appointed Mushir, or marshal, being the first Christian to hold that high office. His achievements as a blockade-runner, his blockade of Crete, and his handling of the Turkish fleet against the torpedo-lined coasts of Russia, showed him to be a daring, resourceful, and skilful commander, worthy to be ranked among the illustrious names of British naval heroes. He died at Milan, 19th June 1886.

Hobart, Garret Augustus (1844–1899), Vice-President of the United States 1897–99, was born at Long Branch, N.J., in 1844. Having graduated from Rutgers College, he practised law at Paterson, N.J., and rose to prominence in the state. In politics he was long conspicuous in the state Republican organization. He served several terms in both the lower and the upper house of the legislature, and was presiding officer of each. Though he never aspired to national office, he accepted the nomination as Vice-President in 1896, on the ticket with President McKinley, and was elected. At Washington his force of character won for him more influence than is generally exerted by a Vice-President; but he was seized with a fatal illness, and was taken to his home at Paterson, N.J., where he died 21st November 1899.

Hoboken, a city of Hudson county, New Jersey, U.S.A., in 40° 44′ N. and 74° 01′ W., on the west bank of the Hudson river, just north of Jersey City, with which it is connected by lines of steam and street cars, and opposite New York, of which it is a suburb, and with which it is connected by ferries. It has a large ocean commerce, the docks of several steamship companies being situated here. It is also an important manufacturing centre; in 1890 it contained 289 establishments, with a capital of $3,948,782, employing 3347 hands, and with a product valued at $7,151,391. It contains the Stevens Institute of Technology, which was founded in 1871, and which has a high rank among technical schools. In 1899 it had 30 professors and instructors and 361 students. Its property was valued at $823,000, and its income was $57,000. The total assessed valuation of real and personal property in 1900, on a basis of about 70 and 50 per cent. of the full value respectively, was $27,790,930; the net debt was $1,292,113, and the rate of taxation was $24·20 per $1000. Population (1880), 30,999; (1890), 43,648; (1900), 59,364, of whom 21,380 were foreign-born and only 101 were negroes. The death-rate in 1890 was 25·9; in 1900 it was 21·1.

Hoboken, a town of Belgium, in the province and 4 miles south of the town of Antwerp. It contains numerous villas of Antwerp merchants, and has a large shipbuilding yard. Population, 9523.

Höchst, a town of Prussia, province of Hesse-Nassau, on the Main, 6 miles by rail west of Frankfort-on-Main. It is a busy industrial town, with large dyeworks and manufacture of snuff, tobacco, waxcloth, gelatine, furniture, &c. It has a fine 9th-century basilica in the church of St Justinus. All that survives of the castle of the Electors of Mainz from the destruction in 1634 is a single fine tower. There is a statue of Bismarck (1899). Population (1885), 6517; (1900), 14,123.

Höchstädt, a town of Bavaria, Germany, district of Swabia, on the left bank of the Danube, 34 miles north-east of Ulm by rail. It has been a place of battles. Here Frederick of Staufen, vicegerent of the empire for Henry IV., was disastrously defeated by Henry's rival in 1081; in 1703 the Imperialists were routed by Marshal Villars in command of the French; and in 1704 Marlborough and Prince Eugene defeated the French and Bavarians commanded by the Elector of Bavaria and Marshal Tallard. This last event is better known in English history and English poetry (Southey) as the battle of Blenheim, more correctly Blindheim. Population (1900), 2246.

Hodgson, Brian Houghton (1800–1894), English ethnologist and naturalist, was born at Lower Beech, Prestbury, Cheshire, on 1st February 1800. His father was a country gentleman, his mother being a sister of Bishop Porteus. In 1816 he obtained an East Indian writership. After passing through the usual course at Haileybury, he went out to India in 1819, and after a brief service at Kumaon was in 1822 appointed assistant to the resident at Katmandu, the capital of Nepal. In 1822 he obtained an under-secretaryship in the Indian Foreign Office, which seemed to open the most brilliant prospects, but his health failed in the climate of Calcutta, and in 1824 he returned to Nepal, to which the whole of his life, whether in or out of India, may be said to have been thenceforth given. He devoted himself in an especial manner to the collection of Sanskrit MSS. relating to Buddhism, and hardly less so to the natural history and antiquities of the country, and by 1839 had contributed eighty-nine papers to the *Transactions* of the Asiatic Society of Bengal. His investigations of the ethnology of the aboriginal tribes were especially important. In 1833 he became Resident, and passed many stormy years in conflict with the cruel and faithless Court to which he was accredited. He succeeded, nevertheless, in concluding a satisfactory treaty in 1839; but in 1842 his policy, which involved an imperious attitude towards the native government, was upset by the interference of Lord Ellenborough, but just arrived in India, and, not unnaturally, anxious to avoid trouble in Nepal during the conflict in Afghanistan. Hodgson took upon himself to disobey his instructions, a breach of discipline justified to his own mind by his superior knowledge of the situation, but which the Governor-General could hardly be expected to

overlook. He was, nevertheless, continued in office for a time, but was recalled in 1843, and resigned the service. In 1845 he returned to India and settled at Darjiling, where he devoted himself entirely to his favourite pursuits. In 1858 he returned to England, and lived successively in Cheshire and Gloucestershire, occupied with his studies to the last. He died at his seat at Alderley Grange in the Cotswold Hills, 23rd May 1894. No man has done so much to throw light on Buddhism as it exists in Nepal, and his collections of Sanskrit manuscripts, presented to the East India Office, and of natural history, presented to the British Museum, are unique as gatherings from a single country. He wrote altogether 184 philological and ethnological and 127 scientific papers, as well as some valuable pamphlets on native education, in which he took great interest. His principal work, *Illustrations of the Literature and Religion of Buddhists* (1841), was republished with the most important of his other writings in 1872–80. His life was written by Sir W. W. Hunter in 1896. (R. G.)

Hof, a town of Bavaria, Germany, district Upper Franconia, on the river Saale, 103 miles south by west of Leipzig by the railway to Ratisbon. The seat of various flourishing industries, notably the manufacture of woollen and cotton goods, dye-works, calico printing, chemicals, machinery, iron and copper wares, breweries, and limestone quarries. Population (1885), 22,257; (1900), 32,782.

Hofmann, August Wilhelm von (1818–1892), German chemist, was born at Giessen on 8th April 1818. Not intending originally to devote himself to physical science, he first took up the study of law and philology at Göttingen, and the general culture he thus gained stood him in good stead when he subsequently began to study chemistry in Liebig's laboratory. When, in 1845, a school of practical chemistry was started in London, under the style of the Royal College of Chemistry, Hofmann, largely through the influence of the Prince Consort, was appointed its first director. It was with some natural hesitation that he, then a *privat-docent* at Bonn, accepted the position, which may well have seemed rather a precarious one; but the difficulty was removed by his appointment as extraordinary professor at Bonn, with leave of absence for two years, so that he could resume his career in Germany if his English one proved unsatisfactory. Fortunately the college was more or less successful, owing largely to his enthusiasm and energy, and many of the men who were trained there subsequently made their mark in chemical history. But in 1864 he returned to Bonn, and in the succeeding year he was selected to succeed Mitscherlich as professor of chemistry and director of the laboratory in Berlin University. In leaving England, of which he used to speak as his adopted country, Hofmann was probably influenced by a combination of causes. The public support extended to the college of chemistry had been dwindling for some years, and before he left it had ceased to have an independent existence and had been absorbed into the School of Mines. This event he must have looked upon as a curtailment of its possibilities of usefulness. But, in addition, there is only too much reason to suppose that he was disappointed at the general apathy with which his science was regarded in England. No man ever realized more fully than he how entirely dependent on the advance of scientific knowledge is the continuation of a country's material prosperity, and no single chemist ever exercised a greater or more direct influence upon industrial development. In England, however, people cared for none of these things, and were blind to the commercial potentialities of scientific research. The college to which Hofmann devoted nearly twenty of the best years of his life was starved; the coal-tar industry, which was really brought into existence by his work and that of his pupils under his direction at that college, and which with a little intelligent forethought might have been retained in England, was allowed to slip into the hands of Germany, where it is now worth millions of pounds annually; and Hofmann himself was compelled to return to his native land to find due appreciation as perhaps the foremost chemist of his time. The rest of his life was spent in Berlin, and there he died on 5th May 1892. That city possesses a permanent memorial to his name in Hofmann House, the home of the German Chemical Society (of which he was the founder), which was formally opened in 1900, appropriately enough with an account of the latest triumph of German chemical enterprise, the industrial manufacture of synthetical indigo. Hofmann's work covered a wide range of organic chemistry, though with inorganic bodies he did but little. His first research, carried out in Liebig's laboratory at Giessen, was on coal-tar, and his investigation of the organic bases in coal-gas naphtha established the nature of aniline. This substance he used to refer to as his first love, and it was a love to which he remained faithful throughout his life. His perception of the analogy between it and ammonia led to his famous work on the amines and ammonium compounds and the allied phosphorus derivatives, while his researches on the colouring matters obtained from it, beginning with rosaniline in 1862, only ended with quinoline red in 1887. But in addition to these and numberless other investigations for which he was responsible—his last communication from the Berlin University laboratory bears the number 888—the influence he exercised through his pupils must also be taken into account. As a teacher, besides the power of accurately gauging the character and capabilities of those who studied under him, he had the faculty of infecting them with his own enthusiasm, and thus of stimulating them to put forward their best efforts. In the lecture-room he laid great stress on the importance of experimental demonstrations, paying particular attention to their selection and arrangement, though, since he himself was a somewhat clumsy manipulator, their actual exhibition was generally entrusted to his assistants. He was the possessor of a clear and graceful, if somewhat florid, style, which showed to special advantage in the obituary notices or encomiums he wrote of such men as Liebig, or Dumas, or Wöhler. He also excelled as a speaker, particularly at gatherings of an international character, for in addition to his native German he could speak English, French, and Italian with fluency. (H. M. R.)

Hofmeister, Wilhelm Friedrich Benedict (1824–1877), German botanist, was born at Leipzig, 18th May 1824. He came of a family engaged in trade, and after being educated at the realschule of Leipzig he entered business as a music dealer; much of his botanical work was done while he was so employed, till in 1863 he was nominated, without intermediate academic steps, to the chair in Heidelberg; thence he was transferred in 1872 to Tübingen, in succession to von Mohl. His first work was on distribution of the Coniferæ in the Himalaya, but his attention was very soon devoted to studying the sexuality and origin of the embryo of Phanerogams; his contributions on this subject extended from 1847 till 1860, and they finally settled the question of the origin of the embryo from an ovum, as against the prevalent pollen-tube theory of Schleiden: he showed that the pollen-tube does not itself produce the

embryo, but only stimulates the ovum already present in the ovule. He soon turned his attention to the embryology of Bryophytes and Pteridophytes, and gave continuous accounts of the germination of the spores and fertilization in Pilularia, Salvinia, Selaginella. Some of the main facts of the life of Ferns and Mosses were already known; these, together with his own wider observations, were worked into that great general pronouncement published in 1851 under the title, *Vergleichende Untersuchungen der Keimung, Entfaltung und Fruchtbildung höherer Kryptogamen und der Samenbildung der Coniferen.* This work will always stand in the first rank of botanical books. It antedated the *Origin of Species* by eight years, but contained facts and comparisons which could only become intelligible on some theory of descent. The plan of life-story common to them all, involving two alternating generations, was demonstrated for Liverworts, Mosses, Ferns, Equiseta, Rhizocarps, Lycopodiaceæ, and even Gymnosperms, with a completeness and certainty which must still surprise those who know the botanical literature of his time. The conclusions of Hofmeister remain in their broad outlines unshaken, but rather strengthened by later-acquired details. In the light of the theory of descent the common plan of life-history in plants apparently so diverse as those named acquires a special significance; but it is one of the remarkable features of this great work that the writer himself does not theorize: with an unerring insight he points out his comparisons and states his homologies, but does not indulge in explanatory surmises. It is the typical work of an heroic age of plant-morphology. From 1857 till 1862 Hofmeister wrote occasionally on physiological subjects, such as the ascent of sap, and curvatures of growing parts, but it was in morphology that he found his natural sphere. In 1861, in conjunction with other botanists, a plan was drawn up of a handbook of physiological botany, of which Hofmeister was to be editor. Though the original scheme was never completed, the editor himself contributed two notable parts, *Die Lehre von der Pflanzenzelle* (1867) and *Allgemeine Morphologie der Gewächse* (1868). The former gives an excellent summary of the structure and relations of the vegetable cell as then known, but it did not greatly modify current views. The latter was notable for its refutation of the spiral theory of leaf arrangement in plants, founded by Schimper and Braun. Hofmeister transferred the discussion from the mere study of mature form to the observation of the development of the parts, and substituted for the "spiral tendency" a mechanical theory based upon the observed fact that new branchings appear over the widest gaps which exist between next older branchings of like nature. With this important work Hofmeister's period of active production closes; he fell into ill-health, and retired from his academic duties some time before his death at Lindenau, near Leipzig, on the 12th of January 1877. (F. O. B.)

Hofmeyr, Jan Hendrik (1845–——), South African politician, was born at Cape Town on 4th July 1845. He was educated at the South African College, and at an early age entered the profession of journalism. He was editor of the *Zuid Afrikaan* till its incorporation with *Ons Land*, and of the *Zuid Afrikaansche Tidjschrift.* By birth, education, and sympathies a typical Dutch Afrikander, he became, almost from his first entrance into the Cape Parliament in 1879, the real leader of the Dutch party. Yet he only held office for six months—as minister without portfolio in the Scanlen ministry from May to November 1881. He held no subsequent official post in the colony, though he shared with Sir Thomas Upington and Sir Charles Mills the honour of representing the Cape at the Intercolonial Conference of 1887. Here he supported the proposal for entrusting the defence of Simonstown to Cape Colony, leaving only the armament to be provided by the Imperial Government, opposed trans-oceanic penny postage, and moved a resolution in favour of an Imperial customs union. At the Colonial Conference of 1894 at Ottawa he was again one of the Cape representatives. But his chief importance as a public man is derived from his connexion with the Afrikander Bond. (See CAPE COLONY.) His control over this organization enabled him for many years, while free from the responsibilities of office, to make and unmake ministers at his will, and earned for him the name of "Cabinet-maker of South Africa." Although officially the term "Afrikander" has been explained by Mr Hofmeyr to include white men of whatever race, yet in practice the influence of the Bond was always exerted in favour of the Dutch language, or rather the local dialect of Dutch known as "the Taal," and its power was drawn from the Dutch districts of Cape Colony. The sympathies of the Bond were thus always strongly with the Transvaal, as the chief centre of Dutch influence in South Africa; and Mr Hofmeyr's position might in many respects be compared with that of Parnell at the head of the Irish Nationalist party in Great Britain. In the Bechuanaland difficulty of 1884 Mr Hofmeyr threw all the influence of the Bond into the scale in favour of the Transvaal. But in the course of the next few years he began to drift away from President Kruger. He resented the reckless disregard of Cape interests involved in Kruger's fiscal policy; he feared that the Transvaal, after its sudden leap into prosperity upon the gold discoveries of 1886, might overshadow all other Dutch influences in South Africa; above all he was convinced, as he showed by his action at the London Conference, that the protection of the British navy was indispensable to South Africa, and he set his face against Kruger's intrigues with Germany, and his avowed intention of acquiring an outlet to the sea in order to get into touch with foreign Powers. In 1890 he joined forces with Mr Cecil Rhodes, who became premier of Cape Colony with the support of the Bond. Mr Hofmeyr's influence was a powerful factor in the conclusion of the Swaziland Convention of 1890, as well as in stopping the "trek" to Banyailand in 1891—a notable reversal of the policy he had pursued seven years before. But the reactionary elements in the Bond grew alarmed at Mr Rhodes's Imperialism, and in 1895 Mr Hofmeyr resigned his seat in Parliament and the presidency of the Bond. Then came the Jameson Raid, and in its wake there rolled over South Africa a wave of Dutch and anti-British feeling such as had not been known since the days of Majuba. Once more Mr Hofmeyr became president of the Bond. By an alteration of the Provincial Constitution, all power in the Cape branch of the Bond was vested in the hands of a vigilance committee of three, of whom Mr Hofmeyr and his brother were two. As the recognized leader of the Cape Dutch, he protested against such abuses as the dynamite monopoly in the Transvaal, and urged Kruger even at the eleventh hour to grant reasonable concessions rather than plunge into a war that would involve Cape Afrikanderdom and the Transvaal in a common ruin. In July 1899 he journeyed with Mr Herholdt to Pretoria, and vainly supported the proposal of a satisfactory franchise law, combined with a limited representation of the Uitlanders in the Volksraad, and in September urged the Transvaal to accede to the proposed joint inquiry. During the negotiations of 1899, and after the outbreak of war, the official organ of the Bond,

Ons Land, was conspicuous for its anti-British attitude, and its violence forced Lord Roberts to suppress it in the Cape Colony district under martial law. Mr Hofmeyr never associated himself publicly with the opinions expressed by *Ons Land*, but neither did he repudiate them. The tide of race sympathy among his Dutch supporters made his position one of great difficulty, and shortly after the outbreak of war he withdrew to Europe, and refused to act as a delegate, with Messrs Merriman and Sauer, to England in 1901.

Hogarth, William (1697–1764). To the account of Hogarth given in the ninth edition of this Encyclopædia the following additions require to be made in view of more recent contributions to our knowledge concerning him. The precise place of Hogarth's birth was Bartholomew Close, where, two years later, his sister Mary was born. He had a second sister, Ann, who was born in 1701. Richard Hogarth, his father, died in May 1718. By the earlier commentators "A Harlot's Progress" was dated 1733–34 (vol. xii. p. 48). It has now been ascertained that Hogarth must have begun to engrave this series—a task which he had at first intended to leave to others—shortly after the conclusion of the last picture in 1731. From an advertisement in the *Country Journal; or, the Craftsman*, 29th January 1732, the pictures were then being engraved; and from later announcements it seems clear that they were delivered to the subscribers early in the following April, on the 21st of which month an unauthorized prose description of them was published. From the MSS. of George Vertue in the British Museum (Add. MSS. 23069–98), it appears that, during the progress of the plates, Hogarth was domiciled with his father-in-law, Sir James Thornhill, in the Middle Piazza, Covent Garden (the "second house eastward from James Street"); and the "Five Days' Peregrination" (May 27–31) must have followed "A Harlot's Progress" instead of preceding it. What Hogarth did to decorate Vauxhall beyond the picture of Henry VIII. and Anne Boleyn is not clear, as the "Four Times of the Day" are said to have been copies by Hayman; but Jonathan Tyers certainly presented him with a gold pass ticket *In perpetuam Beneficii memoriam*, which was lately in the Forman Collection, and now belongs to Mr Fairfax Murray. Mr Warwick Wroth (*Numismatic Chronicle*, vol. xviii.) doubts if Hogarth designed this himself, as generally stated, but he probably did design some of the silver passes to Vauxhall which are figured in Wilkinson's *Londina Illustrata*. Of late years several valuable pictures by Hogarth have passed into the possession of the National Gallery. In July 1895 the Duke of Westminster presented "The Gates of Calais"; and the Trustees have also purchased "Lavinia Fenton as Polly Peachum" (1884), "The Shrimp Girl" (1884), Hogarth's "Six Servants" (1892), and "Mrs Salter," Hogarth's sister Ann (1898). To the National Portrait Gallery was added in 1892, by the gift of the Earl of Carlisle, "The House of Commons examining Bambridge" (vol. xii. p. 47). The Print Room at the British Museum also acquired in July 1896, from Mr E. Cheney, a very interesting set of sixteen designs for the series called "Industry and Idleness," the majority of which formerly belonged to Horace Walpole. Hogarth's house at Chiswick (vol. xii. p. 50), of which he was admitted copyholder in September 1749, and which he left at his death to his widow, is still in existence. In December 1901 it was sold by its owner, Mr Alfred Dawson of Chiswick, to Lieutenant-Colonel Shipway for £1500. A life of Hogarth, together with a copious bibliography of books, pamphlets, &c., relating to the painter and his work, and detailed catalogues of his prints and paintings, was issued in 1891 by the present writer. In 1897 it was followed by a new and greatly enlarged edition. It should be added that "Sloane Museum" (vol. xii. p. 50) is a misprint for Soane Museum; and that the National Portrait Gallery is now at St Martin's Place. (A. D.)

Hohenelbe (Bohemian or Czech, *Vrchlabí*), chief town of a government district, Bohemia, Austria, at the source of the Elbe, 14 miles W.N.W. of Trantenau. Its industries now include iron-foundries and the manufacture of machinery, pottery, brewing and milling, and marble works, in addition to its staple trade in textiles. It is the starting-point for excursions in the Riesengebirge. Population, mostly German and Roman Catholic (1900), 6597. The adjoining village of Ober-Hohenelbe has a population of 2420, with bleaching works and linen and jute manufactories.

Hohenems, or HOHENEMBS, a market-place in the government district of Dornbirn, Vorarlberg, Austria, situated on the right-hand slope of the upper Rheinthal and on the Feldkirch–Bregenz section of the Austrian State Railway. Population (1900), 5662. The chief industries are cotton spinning, weaving, printing, and dyeing, manufactures of yarn, ribbons, and machine embroidery, and there is considerable trade in timber. It is inhabited by the only Jewish community in Vorarlberg, which numbers 118 souls, and has a synagogue. The village has two châteaus, that of Neu-Hohenems and one belonging to Count Waldburg-Zeil. The Hohenembs family became extinct in the male line in the latter half of the 18th century. The title is included in the full list of those borne by the Austrian Emperor, who occasionally uses it when travelling incognito. The late Empress Elizabeth of Austria usually travelled as Countess of Hohenembs.

Hohenheim, a village of Würtemberg, Germany, 5 miles south of Stuttgart by rail. It is the seat of the most important agricultural college in Germany. The college was founded in 1818, and established in a royal pleasure castle, built in 1782 by Duke Karl Eugen. To it have since been added a forestry college (1820), a farming school for peasants' sons, a horticultural and a viticultural school, a technological institute, an institute for testing agricultural seeds (1877), an institute for testing agricultural machinery (1883), a model steam dairy and butter and cheese factory (1883), a fisheries institute and fish-breeding station (1886), a fowl-breeding establishment (1890), a bacteriological institute, a chemical laboratory, botanical gardens of 15 acres, a herbarium of 27,000 plants, an agricultural estate of 800 acres, an orchard, a vineyard, experimental fields, a forest of 6500 acres, experimental stations for testing various processes, a library, physical laboratories, mineralogical, geological, veterinary, and zoological museums, a museum of agricultural implements and various collections of objects connected with farming, a meteorological station; also, in connexion with the technological institute there are a distillery, a brewery, a vinegar factory, and a sugar factory. The college was raised to the position of a high school in 1865, and now ranks with the technical high schools, and consequently has university status. The course is for three years, and there are 27 professors and teachers, and usually rather more than 100 students, including several foreigners. Population, about 280.

See British Diplomatic and Consular Reports, Miscellaneous Series, No. 452, *Agriculture in Germany* (1898), p. 14, &c.; and No. 566, *Würtemberg Schools* (1901), p. 32, &c.

Hohenlimburg, a town of Prussia, province of Westphalia, 30 miles by rail S.E. of Dortmund. It is the seat of various iron and metal industries. A castle overlooks the town. Population (1900), 8111.

Hohenlohe-Schillingsfürst, Chlodwig Karl Victor, Prince of (1819–1901), German statesman, was born 31st March 1819. He belonged to a Catholic branch of one of the most widely extended of German princely families, which until 1806 ruled over considerable dominions in Swabia, and still possesses all the social privileges secured to the mediatized princes. He studied at the universities of Heidelberg, Göttingen, and Bonn, and entered the Prussian civil service. In the year 1845, large estates in Prussia having been left to the family by the Landgraf of Hesse-Rothenburg, a connexion of his mother's, Prince Victor, the eldest brother, took them as his share, and received the title of duke of Ratibor from the king of Prussia; Prince Chlodwig received the Bavarian estates, and became a hereditary member of the Bavarian Upper House, while he also had the title prince of Ratibor. In 1849 he held for a few months a diplomatic post in England, but for the next fifteen years he took little part in public affairs. His attachment to Prussia threw him into opposition to the prevalent opinion in Bavaria. With all his family he belonged to the party of Liberal Catholics; the duke of Ratibor was one of the few Roman Catholics who supported Bismarck in his struggle with the Church, and a younger brother, the Cardinal Hohenlohe, was the leader of the opposition to the Ultramontanes in the Vatican Council. In 1872 Bismarck proposed to appoint Cardinal Hohenlohe Prussian envoy at the Vatican, but the Pope refused to accept a cardinal in this position. After the crisis of 1866, when it was desirable to form a ministry in Bavaria which would carry out the new alliance with Prussia, the king entrusted Hohenlohe with the task. He was minister-president for three years; he took a leading part in arranging the customs parliament, which was the first step towards a closer union of North and South Germany, and he carried out a reorganization of the Bavarian army on the Prussian system; he also brought about a military union of the southern states. During these years he was the most important German statesman next to Bismarck, for he made possible the union of Bavaria with Prussia in 1870. He also issued a celebrated despatch in which he invited the Catholic Powers to interfere at the Vatican Council and prevent the declaration of Papal infallibility; but the greater Powers were too much occupied to venture on so serious a step, and Bavaria was too weak to act alone. His policy was, however, bitterly attacked by the "patriotic" party, who accused him of betraying the independence of Bavaria; they were supported by the Ultramontanes, and when Hohenlohe brought in a Bill for the reorganization of the schools, by which the influence of the Church would be diminished, it was lost. His followers were twice defeated in the elections of 1869, and, notwithstanding the support of the king, he had to resign. He supported and helped to carry the treaty of 1870 with North Germany, and was elected a member of the German Reichstag. In 1873 Bismarck chose him to succeed Count Arnim as ambassador in Paris. In 1879, on the death of Bülow, he acted for some time as secretary of state for foreign affairs, and was the third German representative at the Congress of Berlin. In 1885 he was chosen to succeed Manteuffel as governor of Elsass-Lothringen. Here he had to carry out the strict measures which became necessary in 1887–88, but he succeeded in laying the foundation of a Nationalist party. In 1894, notwithstanding his advanced years, he was appointed Prussian minister-president and chancellor of the empire in succession to Caprivi. (For the events connected with his administration see Germany.) He took a less active part in public business than either of his predecessors; his appearances in the Prussian and German parliaments were rare, and great independence was allowed to the secretaries of state. On more than one occasion the want of a strong controlling force was felt, especially in the management of Prussian affairs. He resigned in August 1900, and died 6th July 1901.

Prince Hohenlohe married in 1851 Marie, princess of Sayn-Wittgenstein-Berleburg, by whom he had several children. On the death of Prince Peter of Sayn-Wittgenstein in 1887 the princess succeeded to his very extensive possessions in Russia. A recent law, however, forbade foreigners to hold land in Russia, and all the influence of the prince was unable to procure an exemption.

Other members of the family of Hohenlohe who have attained distinction in recent years are Prince Adolf von Hohenlohe Ingelfingen (1797–1873), a son of the general who commanded at Jena; he was minister-president of Prussia for a few months in 1862. His son, Prince Kraft von Hohenlohe (1827–1892), Prussian general, was the author of a number of important military works, most of which have been translated into English. A cousin of his was Prince Friedrich Wilhelm von Hohenlohe, duke of Ujest (1816–1897), one of the wealthiest of the Prussian nobility. These all belong to the Protestant branch, as do the family of Hohenlohe-Langenburg, to which belongs Prince Hermann von Hohenlohe, general in the Prussian army, founder and president of the German Colonial Society, and after 1894 governor of Elsass-Lothringen, in which post he succeeded Prince Chlodwig von Hohenlohe. His son, the Hereditary Prince of Hohenlohe-Langenburg, married a daughter of Alfred, Duke of Saxe-Coburg-Gotha, and became regent of the principality during the minority of the present duke. The family of Hohenlohe-Langenburg hold also the title of Count Gleichen. Through the mother of the present prince, a princess from Leiningen, they are closely connected with the English Royal family.

See Rust. *Reichskanzler Fürst Hohenlohe und seine Brüder.* Dusseldorf, 1897. (J. W. He.)

Hohenmauth (Czech, *Vysoké Mýto*), chief town of a government district in Bohemia, Austria. It has now a communal Czech gymnasium, and among its new industries are the manufacture of musical instruments, artificial manure, and pottery. Population, almost wholly Czech (1900), 9473, including a garrison of 1452 men.

Hohenzollern, a bailiwick of the kingdom of Prussia, on the Danube, and almost entirely surrounded by Würtemberg and Baden, with an area of 441 square miles, and population (1900) of 66,780, of whom 95 per cent. are Roman Catholics. Agriculture and a little mining, fruit-growing, and manufacture of iron-ware and cottons are the principal industries.

Hokkaido, the Japanese name for the northern division of the empire (*Hoku* = north, *kai* = sea, and *do* = road), including Yezo, the Kuriles, and their adjacent islets.

Holbeach, a market-town and railway station in the Spalding parliamentary division of Lincolnshire, England, 17 miles south of Boston. All Saints' Church (14th century), with a spire 180 feet high, has been restored; there are Congregational, Baptist, Wesleyan, and other chapels; the grammar school, founded in 1669, has an endowment of about £220 a year, and occupies a building erected in 1877. Other public buildings are the assembly rooms and a market house. Roman and Saxon remains have been found. Area of parish (an urban district), 21,469 acres. Population (1881), 5190; (1901), 4752.

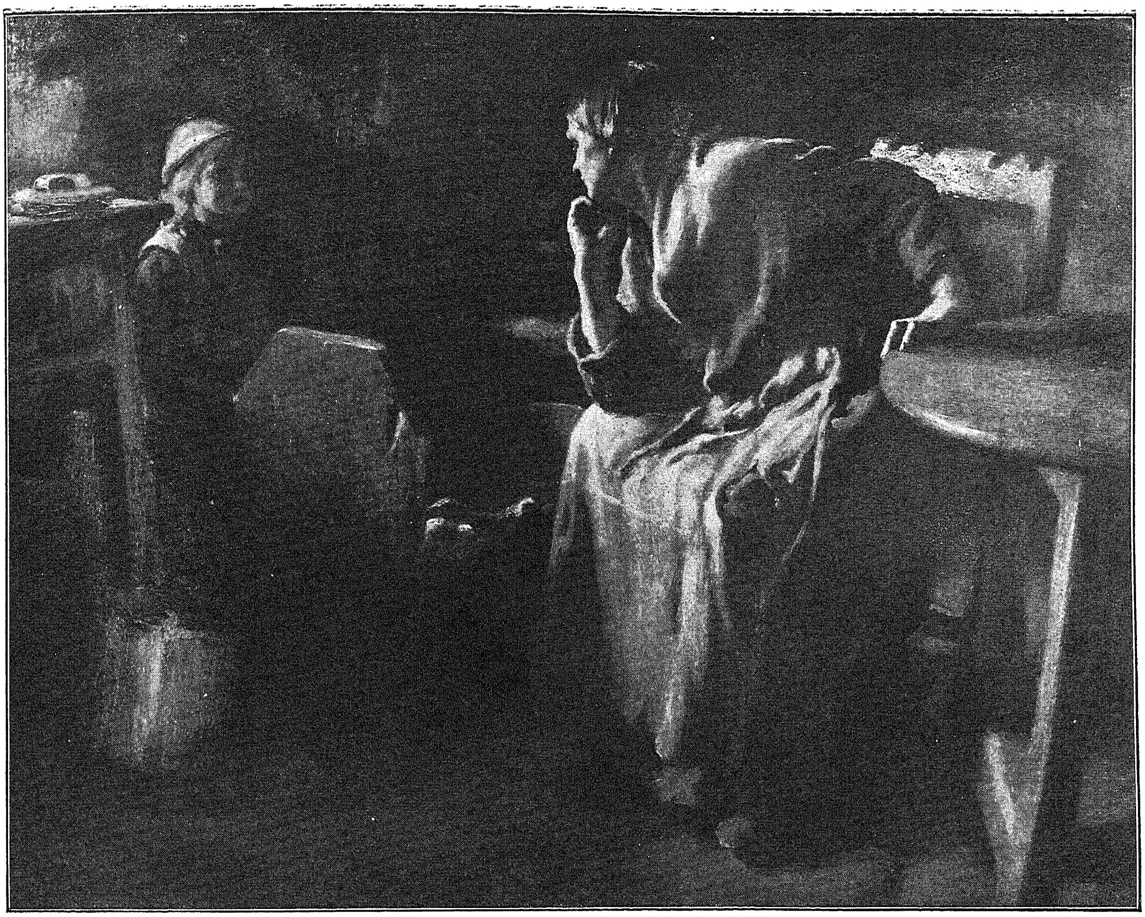
Holden, Hubert Ashton (1822–1896), English scholar, was born, of an old Staffordshire family, in 1822, and educated at King Edward's School, Birmingham, and Trinity College, Cambridge. He was Bell University Scholar (1842) and senior classic (1845), besides being a junior optime in the mathematical tripos, and was elected a fellow of his college, where he remained for some time as tutor. In 1848 he was ordained. From

1853 to 1858 he was vice-principal of Cheltenham College, and from 1858 to 1883 headmaster of Queen Elizabeth's School, Ipswich. He took his Cambridge LL.D. in 1863, and in 1893 was given by Dublin the degree of Litt.D. Dr Holden was one of the finest classical scholars of his time; in 1848 he produced an edition of Aristophanes, and in subsequent years edited various works of Plutarch, Xenophon, Thucydides, and Cicero. His chief title to remembrance, however, rests on his *Foliorum Silvula* (1852), a collection of English poetry and prose for translation into Greek and Latin; *Folia Silvulæ* (the translations), which ran through many editions; and *Foliorum Centuriæ*. In English schools these books became household words, and were indissolubly connected with the writing of Latin and Greek verse. He died in London, 1st December 1896.

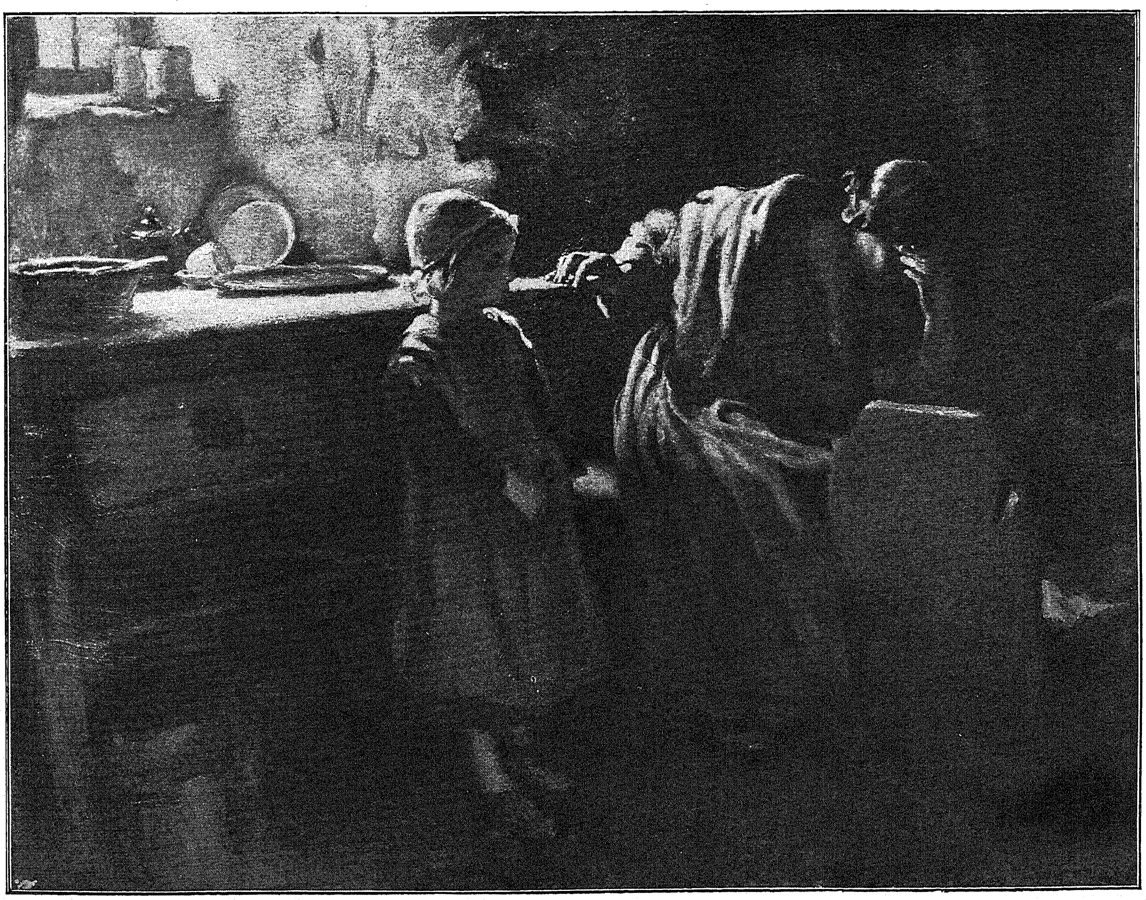
Holden, Sir Isaac (1807–1897), English inventor and manufacturer, was the son of Isaac Holden, a miner of Cumberland, and was born at Hurlet, a village between Paisley and Glasgow, 7th May 1807. His early life was passed in very straitened circumstances, but his father spared no pains to give him as much elementary education as possible. Necessity, however, compelled the boy to seek employment, and he obtained work for two years as weaver's draw-boy, and afterwards in a cotton mill. Meanwhile his education was continued at the night schools, and from time to time, as funds allowed, he was taken from work and sent to the grammar school, to which he at last went regularly for a year or two until he was fifteen, when his father removed to Paisley and apprenticed him to an uncle, a shawl-weaver there. This proved too much for his strength, and he became assistant teacher to Mr John Kennedy until January 1828, when he was appointed mathematical teacher in the Queen's Square Academy, Leeds. At the end of six months he was transferred to Lingard's Grammar School, near Huddersfield, and shortly afterwards became classical master at Castle Street Academy, Reading. It was here that in the course of chemical experiments he invented a lucifer match by adopting sulphur as the medium between the explosive material and the wood, but he refused to patent the invention. In 1830 his health again failed, and he returned to Scotland, where a Glasgow friend set up a school for him. After six months, however, he was recommended for the post of bookkeeper to Messrs Townend Brothers, of Cullingworth, where his interest in machinery soon led to his transfer from the counting-house to the mill. Here he pursued a series of experiments in wool-combing, which ultimately led to the foundation of the firm of Lister & Holden, whose wool-combing business was also established successfully in France. Owing to Holden's devotion to the improvement of his machinery, and his special success in the "square motion" principle, the business grew rapidly, and several branches were established. In January 1859 Mr Lister retired, and the firm of Isaac Holden & Sons was established, which became the largest wool-combing business in the world, employing upwards of 4000 workpeople. In 1865 Holden's medical advisers insisted on complete change of occupation, and he entered upon a parliamentary career in the Liberal interest, and was elected for Knaresborough in July of that year. In 1868 he resigned his seat, and unsuccessfully contested the Eastern Division of the West Riding, the Northern Division in 1872, and again the Eastern Division in 1874. But on the death of Lord Frederick Cavendish in 1882 he was elected for the Northern Division, and returned in 1885 for Keighley. He was created a baronet in 1893, and continued to represent Keighley until his death in 1897.

Holguin, a town in the interior of Santiago province, Cuba, 65 miles N.N.W. of Santiago de Cuba. It was noted as a revolutionary centre. It is connected by rail with Gibara. Population (1899), 6045.

Holl, Frank (1845–1888), English painter, was born in London on 4th July 1845, and was educated chiefly at University College School. He was a grandson of William Holl, an engraver of note, and the son of Francis Holl, A.R.A., another engraver, whose profession he originally intended to follow. Entering the Royal Academy schools as a probationer in painting in 1860, he rapidly progressed, winning silver and gold medals, and making his début as an exhibitor in 1864 with "A Portrait," and "Turned out of Church," a subject picture. "A Fern Gatherer," 1865; "The Ordeal," 1866; "Convalescent" (the somewhat grim pathos of which attracted much attention), and "Faces in the Fire," 1867, succeeded. Holl gained the travelling studentship in 1868; the successful work was characteristic of the young painter's mood, being "The Lord gave, and the Lord hath taken away." His insatiable zeal for work of all kinds began early to undermine the artist's health, but his position was assured by the studentship picture, which created a sort of *furore*, although, as with most of his works, the blackness of its coloration, probably due to his training as an engraver, was even more decidedly against it than the sadness of its theme. Otherwise, this painting exhibited nearly all the best technical qualities to which he ever attained, except high finish and clearness, and a very sincere vein of pathos. Holl was much below Millais in portraiture, and far inferior in all the higher ways of design; in technical resources, relatively speaking, he was but scantily provided. The range of his studies and the manner of his painting were narrower than those of Josef Israëls, with whom, except as a portrait-painter, he may better be compared than with Millais. In 1870 he painted "Better is a Dinner of Herbs where Love is, than a Stalled Ox and Hatred therewith"; "No Tidings from the Sea," a scene in a fisherman's cottage, in 1871—a story told with breath-catching pathos and power; "I am the Resurrection and the Life," 1872; "Leaving Home," 1873, "Deserted," 1874, both of which had great success; "Her First-born," girls carrying a baby to the grave, 1876; and "Going Home," 1877. In 1877 he painted the two pictures shown in our Plate, "Hush" and "Hushed." "Newgate, Committed for Trial," a very sad and telling piece, first attested the breaking down of the painter's health in 1878. In this year he was elected A.R.A., and exhibited "The Gifts of the Fairies," "The Daughter of the House," "Absconded," and a very fine portrait of Samuel Cousins, the mezzotint engraver. This last canvas is a masterpiece, and deserved the success which attended the print engraved from it. Holl was overwhelmed with commissions, which he would not decline. The consequences of this strain upon a constitution which was never strong were more or less, though unequally, manifest in "Ordered to the Front," a soldier's departure, 1880; "Home Again," its sequel, in 1883 (after which he was made R.A.). In 1886 he produced a portrait of Millais as his diploma work, but his health rapidly declined, and he died at Hampstead, 31st July 1888. Holl's better portraits, being of men of rare importance, attest the commanding position he occupied in the branch of art he so unflinchingly followed. They include likenesses of Lord Roberts, painted for Queen Victoria, 1882; the Prince of Wales, Lord Dufferin, the Duke of Cleveland, 1885; Lord Overstone, Mr Bright, Mr Gladstone, Mr Chamberlain, Sir J. Tenniel, Earl Spencer, Viscount Cranbrook, and a score of other important subjects. (F. G. S.)



"Hush." By Frank Holl, R.A.



"Hushed." By Frank Holl, R.A.

(*From Photographs by W. A. Mansell and Co.*)

HOLLAND.

Geography and Statistics.

HOLLAND, as the Kingdom of the Netherlands is generally termed in English, is a maritime country of North-West Europe, bounded on the E. by Germany, on the S. by Belgium, and on the W. and N. by the North Sea. Since 1880 the dykes and dunes have been considerably strengthened by the erection of new breakwaters, walls, &c., at several places, more particularly at West Kappel, near Domburg (Walcheren), along the coast of Delftland and Scheveningen (since the storms of 1894–95), at Petten and the Hondsbossche in North Holland (1884–88), around the shores of Ameland and Vlieland (1880–97), islands which protect the entrance to the Zuyder Zee, and along the coast of the northern provinces. Taking the division of the country into *Lowlands*, lying below the Amsterdam zero (or mean high-water level in front of that city), and *Highlands* (lying above that level), the former may be considered to occupy 38 per cent. of the surface and the latter 62 per cent. A more detailed classification, however, distinguishes seven zones, running roughly from west to east:—

Zone.	1	2	3	4	5	6	7
Mean Altitude between (metres)	−2·5 and 0	0 and 1	1 and 5	5 and 10	10 and 25	25 and 50	50 and 10
Percentage of Total Area	25	13	12	12	24	12	2

The figures indicate the mean height of the zones; the height of the hills is greater: near Vaals (Limburg) the extreme altitude of 1057 feet is reached.

Climate.—The following table supplies data respecting the climate on an average of fifty years:—

Month.	Mean Monthly Temperature.	Mean Monthly Barometric Height.	Average Rainfall.	Average Evaporation.
	Fahr.	Inches	Inches.	Inches.
January	34·64°	29·93	1·93	0·46
February	37·22°	29·45	1·75	1·23
March	40·73°	29·90	1·75	2·12
April	48·85°	29·90	1·49	3·12
May	56·48°	29·92	1·94	5·91
June	62·40°	29·95	2·16	6·88
July	65·10°	29·94	2·97	6·53
August	64·40°	29·93	3·19	3·45
September	59·25°	29·94	2·60	2·07
October	50·65°	29·88	2·87	1·20
November	41·32°	29·89	2·34	0·73
December	36·70°	29·93	2·41	0·59

The mean annual temperature is 49·8° Fahr.; the maximum, 93·9° Fahr.; the minimum, −5·8° Fahr. The mean annual barometric height is 29·93 inches; the mean annual moisture, 81 per cent.; the mean annual rainfall, 27·99 inches. The mean annual number of days with rain is 204, with snow 19, and with thunderstorms 18. The increased rainfall from July to December (the summer and autumn rains), and the increased evaporation in spring and summer (5·2 inches more than the rainfall), are of importance as regards "poldering" and draining operations. The prevalence of south-west winds during nine months of the year and of north-west during three (April–June) has a strong influence on the temperature and rainfall, tides, river mouths and outlets, and also, geologically, on dunes and sand drifts, and on fens and the accumulation of clay on the coast.

Area and Population.—In 1889 the area showed a slight diminution as compared with that of 1877, being calculated to be 12,558 square miles. Including the Zuyder Zee and sand islands (2027 square miles) and the Dutch portion of the Dollart (23 square miles), the total area was returned as 14,613 square miles. About 38 square miles have been reclaimed since 1877 from the Y, Groningen (the Dollart), Zeeland, and the Legmeer.

The following table shows the area and population of the provinces severally:—

Province.	Area in Square Miles.	Population 1889.	Population 1900.	Density Per Square Mile in 1900.
North Brabant	1,980	509,628	553,842	280
Gelderland	1,965	512,202	566,549	288
South Holland	1,166	949,641	1,144,448	981
North Holland	1,070	829,489	968,131	905
Zeeland	690	199,234	216,295	313
Utrecht	534	221,007	251,034	470
Friesland	1,282	335,558	340,262	265
Overyssel	1,291	295,445	333,338	258
Groningen	790	272,786	299,602	379
Drenthe	1,030	130,704	148,544	144
Limburg	850	255,721	281,934	332
Total	12,648	4,511,415	5,104,137 [1]	404

[1] This total includes 158 persons assigned to no province.

The divergence between the density in North and South Holland and that in Drenthe has become more marked than ever. On 1st January 1900 there were twenty-two cities with a population of over 25,000, as compared with only nine thirty years earlier, since when the populations of even the largest had almost, and in some cases more than, doubled. The eight largest were, Amsterdam (510,850), Rotterdam (318,500), The Hague (206,020), Utrecht (102,080), Groningen (66,530), Haarlem (64,080), Arnhem (56,810), Leyden (53,650). The following table gives particulars of the births (living), deaths, and marriages for the whole country in 1889, 1899, and 1900:—

Year.	Births.		Deaths.		Marriages.	
	Number.	Per Thousand.	Number.	Per Thousand.	Number.	Per Thousand.
1889	150,529	33·2	91,135	20·1	31,494	7·0
1899	163,289	32·0	87,319	17·1	37,990	7·4
1900	162,611	31·8	92,043	18·3	39,419	7·7

The illegitimate births in 1900 numbered 4247, as compared with an annual average of 4264 for the years 1879–84, and an annual average of 4529 for the period 1879–1900. There is but little emigration; the number of emigrants annually in 1887–91 was 5271, but this fell in 1896–1900 to 1255.

Changes in Government.—Since 1878 the number of members in the First Chamber has been increased from 39 to 50, South Holland sending 10, North Holland 9, North Brabant and Gelderland each 6, Friesland 4, Overyssel, Limburg, and Groningen each 3, Zeeland, Utrecht, and Drenthe each 2. According to the fundamental law of 1887, they are chosen by the provincial states not only from amongst those who bear the greatest burden of direct taxation in each province, but also from amongst great functionaries and persons of high rank. The members of the Second Chamber number 100. The franchise has been extended until the number of electors—only 3·02 per cent. of the population in 1880—formed 11·19 per cent. in 1900.

Religion.—At the census of 1900 the population was classified thus as regards religion:—

Provinces.	Dutch Reformed.	Other Protestants.	Roman Catholics.	Jansenists.	Jews.	Other Creeds & Unknown
N. Brabant	50,626	13,362	486,847	12	2,108	887
Gelderland	314,414	38,951	201,939	365	5,160	5,720
S. Holland	683,664	140,533	277,442	1,994	17,406	23,409
N. Holland	444,334	142,705	266,356	4,589	61,960	48,187
Zeeland	127,147	28,959	54,456	12	426	5,295
Utrecht	134,647	27,637	83,069	1,737	1,435	2,509
Friesland	204,902	83,653	24,831	7	1,545	25,324
Overyssel	196,497	37,768	89,845	6	4,507	4,715
Groningen	199,070	60,218	19,624	24	6,038	14,628
Drenthe	112,193	22,600	9,242	7	2,292	2,210
Limburg	3,459	712	276,452	1	1,111	199
Total	2,470,953	597,098	1,790,103	8,754	103,988	143,083

The state contributes annually about £164,000 towards the funds of the various denominations.

Education.—The following tables show the progress of education:—

Primary Education.

Year.	Number of Schools.	Number of Teachers.	Pupils. Boys.	Pupils. Girls.	Illiterate per 10,000	Infant Pupils.	Educational Expenditure	Illiterate Conscripts.
							£	%
1875	3,817	11,975	55,485	67,912	1,626	73,018	514,480	12·3
1898	4,544	23,532	379,622	351,066	845	115,985	1,349,473	2·8

Secondary Education.

Year.	Burgher Schools.[1]			High Burgher Schools					
				Boys.			Girls.		
	Schools.	Pupils.	Teachers.	Schools.	Pupils.	Teachers.	Schools.	Pupils.	Teachers.
1875	78	8,087	521	51	3,847	581	9	691	101
1898	126	17,217	1,226	63	8,143	839	12	1,586	174

[1] For drawing and industrial art; technical schools for workmen.

In 1900 the elementary schools numbered 4569, the teachers 24,222, and the pupils (boys and girls) 539,810; the burgher schools 137, the teachers 1225, and the pupils 18,478; the high burgher schools 75, the teachers 1024, and the pupils (boys and girls) 10,299. Of the total number of children of school age (six to twelve years) about 8½ per cent. receive no education. Besides the universities mentioned below, there is the "free (Reformed) university" of Amsterdam, attended in 1900 by 126 students. In 1900 the Polytechnic School numbered 714 pupils, the National School of Agriculture nearly 200, and eleven schools of navigation 1564, with 71 instructors. In 1899 the state spent £883,330 upon education, and the communes an additional £1,003,583. The following universities provide for—

Higher Education.

Year.	Leyden. Prof.	Leyden. Stud	Utrecht. Prof.	Utrecht. Stud.	Groningen. Prof.	Groningen. Stud.	Amsterdam Prof.	Amsterdam Stud.	Amsterdam, Free. Prof.	Amsterdam, Free. Stud.
1898–99	50	792	39	775	38	397	50	929	6	128

Gymnasia (including Latin or Grammar Schools).

Year.	Number.	Teachers.	Pupils.
1899–1900 . .	29	426	2259

The expenditure of the universities and gymnasia amounted in 1877 to £88,141, in 1898 to £253,715. Since 1870 there have been instituted schools of cookery and domestic economy, a technical school for engineers at Amsterdam, schools of commerce and administration, schools for instruction in horticulture and dairy work, for the training of teachers (for primary schools), for the blind, deaf, and mute, for drawing and industrial art, and for music, dramatic study, painting, and architecture. The number of museums and collections of antiquities, engravings, &c., has also been increased.

Crime and Pauperism.—There are a high court, 5 courts of justice, 23 district tribunals, 106 cantonal courts. Trial by jury is unknown. In 1900, 96,869 persons altogether were convicted by the cantonal courts, and 13,236 males and 1254 females at the district tribunals. The number of inmates in prison at the end of 1898 was 2123 males and 156 females; in houses of detention 712 males and 58 females. There are three state workhouses for drunkards, beggars, and vagabonds; the number of inmates at the end of 1898 was 3759. Children under sixteen years of age placed in the three state reformatories in 1898 numbered 593 boys and 98 girls. The relief of the poor is largely effected by religious societies and organized private charities. The state does not interfere except when private charity fails; in that case the pauper must be supported by the commune. The number of poor relieved during 1898 was 235,295, or 4·69 per cent. of the total population.

Finance.—The following statement shows the revenue and expenditure of the kingdom for 1889 and 1900–1:—

Revenue. Source.	1889	1901.	Expenditure. Object.	1889.	1901.
	£	£		£	£
Excise	3,678,075	4,042,500	National Debt	2,727,591	2,906,214
Direct Taxation	2,300,865	2,900,175	Department of War	1,798,698	1,893,036
Indirect Taxation	2,004,745	1,805,583	Department of Waterstaat . .	1,790,291	2,448,339
Post Office	539,405	865,750	Department of Finance . . .	1,537,404	2,092,343
Government Telegraphs . . .	106,970	187,375	Department of Marine . . .	1,038,536	1,388,141
Export and Import Duties . .	440,247	801,500	Department of Interior . . .	815,188	1,330,563
State Domains	213,186	147,000	Department of Justice . . .	426,343	529,159
Pilot Dues	106,079	191,667	Department of Colonies . . .	93,829	109,768
State Lotteries	54,609	54,250	Department of Foreign Affairs. .	57,312	71,101
Gold and Silver Wares . . .	19,496	25,908	Royal Household	54,166	66,667
Game and Fisheries	11,660	11,000	Superior Authorities of the State .	52,476	56,792
Railways	...	361,512	Unanticipated Expenses . . .	1,745	4,166
Total[1]	9,475,337	11,394,220	Total[2]	10,393,579	12,896,289

[1] Including the ordinary revenue (the Indian contributions ceased in 1878), balances from previous budgets, proceeds of sale of domains, &c., which are not specified in details.

[2] Including, besides the ordinary budget, the outlays in payment of annuities, in funding and discharging debt, in railway extension, &c.

The total debt in 1901 amounted to £96,561,287, the annual interest amounting to nearly 3 millions sterling. During the years 1850–1900, £26,034,422 has been devoted to the redemption of the public debt. The total wealth of the kingdom is estimated at 888 millions sterling.

The following table gives a statement of the provincial and communal finances:—

	Revenue. 1889.	Revenue. 1900.		Expenditure. 1889.	Expenditure. 1900.
	£	£		£	£
Provincial	722,583	445,333	Provincial .	740,333	445,333
Communal	6,132,000	9,311,666	Communal	5,683,800	8,503,250

Defence.—The standing army in 1898–99 formed a force of 69,316, as compared with 60,000 in 1878. Of these 3253 were raised by voluntary enlistment, 11,773 were conscripts in arms, 54,290 conscripts not in arms. Personal service has been compulsory since 1898. There are 43,690 in the militia "train-bands" or *schuttery*. The strength of the navy in 1899 consisted of 741 officers and 10,601 men, including marine infantry. The fleet was composed on 1st January 1900 of 32 armour-plated and 68 non-armour-plated ships, with 39 ships for general purposes. The guns numbered about 550. Both seamen and marines are recruited by enlistment.

Agriculture.—The following statement shows the uses to which the land was put in 1899:—Arable land, 26 per cent.; pasture and hay fields, 34 per cent.; market and flower gardens and orchards, 1·65 per cent.; woodland, 6·8 per cent.; waste lands (in 1876, 23 per cent.), 18 per cent.; the remainder is occupied by water, roads, dykes, buildings, &c. Both the diluvium (sandy soil) and the alluvium (marine and fluvial clay) are adapted for agriculture and grazing; the orchards, &c., are principally on the *geest* or higher grounds on the border of the dunes, or skirting the sand and clay strata. The area of waste land has been lessened by the plantation of woods, cultivation of heaths and fens, improved irrigation and

means of communication, and a reduction in the number of sheep. The following table shows the areas under cultivation in grain and other marketable crops in 1899 :—

Crops.	Acres	Mean Production per Acre.	
		1876–80.	1898–99.
		Bushels.	Bushels.
Wheat . . .	178,153	23·61	28·3
Rye . . .	530,383	19·38	24·4
Potatoes . .	385,727	124·78	204·9
Oats . . .	317,993	41·23	50·0
Buckwheat . .	71,989	17·37	17·1
Beans and Pease .	147,416	22·84	28·9
Barley . . .	88,117	30·21	41·0
Rape seed . .	11,815	23·51	28·9
		Cwt.	Cwt.
Beetroot . .	115,233	183·8	254·0
Flax . . .	19,840	3·40	4·8

In addition, over 470,000 acres are annually planted with fodder plants. Notwithstanding the improved production per acre and the progress of agricultural science (promoted by the Government, societies, schools, settlements, winter courses, inspectors, and a special department for agriculture under the minister of the interior) the market value of grain has decreased by about one-half since 1875. Permanent pasture in 1900 extended to close upon 3,000,000 acres. The number in 1876 and 1899 respectively of horses was 268,000 and 284,900 ; of cattle, 1,439,257 and 1,646,500 ; of sheep, 891,090 and 755,400 ; of goats, 150,000 and 177,200 (1898) ; of pigs, 352,000 and 1,348,500. The value of the live stock was estimated in 1897 at about £14,473,200. Stock-breeding, like agriculture, has considerably improved under the care of the Government (state and provincial), which grants subsidies for breeding, irrigation of pasture-lands, the importation of finer breeds of cattle and horses, the erection of factories for dairy produce, schools, &c.

Fisheries.—The position of the fishing industry in the four great fishing areas in 1899 was :—

	Vessels.	Men.
North Sea Fishery (Salt Herring, Cod, and Flat Fish) . . .	1,459	10,632
Zuyder Zee Fishery . . .	3,511	7,492
Groningen and Friesland Fishery .	98	288
Zeeland Fishery	1,072	2,383

The herring exported from the North Sea fishery in 1898 amounted to 354,333 tons, value £530,878 ; the herring exported from the Zuyder Zee fishery amounted to 71,380,000 fish—various fresh sea-fish, 89,027 cwt. ; salt cod, 728 cwt. ; stockfish, 63,718 cwt. ; anchovies, 43,300 ankers (an anker contains 1500–4000 fish, according to their size) ; oysters, 50,819 cwt. ; shrimps, 60,943 cwt. The great advance in the activity of the fisheries must be attributed to the use of better nets and vessels (*loggers*), improved laws and international treaties, the scientific study of ichthyology, and the connexion of the chief ports with the various railways.

Industries.—The following are the statistics of the occupations of the people :—

Industries.	Total Number of Workers.	Number of Women Workers.
Earthenware, Diamonds, Glass, Mortar, and Stone . .	28,572	2,354
Printing and Lithography .	12,105	88
Building	120,975	343
Chemical Industry . .	3,509	565
Wood, Cork, and Straw .	37,387	521
Dress and Dyeing . .	75,645	43,014
Handicrafts	1,598	221
Leather, Oilcloth, Indiarubber	37,422	624
Coal, Salt, Turf . . .	15,371	2,088
Metallurgy	41,633	457
Papermaking	2,923	595
Ship and Carriage Building .	13,516	71
Steam and other Engines .	6,456	56
Textile	44,455	10,833
Lighting, Oils, Varnish . .	6,332	485
Food and Narcotics . .	84,327	3,355
Total . .	532,226	65,670

About a third of the productive population of 1,658,000 find their means of subsistence in factories or workshops or as odd workmen. The number gaining a living from agriculture, live stock, gardening, &c., is 525,000. The factories are very unequally distributed amongst the different provinces. South and North Holland, Brabant, Gelderland, Overyssel, and Groningen combined have 3340 out of 4089 factories, 3978 out of 4812 engines, 56,968 out of the 68,278 total horse-power. Among industrial products the export of margarine represents a value of £3,725,400 ; sugar, £4,482,000 ; textiles, raw and manufactured, £7,338,300 ; paper, £3,636,000 ; vegetables, fresh and dried, £3,951,300 ; butter, £1,881,000 ; iron and steel goods, £11,877,000 ; cheese, £1,339,000 ; cereals and flour (wheaten, rye, potato, &c.), £15,996,400. By means of national and international exhibitions, museums, and schools, including those for women, the Government and various societies have considerably promoted industry.

Trade.—In 1900 the value of the imports for home consumption was estimated at £164,000,000, and the exports of home produce at £141,250,000. The following table shows the value of the imports and exports of the great classes of products for 1900 :—

	Imports.	Exports.
	£	£
Food Products . .	42,497,000	40,906,000
Raw Materials . .	38,568,000	29,022,000
Manufactured Products .	20,325,000	20,002,000
Miscellaneous. . .	29,668,000	25,109,000

Of the exports, 48·8 per cent. go to Prussia, 22·7 per cent. to Great Britain, 13 per cent. to Belgium, 4·4 per cent. to Java, 3·2 per cent. to the United States. Of the imports, 18·9 per cent. come from Prussia, 16·5 per cent. from Great Britain, 11·5 per cent. from Belgium, 13·7 per cent. from Russia, 14 per cent. from Java, 7·7 per cent. from the United States. In the total value of the imports, grain and rice represent 22·44 per cent. ; drugs, 12·96 per cent. ; iron and iron goods, 5·97 per cent. ; coals, 2·89 per cent. ; yarn, 2·43 per cent. ; coffee, 2·50 per cent. In the value of the exports, grain and rice represent 16·22 per cent. ; drugs, 14·65 per cent. ; iron and iron goods, 5·10 per cent. ; sugar, 3·72 per cent. ; butter and margarine, 3·64 per cent. ; manufactured goods, 3·44 per cent. ; coffee, 1·82 per cent., &c.

Shipping and Navigation.—The access to river-mouths and seaports has been improved by the new waterways to Amsterdam and Rotterdam (and in the case of the former town by the use of ice-breakers), by the new sluice at Ymuiden (1892–96), and by the new facilities for communication with the sea at Terneuzen (1882), Stavoren (1883–88), Harlingen (1894), Lemmer (1886–88), and Zwolle (1878). From £585,000 to £665,000 was expended between 1872 and 1897 on the building of lighthouses and lightships, in addition to £8,335,000 upon the improvement of waterways and seaports. The depth in the chief sea outlets and river-mouths is :—For the northern (*Friesche zeegat*, that for Terschelling, Texel, and Oude Vlie) 7·9–19·4 feet, for the southern (that for Goeree, Brouwershaven, the Krammer, Volkerak, Hollandsch Diep, and West Scheldt) 9·8–27·2 feet. The number of vessels belonging to the mercantile navy at the end of 1900 was 638 of 348,174 tons, of which 425 of 78,588 tons were sailing vessels and 213 of 269,586 tons steamers. In 1900 the total number of vessels which entered the ports was 12,307 of 9,475,164 tons, and cleared 12,367 of 9,449,676 tons. Of the total number entered, 3335 of 2,381,358 tons were Dutch vessels. Of the total entered, 6401 vessels of 5,816,928 tons were at the port of Rotterdam and 1884 of 1,453,170 tons at Amsterdam. About 70 Dutch steamers give passage to the colonies and other parts of the world.

Inland Communication—Railways.—Since 1890 the Rhine railway, and since 1898 the railway between Maestricht and Liége and the portion of the Central Belgian Railway on Dutch ground, have been worked by the state. The following table gives the railway statistics for 1899 :—

	Miles.		Traffic (1899).	
	1875.	1898.	Passengers.	Tons of Goods.
State Railways . .	528	972	11,733,000	7,060,000
Railway of Holland .	147	796	14,463,000	3,425,000
Central Railway . .	63	69	1,123,000	394,000
North Brabant—German Railway . .	32	63	545,000	322,000
Total . .	770	1900	27,864,000	11,201,000

The revenue of the railways was in 1900 £3,554,350, and expenditure £2,969,850. Since 1877 communication has been greatly improved by the construction of tramways (61, of which 36 are steam). Their total length was 927 miles in 1899, when they transported 53,697,000 passengers and 520,535 tons of goods. Their chief importance consists in the connexion they form

between rail- and water-ways, and the opportunity they give the working-classes of living outside the great towns. Altogether, Holland has 9321 miles of roads and dykes; these last being the embankments which shut out the sea and protect the low-lying country against the rivers.

Inland Communication—Rivers and Canals.—The corrected figures, showing the breadth and depth of the rivers in recent years, are very interesting. The expenditure upon their improvement, which from 1844 to 1861 amounted only to £791,600, rose, for the years 1862 to 1898, to £10,416,600. The normal breadth (minimum) of the fairway and depth (on the shallowest part at lowest tide) of the chief rivers are respectively as follows:—Upper Rhine, 657 feet and 10½ feet; Waal, 1017 feet and 8·9 feet; Lek, 453–738 feet and 6·6 feet; Meuse, 109–131 feet and 3·3–5·4 feet. Considerable sums have also been spent since 1874 on the improvement of small rivers such as the Dommel, Old Yssel, Berkel, Vecht, and Regge, to make them available for irrigation and canalization, and to prevent inundations. The chief canals constructed since 1877 are the Deurne canal (1876–92), depth 5·9 feet, from the Meuse to the Helena Fen (North Brabant); the Merwede canal (1881–93), depth 10·2 feet, from Amsterdam to Gorkum; the Overyssel (1884–88), depth 5·2 feet, in the province of Overyssel; the Stieltjes and Orange canals, in the province of Drenthe, depth 6·6 feet, and constructed respectively in the years 1880–84 and 1881–89; and the Groningen (1877–81), depth, 3·3 feet. The total length of navigable river channels in 1898 was 860 miles, of canals 2082 miles. The latter vary in depth from 33 to 3 feet, according to their importance as highways to the North Sea, the Scheldt, the great rivers Rhine and Waal, or as waterways between the greater towns, and as provincial canals to the fens. The inland traffic cannot be tabulated in definite figures, but its extent may be estimated by the quantity of produce brought to the public markets and the number of ships employed on rivers and canals. Of late years there has been annually brought to the market of Alkmaar about 13 million ℔ of cheese; to that of Sneek (Friesland) about 4½ million ℔ of butter; to the market of the small town of Purmerend 80,000 sheep and 50,000 head of cattle; to Leeuwarden 163,000 head of cattle; to Rotterdam more than 200,000 head of cattle, sheep, &c. The foreign shipping on the rivers in 1897 consisted of 68,712 vessels. Lobit on the Rhine was passed in 1898 by 58,546 vessels. But for inland traffic there are thousands of other large and small vessels passing the canals and sluices. Between Amsterdam and Rotterdam 26,812 ships passed in 1898; St Andries, the sluice between the Waal and Meuse, was passed by 4719 ships; 5841 ships traversed the Walcheren canal; 41,161 the South Beveland canal (Zeeland); 37,252 the Merwede canal; Zwartsluis, on the Meppeler Diep, was passed by 16,990 ships; the total inland traffic amounting to about 1,700,000 tons.

Money and Banking.—Since 1875 there has been an unrestricted coinage of ten-guilder (guilder=1s. 8d.) pieces in gold. There are no State banks. The Bank of the Netherlands is the only one having the right to issue bank-notes for a period of fifteen years from 1888, the contract being renewable for ten years. Two-fifths of the paper money must be covered. In 1901 the notes in circulation amounted to £19,322,400; total exchanges, £40,360,900; stock of gold, £6,191,700; stock of silver, £5,670,000. The capital amounts to £1,666,666; the reserve fund to £458,333. The bank keeps the State treasure and the cash of the post office savings bank. There are many savings banks, all private. Besides these there is a post office savings bank, established in 1881. The total deposits of the private banks in 1900 amounted to £6,405,600, and of the post office savings bank to £7,058,100; the number of depositors in the former was 420,885, in the latter 764,201.

Post Office and Telegraphs.—The following table shows the progress made since 1875:—

Year.	Letters.		Printed Matter.	Postcards.		Letters and Cards per Head of the Population.	Telegraph.		
	Inland.	Foreign.		Inland.	Foreign.		Miles of Line.	Miles of Wire.	Messages.
1875	35,581,000	10,344,000	50,000,000	7,545,000	259,000	14·3	2,138	6,341	2,500,000
1900	74,800,000	28,112,000	156,063,000	46,613,860	9,193,400	30·8	3,831	14,210	5,393,870

The receipts of the post office in 1900 amounted to £845,800, and expenses £645,200; of the state telegraphs, receipts £178,450, and expenses £227,250.

Colonies.—The Dutch colonies in the East Indian Archipelago cover an area of 740,193 square miles, or an area sixty times that of the mother country, with a population in 1897 of about 63,315 Europeans, 469,534 Chinese, 24,410 Arabs, 11,625 other foreigners, and 34,000,000 natives. For the West Indian colonies the area of Surinam is 57,917 square miles, with a population in 1898 of 65,168. The West Indian Islands—Curaçao (212 square miles), Bonaire (129 square miles), Arūba (64 square miles), St Martin (17 square miles), St Eustatius (8 square miles), Saba (4 square miles)—had a combined population in 1900 of 51,693. The East Indian possessions no longer (since 1893) yield an annual contribution. Their expenditure exceeded their revenue in the three years 1897–99 by the respective amounts of £1,500,000, £1,415,000, and £415,000; but in 1900 and 1901 there were surpluses of £386,656 and £4213 respectively. The West Indian colonies require aid to the extent of £15,000 to £32,000 annually.

AUTHORITIES.—Statistical: *Jaarcyfers voor het koningryk der Nederlanden* (annually).—Dr BLINK. *Nederland en zijne bewoners* (1887–92), and *Tegenwoordige Staat van Nederland* (1897).—R. SCHUILING. *Aardrykskunde van Nederland* (1897); *Eene halve Eeuw* (1848–98); *Historisch Gedenkboek* (1898), containing a series of articles on all subjects connected with the kingdom during the latter half of the 19th century, written by specialists. *Les Pays Bas* (1898), a work of the same class as the preceding. *Gedenkboek uitgegeven ter gelegenheid van het 50 jarig bestaan van het Koninklyk Instituut van Ingenieurs, 1847–97* (1898)—an excellent aid in studying technically the remarkable works on Dutch rivers, canals, sluices, railways, harbours, drainage and irrigation works, &c. A special manual on the characteristic hydrography of the Netherlands is BEEKMAN's *De Stryd om het bestaan* (1887). Amongst the publications not written in Dutch, and therefore more accessible to foreigners, may be mentioned: RÉCLUS, *Nouvelle Géographie* (1879, vol. iv.).—KIRCHHOFF. *Länderkunde von Europa* (1889, vol. i.).—BLOK. *History of the People of the Netherlands*, 1898–99.—DITCHFIELD. *The Church in the Netherlands*, 1892.—DOUGHTY. *Neerland Meres*, 1890.—*Topographische Atlas van het Koningryk der Nederlanden*, 1892; the new edition of the *Waterstaatskaart van Nederland*, of the *Rivierkaart van Nederland* (1883), and of the *Geologische Kaart van Nederland* (1889). A new edition (1895, Arnheim) of Witkamp's *Aardrykskundig Woordenboek* has been published. Of much higher rank are the *Nomina geographica Neerlandica* (for the history of geographical names) and the *Algemeene aardrykskundige bibliographie van Nederland*, giving the literature for the kingdom, the provinces, and the towns, both published by the Royal Geographical Society at Amsterdam.—D. S. MELDRUM. *Holland and the Hollanders*. London, 1899. (C. M. K.)

RECENT HISTORY.

The writer of the history of Holland in the earlier volumes of this Encyclopædia (9th ed.) broke off his narrative practically at the most critical juncture of modern Dutch political affairs in 1850. From that date the newest, and in many respects the most important, stage in the history of Holland in the 19th century may be said to have begun. When King William the Second died at Breda in March 1849, a remarkable Prince of Orange had passed away—a man of singular purpose and force of character. A born soldier, he had developed, upon Wellington's battlefields in the Peninsula, in the Pyrenees, and around Waterloo, some rare tactical gifts, and a personal valour which commanded the admiration and the lifelong friendship of the Iron Duke himself; and he enjoyed a popularity, both in Holland and in Belgium, which survived even after the Belgians had risen against the unwise and intolerant rule of King William the First, which the narrow-minded Congress of Vienna had imposed upon them. But the second King William of Holland was not a politician. He showed his lack of political wisdom in acting diametrically against the positive instructions of his royal father, who had sent him to the south with a mission which he openly ignored by issuing a manifesto to the Belgians in which he professed to recognize their independence. The king immediately repudiated that manifesto, which, without adding to his son's popularity in the Southern Netherlands, seriously jeopardized his prestige and prospects in the

William II.

north. Indeed, the wrath of the Dutch people, then highly incensed at what they branded as Belgian treason, became so violent that it was publicly proposed to exclude him from the throne. Nor was his conduct in London, whither his father sent him on another political mission, which proved as futile as his previous errand to obtain the hand of Princess Charlotte had been, calculated to regain for him the hold he had lost upon his future Dutch subjects. Not even the brilliant military campaign which he undertook in Belgium at the head of the Dutch army could, fruitless as it turned out to be, entirely restore confidence in him. So when King William the Second ascended the throne of Holland on the abdication of his father in 1840 his position could hardly be called satisfactory or secure.

Peace with Belgium had, it is true, at last been made, but that more or less beneficial settlement of the Dutch crisis abroad was perhaps more than counterbalanced by threatening internal complications. The finances had become disordered, if not critical, in consequence of the Belgian troubles; taxes had been rapidly increasing, and with them popular discontent and disgust against a *régime* which failed to grasp the fact that the flimsy reforms, grudgingly bestowed in 1840, were wholly unavailing to stem the current of national feeling which set in stronger and swifter as the fateful year 1848 approached. A wise and statesmanlike ruler would not have resisted the popular demand for a thorough remodelling of Holland's Constitution upon an enlightened basis so long as King William the Second did. But he was a soldier, not a statesman. Married to Anna Paulowna, a Russian grand duchess, he seemed to have abandoned the liberal traditions of his predecessors and of his people for the autocratic tendencies of Muscovite rule. For eight years the king withstood the efforts of the Dutch reform party, who in Johan Rudolf Thorbecke, the foremost statesman of Holland in the 19th century, and "too great a man for so small a country" (as a British statesman is said to have characterized him), had found a leader and a soul. Already in 1844 Thorbecke, with eight other members of the Dutch Chamber, had elaborated a reform Bill. Thorbecke, a student, afterwards a professor in the law faculty of Leyden University, was strongly supported by the vast mass of his educated and enlightened countrymen, then mostly unrepresented in the legislature. Yet for a time all his endeavours were baffled by the powerful court party, and Thorbecke even failed to obtain re-election as a member of the Second Chamber in 1846. His time, however, was coming rapidly. In 1847 serious riots occurred at various places, even at The Hague, and notably at Groningen. The king at last saw the danger of further delay, and, prompted maybe by the warnings of coming crisis all over Europe, he promised reforms when opening the States-General in the autumn of the same year. There is no doubt that this timely resolve warded off from Holland the threatening revolution which had broken out in neighbouring states. In March 1848 a royal commission was appointed to elaborate a new Constitution. Of that royal commission Thorbecke was much more than a member. The commission was virtually his commission, and the project it presented to the king his life-work. Its main features having been fully discussed and accepted beforehand, its progress was swift. In October following it became law, and an interim cabinet was appointed to carry out its provisions. The king's signature was practically his last political act. He died at Breda on the 17th of March 1849, and his son William, born at Brussels on the 19th of February 1817, ascended the throne (on the 21st of March) as King William the Third. But for these events, it is probable that the first ministry of Thorbecke would have been formed at an earlier date than the end of October 1849.

The reform movement.

The Prince of Orange who now mounted the throne was, in character, tastes, and ambitions, essentially different from his predecessors. During his protracted reign, extending over more than forty years, he never displayed any lofty and ambitious statecraft which might have endangered the international position of Holland, except perhaps in 1867 by the proposed sale of Luxemburg to France, and three years later when some court leanings towards Napoleon III., fostered by the anti-Prussian feelings of his first wife, Queen Sophie, a Würtemberg princess whom as crown prince he had married in 1839, threatened to embroil his kingdom in the Franco-German conflict. With the Russian blood of his mother in his veins, King William III. had inherited an autocratism ill befitting a constitutional monarch, an abrupt frankness that sometimes amounted to absolute brutality, a punctiliousness in matters political, military, and even social, not unfrequently embarrassing and humiliating to those to whom the king addressed his curt remarks. But he never could forfeit his hold upon the popular mind. The people knew that their prince meant well, that he had a kindly heart —evidenced by his noble self-sacrifice in the calamitous floods of 1855 and 1861—a sort of magnificent instinct which prevented him from acting against the interests of the nation and prompted him to follow in times of temptation and crisis the advice of his constitutional counsellors. So they readily forgave his several domestic blunders which estranged him from his first queen and drove his eldest son William Prince of Orange (born in 1840), a young man of extraordinary promise, into exile at Paris, where he died on 11th June 1879. The king did not like the austere Thorbecke, yet recognized in him a superior mind and political wisdom, born of thought, learning, and experience, and he yielded to Thorbecke's influence whenever it became absolutely necessary to do so, though not always willingly.

William III.

The preponderance of Thorbecke in Dutch political life during the latter half of the 19th century was such that the modern history of the Netherlands may be safely divided into two periods: the Thorbecke period, and the period after Thorbecke's death. The first Thorbecke ministry, formed as the natural outcome of the triumph of his efforts and principles, lasted only till 1853, but was marked by extraordinary activity. During that comparatively speaking brief period many fundamental laws were passed for which the Constitution had already provided—such as a new electoral law; a law to regulate the responsibility of ministers; another, to settle the rights and duties of provincial governments and councils, and of communal governments and councils, together establishing, in large measure, a complete system of decentralization—thus practically introducing a kind of local government in Holland half a century before it was attempted in Great Britain, but within well-defined limits and safeguards; an act to regulate the rights and duties of Dutch citizenship; another, to settle the parliamentary prerogative of inquiry, &c. In Van Bosse, Thorbecke had secured the services of an able and energetic minister of finance, who raised the state credit, abolished several irksome and oppressive taxes, and established free trade, Holland being the only Continental state that afterwards remained faithful in the main to free trade principles. The postal and telegraph services were reorganized, and the great work of draining the Haarlem Lake was completed. The first Thorbecke cabinet came to an untimely end in 1853, in consequence of what was called "The April Movement," because it had originated in that

Thorbecke's First Ministry.

month. Article 165 of the Constitution had recognized, in a country where there was no state Church, the equality of all religious bodies, subject to governmental control. The Pope and the Militant Clerical party in Holland perceived in that article an opportunity to re-establish in the Low Countries the ancient bishoprics of Utrecht, Haarlem, Bois-le-Duc, Breda, and Roermond, the bishop of Utrecht becoming an archbishop. This measure — coupled, it must be confessed, with some unfortunate reflections on Dutch Protestantism by the Pope in his decree on that occasion—revived all the anti-Catholic prejudices of former days. Some political enemies of Thorbecke, who could not forgive him his triumphs, were not loth to fan the flames, and a veritable No Popery storm swept over the country, which Thorbecke resisted but could not withstand, he himself being accused of treasonable "Papism." For several years to come Thorbecke was compelled to relinquish the active duties of leadership, and not until 1862 did he regain it. The intervening years form a sort of interregnum in modern Dutch history. Four cabinets followed each other at about equal intervals, the most important among them being the ministry of Dr Justinus Van der Brugghen. It was during his premiership in 1857 that the Primary Education Law was passed, which established neutral (non-sectarian) state schools, and afterwards largely became the pattern of similar legislation in foreign countries, notably of the Education Act of 1870 in England. The Dutch law, however, did not as yet provide for compulsory education.

It is curious to note that an article in Van der Brugghen's Education Bill, in which it was proposed to grant Government subsidies to denominational schools if parents wished it, was defeated by the Catholic and anti-Revolutionary parties, acting in conjunction with a section of Liberals—that is to say, by the action of the very people who afterwards demanded the abrogation of the same article. The preceding cabinet of Dr Van Hall, an opportunist statesman of considerable ability, was chiefly remarkable for the passing of a statute providing for the better administration of the Dutch East Indies. This is the so-called *Règlement* of 1854, or Rules of Government, which practically inaugurated a new era in Netherlands India. (See, for further particulars, MALAY ARCHIPELAGO, *History*.)

Railways.

The subsequent cabinet of Dr Van Hall carried in 1860 a most important law, directing the construction of a vast system of state railways, connecting the already existing private lines, and involving the building of very costly bridges over the broad rivers in the south. The first State Railways Act of Holland was carried, after much strenuous opposition in both branches of the Dutch legislature, very shortly after the rejection by the First Chamber of another Government scheme, which provided for the construction of certain railway lines by a private company, the state guaranteeing the capital required for construction. The defeat of the Government led to a ministerial crisis, and the new cabinet immediately took up the railway question, making it the chief plank of its platform. That the Dutch Chambers adopted the principle of state railways in 1860 was largely due to Thorbecke's influential advocacy. He pointed out that Holland was still very backward in this respect, and that the country could not successfully cope with foreign states whilst this condition prevailed. Thorbecke's main proposition was indeed self-evident. Up to 1860 only a small number of private railway companies were at work, chiefly in the central provinces, and the aggregate length of their systems did not amount to 300 English miles. Moreover, they were handicapped by the Government having too long maintained an antiquated gauge, which precluded all connexion with foreign railways having a narrower one. The State Railways Act of 1860 provided that ten million guilders per annum would have to be applied to the construction of the lines decided upon, and by 1872 the whole first network of Dutch state railways was at last completed. It is noteworthy that the cost of building them was almost entirely furnished by the surplus funds accruing annually (up to the year 1877) from the administration of the Dutch East Indies under the "culture system." Consequently the Dutch state railways are the only ones in existence not burdened with debt. The state, however, did not undertake their working. This was entrusted to a private company, founded in 1863 under the title of the Dutch State Railways (Working) Company, the state merely receiving a share in the net profits.

The important statute, constituting the "State (Privy) Council," and regulating its functions, as prescribed by the Grondwet, dates from the same legislative period, and was the work of the minister of justice, Dr Godefroi, with Thorbecke's assistance.

Thorbecke's Second Ministry.

Thorbecke came back to power in January 1862. His second term of office was marked by the same reforming energy as the first, in spite of a strenuous and somewhat personal opposition, which disgusted even some of his more fair-minded adversaries. In the four years that it lasted Thorbecke had the Secondary Education Act passed (1863), completing the work of 1857; contributed to the legislation by virtue of which the great canalization works at Amsterdam and Rotterdam were sanctioned (1863); carried his Bill emancipating upwards of 30,000 slaves in the Dutch West Indies, at the cost of ten million guilders in compensation, paid by the state; and, last though not least, brought about the Financial Administration Act for the Dutch East Indies, which determined the right of the Dutch Chambers to control Dutch-Indian ways and means, thus consolidating the *Règlement* of 1854. A dispute with the colonial minister, Mr Franssen van de Putte, led to a fresh cabinet crisis, and to the advent of Mr Heemskerk, the leader of the Conservative party. Heemskerk was Thorbecke's great antagonist, the two Dutch statesmen playing in the political arena parts somewhat resembling those of Gladstone and Disraeli in England. Heemskerk, who died in 1880, and who stood three times at the head of affairs, was a politician of talent, though of less calibre and moral fibre than Dr Van Hall, his greater predecessor, and his reactionary tendencies and views found favour at court and led to legislative proposals and measures which were not always in accord with the spirit at least of the 1848 Constitution. A real constitutional crisis of some duration ensued, a struggle between the Government and the Second Chamber, during which Heemskerk attempted to shield himself behind the Crown, but in vain. There is little doubt that the king's proposal, in 1867, to transfer Luxemburg to France, if it did not emanate from Heemskerk, had his warm approval. It was none the less dangerous, especially as it came after Sadowa, which had settled the German question in a manner not at all favourable to Napoleonic ambitions. It was perfectly well known that France had coveted the grand duchy for some time as a sort of compensation for loss of prestige on the Rhine. Equally notorious was it that Bismarck, the arbiter of Germany's destinies, had no backing for his methods and aspirations from the king and queen of Holland. The Iron Chancellor was, indeed, well aware that Queen Sophie's former feelings of friendship and admiration towards him had greatly changed since the days

International difficulties, 1866-70.

of 1866. It was to her animosity that he ascribed both the hostile attitude of the South Germany States (particularly Würtemberg, her native kingdom), when they combined with Austria against Prussia, and their previous coquettings with Napoleon III. In his *Reminiscences*, published after his death, Bismarck refers to the "relations between Stuttgart and France, which were chiefly maintained by the partiality of the queen of Holland, a Würtemberg princess," and he goes on to declare that he also traced her "evil" influence in Napoleon's foreign policy of 1867, especially in the speech Rouher made in the French Senate, March 16, when the latter announced that France would never tolerate Prussia's advance towards the Zuyder Zee. Rouher, said Bismarck, could not have spoken as he did on that occasion without some inspiration from The Hague; before receiving it, the French minister probably did not even know of the existence of a Zuyder Zee!

Queen Sophie, then, belonged to the most unflinching and ablest opponents of Bismarck's policy. She corresponded much with Napoleon III., and wrote articles in the *Revue des Deux Mondes* against it. In 1871, after the sacking of the Tuileries, among many documents discovered were a large number of the queen's letters to Napoleon. Some were subsequently published, and demonstrate that she repeatedly warned him against the designs and armaments of Prussia. "But," says Lord Malmesbury in his *Memoirs* (ii. 370), "her warnings and counsels were laid aside and unheeded, like those of Stoffel, the French military attaché at Berlin." "The queen," he adds, "was a very clever woman, and knew all the affairs of Europe better than most ministers." Nor was Queen Sophie loth to reveal her antipathies towards Greater Prussia, at least among her English friends, who were both numerous and influential. Henry Reeve was one of them, and his *Memoirs* (published in 1898) contained some remarkable letters from the queen. In answer to Reeve's request for some Luxemburg papers, Queen Sophie wrote (in English): "Such is the fear of the kingdom of the Netherlands to be involved in any of the impending Luxemburg difficulties, that everything relating to that part of the world is scrupulously ignored; and if the papers are not claimed at Luxemburg, where the most jealous of men, Prince Henry, governs, you cannot obtain the real truth. The fact is, M. de Bismarck *a cherché une querelle d'Allemand*, first to obtain a free passage through the Luxemburg railroads; in the future, to annex the little grand duchy, to close the frontier on that side entirely. This, however, is still kept for a few months hence, as M. de B. would not be put quite on the same line with Prince Gortchakoff, though they are perfectly of the same opinion. It is a sad time, a very bad symptom, when principles, engagements, treaties, are all *à la merci* of two or three unscrupulous men."

The dangers foreshadowed or undergone in 1866–67 were accentuated four years later, during the Franco-German complications, ending in the downfall of the French empire. Like Belgium, Holland was put upon her trial in guarding her frontiers and her neutrality between two powerful neighbours engaged in a deadly struggle, with a court notoriously, if not openly, inimical to one of them, at least during the early stages of the contest. Fortunately a Liberal cabinet had succeeded, with some difficulty and not without struggle, to the perilously reactionary ministry of Heemskerk and Van Zuylen in 1868. It had carried through some useful reforms, such as uniform inland postage and the abolition of the newspaper stamp duty—the abolition of the death penalty in Holland belongs to the same legislative period—and the Fock cabinet succeeded in keeping the Netherlands outside the war arena. Sedan, needless to say, profoundly affected Queen Sophie, even apart from the great triumph of Bismarck; but, staunch in her friendships and antipathies alike, she never forsook the fallen emperor. Henry Reeve again records this in his *Memoirs*. When the *Edinburgh Review* had published in January 1871 an article severely condemning the Second Empire, Queen Sophie sent Reeve from The Hague a dignified protest, in which she observes: "Allow me to regret the great severity with which you treat the fallen empire. I put aside every personal feeling, but I remain convinced that posterity will be more lenient. There were faults in the system inherent and inherited. As to the head of the system, few men have been more naturally kind and good. He had the weakness of these natures—wishing to content every one. No question of principle seemed to him worthy of the inestimable enjoyment of peace. *Avec les differents partis il se laissait aller à des paroles, à des engagements contradictoires; de là une apparence de dissimulation, bien éloignée de sa nature.* The prisoner of Wilhelmshöhe belongs to the past. To those that have known and loved him falls the task of obtaining justice for him. I cannot talk of the present events, of the destruction of Paris. I bow my head and I hope in God's justice."

The king sent for Thorbecke again in January 1871, in this instance for the third and last time. He succeeded in forming another ministry, but he was no longer the Thorbecke of yore. Much aged, and feeble in health, soured by continued strife and opposition, he found the state of affairs in his country materially altered. The Liberal party, once all-powerful under his guidance, was no longer so compact, so obedient to his directive impulses, his masterful discipline. Many years had passed, many changes had occurred since the Constitution of 1848 was enacted, and even among Thorbecke's admirers and followers there were not a few who felt that it had served its purpose, and required enlargement of scope to suit the needs of a new generation. Thorbecke himself, indeed, had recognized this only three years before his death. Yet many doubted his power to carry through that revision of the Constitution which experience had taught to be necessary, whilst others derided even the breadth of his views and the generosity of his policy, contending that Thorbecke had become at heart a Tory, autocratically narrow in his opinions, particularly upon matters religious, colonial, domestic, and artistic. It was a curious spectacle to see those who in 1853 had denounced Thorbecke as a Papist bitterly attacking him in 1871 as an enemy of the Roman Church, because he defended the recall of the Dutch minister at the Vatican when the Italians had taken possession of Rome. The groups in Holland, acting in opposition to Thorbecke's cabinet from various motives, had latterly grown more powerful, some demanding an extended suffrage, others the revision of the Education Act, factory laws, and other reforms. Each faction, in truth, was not strong enough to work much mischief, but, supported by the Extreme Liberals, or united with the so-called anti-revolutionary party of Mr Groen Van Prinsterer and the Roman Catholics, against the statesman who had refused to admit the clerical grievances against the non-sectarian state schools, it undoubtedly ceased to be a *quantité négligeable*. At any rate, before Thorbecke died, in June 1872, he must have been conscious that his death might mean the partial disruption of the party he had created, as well as the shattering of the edifice he had been instrumental in building up. His cabinet did not survive for long under the leadership of his successor, Dr Geertsema, and finally disappeared in August 1874, after having had its Income Tax Bill rejected. Its most important measures had been the further extension of state railways

Death of Thorbecke.

in Holland (1873) and her colonies, the abolition of differential import duties in the Dutch East Indies, and the transference of the remaining Dutch portion of the Gold Coast to the British Government for a sum of money and certain British "concessions" in the Eastern Archipelago. This transaction, which shortly afterwards resulted, on the one hand, in the Ashanti expedition, and on the other in the disastrous war of the Dutch against the Achinese, had been one of the many weapons used by the Opposition against Thorbecke.

Thorbecke's last illness would have commanded a keener national interest than it did but for the fact that it was thrust into the background by the festivities to celebrate the three hundredth anniversary of the capture of Briel on 1st April 1572, which signalized the commencement of the great struggle against Spain. In the spring of 1874 festivities on a much larger scale than those at Briel took place all over Holland when King William celebrated the twenty-fifth anniversary of his accession to the throne. They were particularly brilliant at The Hague and Amsterdam, and the enthusiasm of the people was as genuine as it was unbounded. It was the last time that the nation saw the whole royal family of the Netherlands together, apparently happy and in good health. Many knew that Queen Sophie had latterly suffered from illness, but few suspected her end to be so near. "Full of charity, constantly occupied with thoughts of others, forgetful of self, and deeply interested in all great subjects which occupy the attention of the more elevated intellects," as the historian Motley described her, Queen Sophie died at The Hague in June 1877. As far as the Dutch royal family were concerned, the effect of Queen Sophie's decease was absolutely disastrous. The quarrels between the king and the Prince of Orange, who had inherited the wit and the mind of his royal mother, and who if he had lived might have proved one of the most distinguished of his race, became aggravated when the wife and the mother was no longer there to conciliate and pacify. Father and son parted, never to see each other again. So estranged had he and his father become, that the prince was even absent from the king's wedding in January 1879 at Arolsen.

Death of the Queen.

It is at least probable that the departure of the Prince of Orange for Paris, and the unlikelihood of his return to Holland during the lifetime of his father, may have had as much bearing on the king's decision to re-marry as the circumstance that his second son Alexander, who succeeded to the title and presumptive rights of the Prince of Orange after the decease of his elder brother, but who died in 1884, was then in very bad health. The direct Nassau line was threatened unless King William were to marry again and had further issue. His bride was Princess Emma of Waldeck-Pyrmont, and by the marriage King William consolidated his popularity. Popular rejoicings greeted the birth, on the last day of August 1880, of a princess, who received the name of Wilhelmina Sophia Frederika and the title of Princess of Orange. Two years later the king, accompanied by his queen, went over to England to attend the marriage of Queen Emma's sister to the Duke of Albany.

The King re-marries.

The second ministry of Dr Heemskerk had terminated in November 1877, and was succeeded by that of Dr Kappeyne van de Copello, who in the following March was able to persuade the Chambers to adopt his Primary Education Bill, strengthening the Act of 1857, despite the violent opposition offered by the reactionary parties, who continued it even after the Bill had passed, petitioning the king (but fruitlessly) to veto it.

Up to the year 1880 Dutch politics, externally, were largely dominated by events in Achin, where the new arrangements with Great Britain, materially modifying the treaty of 1824, had given Holland a free hand, of which she had not failed to avail herself, although the subjugation of that sultanate proved much more difficult and more costly—especially in its after results, an endless and wasteful warfare — than had been anticipated. Internally, the second ministry of Heemskerk, succeeding that of Geertsema, had to cope with a hostile Liberal majority in both Chambers, which hampered it greatly, and it was not able to do much more than add the Higher Education Act to the statute-book. But that measure was very comprehensive and important. It regulated and equalized in 1876 the three state universities of Leyden, Groningen, and Utrecht, enabling Amsterdam to establish a communal university with equal rank in 1877, and the anti-revolutionary party to found a free university of its own in 1880. Not much progress had, however, been made with two other reforms of great national importance: first, a new codification of the criminal law — the old Napoleonic Penal Code introduced in 1810 being still the law of the land; second, the framing of a new Constitution, to replace Thorbecke's Grondwet of 1848. Although the former reform was carried in 1881, it did not come into operation till January 1886. Professor Modderman of Leyden, head of the department of justice, was largely instrumental in the passing of the measure during the ministry of Count van Lynden, who had succeeded Kappeyne van de Copello as premier; and his friend and colleague, Dr Vissering, the minister of finance, carried through the Bill establishing post office savings banks.

Political progress.

The revision of the old Constitution, which had been prepared by a royal commission, proved an even more arduous and more laborious task than that of the penal code. Thorbecke had, perhaps wisely, made the tampering with the Fundamental Law of 1848 as difficult an undertaking as possible; one of the final clauses provided, for instance, that proposals affecting succession to the throne, and the modification of the Constitution, could not be entertained during a regency—the very thing that was likely to happen in Holland if the king died during the minority of the Princess of Orange. The alteration of this clause had therefore to be undertaken first (1884) before the revision proper could be made. The death of the Prince of Orange (1879) and the birth of a daughter to the king had for the moment brightened the chances of such revision. Seeing that it had become a national necessity, Dr Kappeyne van de Copello, when prime minister, had made revision a plank of his platform, but by a curious freak of fate it was not he, but his reactionary successor Heemskerk, who carried the revision scheme through in 1886.

Constitutional revision.

The new Grondwet, or Fundamental Law, came into force in 1887. This statute comprises eleven chapters, apart from some "additional clauses" concerning the method of carrying it into effect. The first chapter treats of the kingdom and its inhabitants, and declares that the Fundamental Law is applicable to the Netherlands alone, and not to the Dutch colonies. Dutch citizens only may hold appointments; but liberty of speech, of the press, of meeting, and of petition, and the rights of property, are guaranteed to all residents. Chapter ii. (Succession to the Throne) declares that the crown may pass to a female, who, however, will forfeit the crown if she marry without the consent of the States-General. The latter may, in default of any heirs, elect a king (or queen) in an extraordinary combined session of the two

The Constitution of 1887.

Chambers. No king is allowed to wear a foreign crown, and the seat of government may not be established outside Holland. The civil list for each reign must be fixed by a special law. During a minority of the king or queen, or should he or she become unable to govern, the two Chambers may appoint a regent. The oath to be taken by each king or queen on ascending the throne is given in the Fundamental Law, and shows that the regal rights in Holland are conferred by special contract between the people and the crown, and not inherited of divine right. The king is inviolable, but his ministers are responsible. The king declares war, makes and ratifies treaties with foreign Powers, and has the general direction of foreign affairs, but no treaties with foreign Powers, involving territorial changes, or affecting public rights as established by statute, are valid unless sanctioned by the States-General. The king also has the supreme control of the state finances. He confers ranks and titles; has the right of pardon, of initiative of Bills in the Second Chamber, and may sanction or reject measures passed by both Chambers; he also possesses the power of dissolving the latter, and nominates the members of the Council of State, to which he submits all Bills intended to be presented to Parliament. He also appoints and dismisses all ministers whose responsibility is regulated by special statute. According to the third chapter, the States-General represent the whole people, being divided into a First and a Second Chamber, the former consisting of fifty, the latter of one hundred members—Amsterdam returning nine, Rotterdam five, The Hague three, Groningen and Utrecht two each. This was an important addition of strength, the old Second Chamber having had at most eighty members, one for every 45,000 of the inhabitants. The basis of the franchise was at the same time materially altered and much enlarged, the effect being to add some 200,000 male voters of the age of twenty-three to the electorate, the rights of the latter being afterwards settled in a special statute. For the First Chamber, however, the old basis (election of delegates by the provincial states from among the highest taxed or otherwise prominent burghers in each province) was maintained, each member being elected for nine years, one-third retiring every three years. The members of the Second Chamber are elected for four years, when the whole retire in a body. The members of both Houses receive certain allowances from the Treasury to meet the expenses of their journeys to and from The Hague, and of their residence there during the session. The Second Chamber alone has the right to initiate legislation, and the First Chamber does not possess the right of amending any Bill sent up to it by the other Chamber. Ministers may attend the sittings of each Chamber, but are not allowed to vote unless they are members themselves; no one can be a member of both Chambers simultaneously. No male person is eligible who has not attained the age of thirty. The fourth chapter deals with the provincial states, elected by the people directly in the eleven provinces, in each of which there is a royal commissioner who presides over the provincial assemblies. The communal councils, with presidents (burgomasters) nominated by the king, are also elected by the people of each commune, but are under the control of the provincial states. The fifth chapter treats of the administration of justice, and the sixth of public worship. The latter guarantees freedom and equality of rights to all religious bodies, the clergy receiving a salary and a pension from the State. The seventh chapter deals with the national finances; the eighth with national defence, declaring all able-bodied citizens liable to serve in the army, reserve, or militia; and the ninth with the *waterstaat* (dykes, roads, bridges, dunes, &c.). The tenth chapter, dealing with public education and poor law administration, sets forth that both are a constant concern of the Government. Although the clauses of this chapter are seemingly the same as the corresponding clauses in Thorbecke's Grondwet, yet it was perfectly well understood, when the Constitution Bill was passed, that they must be interpreted in a sense widely different from that which the legislators of 1856 had imparted to the Primary Education Act of the following year; for that Act established, as we have seen, primary State schools upon a non-sectarian basis, and this led to a bitter campaign on the part of the Church parties, which was renewed in 1878 against Dr Kappeyne's even more stringent educational policy. They maintained that the State had no right to "withhold the Bible" from the school children, or, by refusing State aid to private (denominational) schools, starve the latter out in order to promote a "neutral" instruction of which they could not conscientiously approve. The Roman Catholics and the orthodox Protestants had therefore insisted upon the abrogation of the Education Act of 1878, and the passing of another statute to remedy their grievances. With the aid of a section of the Liberal party which sympathized with their anti-revolutionary and Catholic countrymen in this respect they were able to enforce their views, and the introduction of a new Education Bill, which under the ministry of Baron Æneas Mackay became law in 1889, was in the nature of the redemption of a pledge. In accordance therewith the Act of 1889 was a virtual reversal of the Liberal education policy adopted in 1857–78, for it contained the following important provision: "The State will, in each governmental budget, allocate to the private primary schools subventions proportionally equal to those granted to the communal [public primary] schools." Thus it not only placed the sectarian lower schools upon a basis of equality with the public primary schools, but might even be regarded as favouring the former at the expense of the latter. It is fair to add, however, that the effect of what was virtually a compromise was to set at rest for some time to come a long and bitter controversy. Another important clause in the Act of 1889 was to the effect that gratuitous instruction was no longer possible, except in the case of pauper children.

Education Act of 1889.

The necessity of the new Constitution had already been demonstrated early in 1889, when the king's alarming condition, physical and mental, had compelled the appointment of a regent. In Luxemburg, indeed, where, owing to the Salic Law, a queen could never reign, the heir-apparent to the grand duchy, the Duke of Nassau, had already assumed the regency, in the general expectation that King William would not recover. But by May 1889 the king recovered as suddenly as he had collapsed, and his physicians having reported that his Majesty was again in a fit state to govern, the Duke of Nassau took a somewhat hasty departure from Luxemburg, whilst the States-General of Holland resolved to invite King William to resume the government, the services of a regent being no longer required. This was accordingly done, and shortly afterwards the fortieth anniversary of his accession to the throne was celebrated with some pomp. But the king's restoration to health proved of short duration. In September 1890 the ministry reported a recurrence of the alarming symptoms of the year before. A consultation of physicians again took place in October, and they reported that the king could no longer perform his regal duties. The prime minister thereupon introduced, and

Death of King William.

carried, a Bill vesting the royal power for the time being in the Council of State. The king growing steadily worse, and the end, to all appearances, rapidly approaching, a further Bill was introduced and passed, appointing Queen Emma regent of the Netherlands during the minority of the Princess of Orange, a council of guardians for the latter being also nominated. One of the guardians was Baron van Goltstein, who afterwards became the Dutch minister in London, a post he was holding when the young queen, then (1895) still in her teens, visited London, accompanied by her royal mother and by more than one of her tutors.

The Regency.

On 23rd November 1890 King William died. In different circumstances the death of the king might have been productive of serious and even critical results to the Dutch people. As it was, the event did not occur unexpectedly, and there had been ample time to prepare fully for all emergencies, while it brought at least one unmistakable advantage—namely, the complete severance of the connexion with Luxemburg. Yet at the end of 1890 Queen Wilhelmina was a mere child, and although the queen-regent and the council of guardians could be trusted to perform their duty to the new sovereign and her people conscientiously, still a difficult period was before the nation until the young queen should ascend the throne, upon her attaining her majority eight years later. That critical time, however, was passed without serious disturbance. Queen Wilhelmina's health remained good, and through Queen Emma's untiring devotion she received a good education, and gave general pleasure by her simplicity of manner, natural charm, intelligence, and force of character.

One of the chief legislative events of the year 1890 was the purchase by the State of the Dutch–Rhenish railway, the working of its lines, leading from the chief coast towns to the German frontier, being entrusted to the States Railway (Working) Company. That purchase was followed by the so-called railway agreement, dividing the whole railway network into two chief systems of State railways and of the lines of the Holland Railway Company. The effect has therefore been to centralize the working of the Dutch lines in the hands of two powerful companies, subject of course to a rigid Government supervision. This arrangement only leaves out a few minor railways, but it has been largely supplemented by a growing network of canals, light railways, ordinary, steam, and electric tramways, the vast extent of which is indicated in the statistical article above. The international railway relations of Holland, whose railway companies formed part of the Continental Railway Union before 1890, were satisfactorily settled by the Convention of Bern signed in October of that year.

In August 1891 an apparently strong Liberal cabinet had been formed under the leadership of Dr van Tienhoven. Its moving spirits were the distinguished economist and financier, Dr Pierson, and Dr Tak van Poortvliet, a former minister of commerce, who had shown great ability in promoting railways and canals, and who was a staunch supporter of national steamship lines to England and the Dutch colonies. Dr Tak was an advanced Liberal, and had a fair majority at his back in the Second Chamber, but his franchise proposals in 1894 led to a ministerial crisis and his own downfall. Undoubtedly they were too drastic, practically involving universal manhood suffrage, which by many of Dr Tak's own followers was considered unconstitutional, *i.e.*, in conflict with the Fundamental Law. Dr Tak tried to gain his ends by an appeal to the electors, the Second Chamber having been dissolved in March 1894; but a portion of the Liberal party combining with the anti-Liberals, and being supported by the most influential Liberal daily paper of Holland, the Government was defeated at the polls, and Dr Tak, finding himself in a minority, had to resign. Electoral reform was then taken up by Dr van Houten, his successor as minister for home affairs in the Roëll cabinet. He succeeded in carrying his measure, which was, however, conceived on much more modest lines than the ambitious attempt of Dr Tak. Van Houten's Bill, which abolished the *scrutin de liste*, introduced the lodger franchise, and virtually made every male citizen capable of supporting himself and family a qualified voter, passed the Second Chamber in June 1896, and the First Chamber in the following September. It was the most far-reaching electoral reform yet attempted in the Low Countries, as it not only largely increased the number of voters, but extended the suffrage to social strata hitherto deprived of all franchise rights. Nevertheless many reformers still demand, if not universal suffrage for men and women alike, at least a large service franchise, proportional representation, and reform in the election of the First Chamber. They ask also for a new revision of the Fundamental Law, without which, it is admitted, such reforms could not be obtained.

Electoral reform.

In the concluding years of the 19th century the ministerial efforts in Holland, under the influence of Dr N. G. Pierson, formerly president of the Netherlands Bank, and a distinguished professor of political economy, mainly consisted of financial and labour legislation. The state finances, much improved by the first conversion of the 4 per cent. state debt into $3\frac{1}{2}$ per cent., which was carried through in 1886 with the assistance of the house of Rothschild in London, underwent a further amelioration in 1893 and 1894 by the imposition of taxes on capital and on industrial, commercial, and professional incomes not derived from capital; and in 1896 by a fresh conversion of the $3\frac{1}{2}$ per cent. state debt into 3 per cent. The Dutch state debt was in 1902 composed mainly of $2\frac{1}{2}$ and 3 per cent. consols, the only exception being about 3,000,000 guilders of bonds, bearing 5 and 6 per cent. interest, a responsibility which the Government acquired when it took over the old Dutch–Rhenish railway. Dutch labour legislation, tentatively commenced in 1874 by Dr van Houten's mild Factory Law, which prohibited child labour in factories for children under twelve years of age, has taken great strides. In 1889 the Factory Law was much enlarged. Women, and children under the age of sixteen, are not allowed now to work at night or on Sundays, nor more than eleven hours in the daytime, with one hour's interval for meals. Mothers are not allowed to work in factories until four weeks after their confinement. State inspection of factories and workshops has been made much more stringent by a special statute, passed in 1895, which in matters of ventilation, light, hygiene, &c., seems moulded after an English pattern. Agricultural labourers and servants are not yet in possession of similar protection, but some have already commenced to agitate for it. Compensation to workmen in factories and workshops, to be paid by their employers, has also been enacted, and old age pensions have been discussed. Moreover, an important law has been added to the statute-book, instituting chambers of labour in all the more considerable industrial centres, composed of an equal number of masters and men, elected as delegates in each trade or industry. These bodies act as advisory boards in ordinary times, and as conciliation boards in the case of disputes, strikes, or lock-outs, but they have no power to enforce their decisions.

Financial and labour reforms.

Holland's foreign relations between 1850 and 1880 were

not always of a smooth and pleasant nature, and if peace remained undisturbed, at least in Europe, it was not because there never arose any dangers to threaten it, but because a skilful diplomacy succeeded in avoiding them. We have seen the perilous complications of the Luxemburg question, in which a European war was, as we now know, merely averted because Germany was not ready to strike in 1867. But the Limburg question, dating from a still earlier period, had its pitfalls too, though these were of a dissimilar nature. They were the outcome of one of the many mistakes of King William I. In 1839 he joined the Germanic Confederation for Limburg only. The hazards of this dual position for that province might have been terminated in 1848, when the Germanic Confederation ceased to exist, but the Dutch Government deliberately chose to renew them in 1849, by joining, again for Limburg alone, the federation of German States which had then been formed. While peace lasted the Limburg dangers remained in abeyance, but they became apparent in 1859, when France and Italy were at war with Austria, and when the German Confederation decided to mobilize a portion of its troops. Limburg—that is, Holland for her province—was then called upon to furnish a contingent, and this was kept in readiness for all emergencies. If a war had then ensued between Germany and France, Dutch troops might have been fighting on the German side, thus embroiling Holland in a quarrel which did not concern her. Fortunately, when the German Confederation came to an end in 1866, Holland did not join the North German Confederation, and thus the anomalous position of Limburg disappeared. When the Luxemburg and Limburg questions had been finally disposed of, Holland's international status was materially strengthened as a result of the war of 1870, and the ground was cleared for a political rôle in Europe, if less ambitious, certainly more congenial to a people so essentially peace-loving as the Dutch.

Foreign relations, 1850-80.

So far as foreign relations since 1880 are concerned, these have been cordial with Germany, neither the opinions of some Germans, that Holland ought to be annexed or acquired, nor the efforts of isolated Dutchmen to bring about a federation with Germany finding much favour. The question of the navigation of the Rhine had been solved by the abolition of tolls along the whole course of the river from Basel to Krimpen and Gorkum (1867), and by the appointment of an International Board which should settle all disputes arising from the interpretation of the Rhine Navigation Act (1868) and subsequent regulations and enactments. Upon more than one occasion this Board rendered useful services, notably in 1893, when it decided in favour of Holland concerning the long-disputed claims of Rotterdam in the matter of its harbour dues. The Rhine fisheries difficulty was terminated much later, in 1885, by the Salmon Fishery (Rhine) Convention, signed at Berlin. Its main provisions, which are equally applicable on the Moselle, provide a close time for salmon, which varies according to locality, and forbid Sunday fishing altogether. The relations of Holland and Belgium had been occasionally strained, particularly before 1863, owing to Holland's maintenance of tolls on the river Scheldt, which was of course detrimental to Antwerp, and owing also to the building of a Dutch state railway to Flushing, which involved the laying of a dam across one of the branches of the same river. Belgium contended that Holland had not the right to dam up the eastern Scheldt, which must in course of time unfavourably affect the navigable channel in the western Scheldt, and an acrimonious international controversy ensued. But in both cases Holland gained her point. The Scheldt tolls were abolished in 1863, but Holland received £750,000 in compensation, paid by the states whose ships used the Scheldt most, Great Britain contributing £175,650. In the case of the western Scheldt the protests of Belgium remained unavailing. These questions and quarrels removed, the relations with Belgium became more than cordial, both nations realizing that together they might offer a more effective barrier against the encroachments of strong neighbours than separately. What has probably contributed to this *rapprochement* is the miscalled "Flemish" movement in the Dutch provinces of Belgium, which is really a revulsion of feeling among the Dutch-speaking Belgians against the French usurpations and encroachments of the Walloon minority, all of which having been gradually swept away, Dutch is now as much the official language as French in the Belgian parliament, law courts, and government offices. The scheme, however, of many enthusiasts for a *zollverein*, or even for a political federation, between Holland and Belgium has not yet taken practical shape. With England relations were not always of an entirely amicable nature. Friction occurred in the Eastern Archipelago—not easily preventible perhaps in so vast an area, with rival interests and tendencies everywhere side by side. The most formidable case arose in Borneo, caused by the British Government, in the autumn of 1881, granting a royal charter to the British North Borneo Company, which had taken over certain territorial concessions given by the sultan of Brunei on the north-western coast to Mr (afterwards Sir) Alfred Dent and other British merchants of Singapore and Hong Kong. The Dutch Government protested against the charter, founding its protest, as in the case of Sarawak, on the Anglo-Dutch treaty of 1824, contending that this treaty placed Borneo outside the sphere of British interests in the Malayan Archipelago. Some correspondence ensued, the British Government arguing that territorial acquisition by a chartered company did not imply territorial acquisition by the British Government. The Dutch Government would not admit this, but had finally to acquiesce; and subsequently a British protectorate was declared (in 1888) over the entire northern portion of Borneo not previously claimed by the Dutch, a British resident was appointed in Brunei, and Labuan was transferred (two years later) to the control of the British North Borneo Company. In June 1891 a treaty was concluded between Great Britain and Holland, whereby the new boundaries of their respective possessions in Borneo were definitively settled. The partition of New Guinea between Great Britain, Germany, and Holland was accomplished in 1895. A similar friction more than once arose in Sumatra over Achin, the contention of the Dutch being that the tough opposition to their rule was encouraged and fed by certain parties at Singapore, despite the action of the British authorities there, who maintained for many years a prohibition of all export of arms to Achin. The difficulties assumed a critical character in November 1883, when the British merchant vessel the *Nisero* was wrecked off the coast at Tenom, and her captain and crew captured and taken into the interior by the raja. Some died, and the remainder were only rescued some months afterwards by the payment of a ransom and compensation, but not before a somewhat heated correspondence had passed between London and The Hague. A similar thing happened again in 1894, when in another part of the Malay Archipelago Mr Carpenter, the captain of the British merchant vessel the *Costa Rica Packet*, was detained and punished by

Foreign relations, 1880-1900.

the authorities of Macassar. But this incident was closed in 1895 by arbitration and an award in favour of Great Britain. The issue was the more satisfactory, because arbitration had been resisted in this instance by an influential party in Holland. The advocates of international arbitration, however, pointed out with truth that this principle had been admitted in many of the Dutch treaties with foreign Powers, notably with Italy (1884) and Belgium (1892), concerning actions at law, *pro Deo*, by the subjects of either country in the other; with Portugal (1893) relating to boundary questions in Timor, &c. Moreover, the policy of Holland, steadily pursued ever since Baron van Goltstein, the minister of foreign affairs, circularized her representatives abroad in 1860 in support of the policy of the United States, which proposed great reforms in maritime law, has always tended towards minimizing the risks of international strife by substituting the pacific adjustment of disputes for the arbitrament of the sword. That policy culminated in 1899 in the Peace Conference at The Hague and the formation of a permanent international court of arbitration, Holland taking a prominent part in both. Of course a small country cannot wield the influence of a great Power, yet the example and the policy of Holland left a distinct impression on international politics in more directions than one during the second half of the 19th century. Thus she played an important rôle in the Congo Conference at Berlin (1885), which resulted in the creation of the Congo Free State; and it was mainly due to her efforts that the conference, in the interest of the Dutch settlements on the Congo, decided that for twenty years no import duties were to be levied in the new Free State. It is true that Holland was unable to resist the reversal of these free-trade principles which the Brussels Conference enacted in 1890. The magic of a great name, and the respect which her historic traditions inspired, were not less conspicuous at the Suez Canal International Conference in 1885 at Paris, convened for settling the future status of that waterway. Holland had not originally been invited, but, considering that the number and the tonnage of her ships passing through the canal were only less than those of two other European Powers, it was ultimately decided that she had a right to be represented. During the proceedings her two delegates were able to influence the decisions in matters of great political and commercial moment to the nations interested in the Suez Canal, and Holland is one of the states charged with the joint control instituted by the Conference and the signatories of the 1888 treaty.

Within a more restricted sphere of international politics the influence of Holland made itself equally felt. In 1880 special inquiry instituted by the British Government revealed an extraordinary state of lawlessness among the fishermen of various nationalities on the North Sea. By its invitation a conference of the Powers interested met at The Hague (October 1881), and the result was a treaty, signed in the following May, chiefly remarkable as the first attempt at an international police on the high seas, in which all the Powers interested (except Sweden and Norway) afterwards participated. The new system worked very well, but it did not include the control of the liquor traffic, the abuses of which had been mainly responsible for the lawlessness. That traffic was regulated by another treaty, signed in November 1887, after a second conference at The Hague of delegates of the same Powers.

The Boer question.

Another source of diplomatic and popular friction between London and The Hague was furnished by the Transvaal question in 1881. The Boer war of that year roused extraordinary interest and excitement among the Dutch, who somewhat suddenly remembered that the Boers were their descendants and had a claim on their admiration, if not their affection, as kinsmen. Under pressure the Dutch Government offered to mediate between Great Britain and the Boers, but its services proved unnecessary, as Mr Gladstone had determined to restore the independence of the Transvaal. The Jameson Raid (1896) and the second Boer war (1899) again caused intense excitement and pro-Boer enthusiasm in Holland, coupled with a growing resentment against the British Government. No doubt circumstances had much changed since 1881, but that did not make Dutch feelings less keen, for after 1881 Holland had acquired important material interests in the South African Republic, especially in its railways, banks, and several industries, though not in its gold mines. Dutch pro-Boerism had therefore ceased to be purely sentimental, albeit it had latterly done much to promote Dutch emigration and education in the Transvaal. Holland, however, maintained a strict neutrality, and it is upon record that the Dutch Government, in the autumn of 1899, advised President Kruger not to enter upon the war with Great Britain. An attempt at mediation, based partly upon the provisions of the Peace Conference, failed; and a renewed offer at the beginning of 1902 to institute peace preliminaries—without, however, any authority from the Boer leaders—was politely declined by Great Britain.

Marriage of Queen Wilhelmina.

The young queen attained her majority in 1898, and was solemnly enthroned in the so-called New Church in Amsterdam, taking her oath of fidelity to the Constitution in the presence of the States-General on 6th September, in accordance with the ceremonial prescribed, amid national festivities and rejoicings which lasted several days and concluded with a naval review on the Hollandsch Diep. In October 1900 the announcement that the young sovereign was betrothed to Duke Henry of Mecklenburg-Schwerin, a Prussian officer of the guard, four years her senior, was well received. The approval of the States-General, prescribed by the Constitution, was therefore readily obtained, and the marriage was solemnized with great pomp in the Great Church at The Hague on 7th February 1901, Duke Henry having been created a prince and a general in the Dutch army for the occasion, under the title of Prince Henry of the Netherlands, thus happily reviving the popular title of a popular prince, King William's brother, which threatened to be extinguished with his demise in 1879.

The June elections for the States-General proved disastrous to the Liberal ministry of Dr Pierson, owing to dissensions among his following anent several important points of home policy. The combined Clericals (Catholics and Ultra-Protestants, or so-called Anti-Revolutionists) gaining a decisive victory at the polls, the Pierson cabinet tendered its resignation. Queen Wilhelmina then sent for Dr Abraham Kuyper, for many years the leader of the Anti-Revolutionary party in Holland, who succeeded in forming a ministry, in which representatives of that and the Roman Catholic party held office together. Its programme, as reflected in the speech from the throne in September, was a "Christian-National" policy, both at home and in the colonies. It has merely to be added that amongst the last achievements of the Pierson cabinet were the enactment of compulsory education (1900) and the introduction of obligatory military service consequent upon the reorganization of the Dutch army (1901).

This survey of Dutch history indicates the enormous strides that have been made in every direction since 1850.

Conclusion. The population of the kingdom, which stood at only 3,000,000 in 1849, had advanced to over 5,000,000 by January 1900. In the provinces of North and South Holland the population has indeed almost doubled in half a century. The population of Amsterdam, The Hague, and Utrecht more than doubled, whilst that of Rotterdam shot up from 90,000 to 318,000. In 1850, 30,396 depositors had £317,580 in the private savings banks; in 1898 their number had increased to 361,509, and their claims to £6,512,000, notwithstanding the competition of the post office savings bank, which had, in 1898, 693,228 depositors, with a balance to their credit of £5,834,330. The imports for consumption, which were valued at £15,052,012 in 1849, had grown to £136,241,666 in 1896; the exports having increased in the same period from £10,634,128 to £111,708,333. The spending powers of the nation naturally kept pace with these increases, and the total budget expenses, which were £5,803,678 in 1850, had grown in 1897 to £11,560,737. It is true that the cessation of yearly contributions from the Dutch Indian revenues since 1878, and the constant enormous outlays for railways, canals, other public works, education, &c., caused in later years a material increase in the national debt, which stood at over £83,300,000 in 1898, but this increase was more than balanced by rapid decreases in the course of years. These aggregate about £91,660,000, whereas the increases were only £80,500,000; while by the repeated conversions, rendered possible by the steady rise in national credit, the annual debt charges were considerably lessened. On the other hand, it should be borne in mind that the national assets had been enormously strengthened since 1850, no less than £20,830,000 having been invested in the state railways alone by 1897, besides large investments in canals, the total length of which reached nearly 3000 English miles in 1898, and was constantly increasing. Among the greatest canals was the North Sea Canal at Amsterdam, originally constructed by a private company, but taken over in 1882 by the State. The dues were abolished in 1890, and this waterway considerably improved in 1896. Next in importance is the new waterway between Rotterdam and the German Ocean, which was completed in 1872, but has been improved since, allowing the largest ocean vessels to enter the Meuse, and making Rotterdam one of the greatest Continental ports. A further comparison of the State budgets for 1849 and 1897 shows that the advance was as marked in matters intellectual as in the material departments of national life. Thus education expenses in 1901 absorbed £833,000, against £43,500 fifty years before; the postal and telegraph services as much again, against £39,100 in 1849; in 1898, £2,000,000 was spent for public works and industries, against barely £166,000 in 1849; £70,450 for arts and science, against £9655 in 1849; and £115,700 for the colonies, which fifty years before yielded a revenue and cost nothing. Yet, by this immense material improvement in every department the burghers were at the end of the 19th century better able to pay £8,833,000 of taxes than those of 1849 to pay half that amount; their wealth had enormously grown, and the bulk of the national debt was held in Holland. Two principal conditions accompanied and dominated the great progress of these fifty years—the uninterrupted maintenance of peace, and the upholding of the principles of free trade, in which the Low Countries stood absolutely alone on the Continent of Europe.

For literature concerning this period of Dutch political history, see also the *Staatsalmanak* (official annual), the *Annual Register*, and similar publications in Holland and England; Motley's *Correspondence* (2 vols.); Henry Reeve's *Memoirs* (2 vols.); Earl of Malmesbury, *Memoirs of an Ex-Minister* (1884, 2 vols.); *Bismarck, the Man and the Statesman* (English translation, 1898, 2 vols.); *Les Pays Bas*, a sumptuous and full compendium of the Netherlands, privately printed and distributed by the Dutch Press Club of Amsterdam upon the occasion of Queen Wilhelmina's enthronement in 1898. There were also at that time numerous other publications of a similar character, mainly in the Dutch language, the principal among them being, perhaps, *Eene halve Eeuw* ("Half a Century," in 2 vols.), a comprehensive survey of modern Holland, historical, political, commercial, industrial, artistic, and literary, published at Amsterdam. (H. Ti.)

Recent Dutch Literature.

The recent literature of Holland presents the interesting phenomenon of an æsthetic revolution, carefully and cleverly planned, crowned with unanticipated success, and dying away in a languor encouraged by the complete absence of organized resistance. It would perhaps be difficult to point to another European example so well defined of the vicissitudes which keep the history of literature varied and fresh. For the thirty or forty years preceding 1880 the course of *belles-lettres* in Holland was smooth and even sluggish. The Dutch writers had slipped into a conventionality of treatment and a strict limitation of form from which even the most striking talents among them could scarcely escape. At the period of which we are about to speak, the most eminent authors of this early period were ready to pass away, and they appeared to be preparing no successors to take their place. The greatest humourist of Holland, Nicolaas Beets (born 1814) (*q.v.*), had drawn his works together. The most interesting novelist, Mrs Gertrude Bosboom-Toussaint (1812–1886) (*q.v.*), had in her last psychological stories shown an unexpected sympathy with new ideas. A very remarkable genius, of whom we write elsewhere, was Edward Douwes Dekker, "Multatuli" (1826–1887). The two other leading Dutch men of letters were critics, Conrad Busken-Huet (1826–1886) (*q.v.*) and Carel Vosmaer (1826–1888) (*q.v.*). In Huet the principles of the 1840–80 period were summed up; he had been during all those years the fearless and trusty watchdog of Dutch letters, as he understood them. He lived just long enough to become aware that a revolution was approaching, not to comprehend its character; but his accomplished fidelity to literary principle and his wide knowledge have been honoured even by the most bitter of the younger school. Vosmaer, although in certain directions more sympathetic than Huet, and himself an innovator, has not escaped so easily, because he has been charged with want of courage in accepting what he knew to be inevitable. We have now, however, mentioned the leaders of the old guard, and must proceed to sketch the course of the movement which replaced them.

In November 1881 there died a youth named Jacques Perk (1860–1881), who had done no more than publish a few sonnets in the *Spectator*, a journal published by Vosmaer. He was no sooner dead, however, than his posthumous poems, and in particular a cycle of sonnets called *Mathilde*, were published (1882), and awakened extraordinary emotion. Perk had rejected all the formulas of rhetorical poetry, and had broken up the conventional rhythms. There had been heard no music like his in Holland for two hundred years. A group of young men, united in a sort of esoteric adoration of the memory of Perk, collected around his name. They joined to their band a man somewhat older than themselves, Marcellus Emants (born 1848), who had come forward in 1879 with a symbolical poem called *Lilith*, which had been stigmatized as audacious and meaningless: encouraged by the admiration of his juniors, Emants published in 1881 a treatise on Young Holland, in which the first open attack was made on the old school. The next appearance was that of Willem Kloos (born 1857), who had been the editor and intimate friend of Perk, and who now undertook to

lead the army of rebellion. His violent attacks on recognized authority in æsthetics began in 1882, and created a considerable scandal. For some time, however, the new poets and critics found a great difficulty in being heard, since all the channels of periodical literature were closed to them. But in 1883 Emants expressed his intellectual aspirations in his *Twilight of the Gods*, and in 1884 the young school founded a review, *De Nieuwe Gids*, which was able to offer a direct challenge to *De Gids*, the ultra-respectable Dutch quarterly. In this year a new element was introduced: hitherto the influences of the young Dutch poetry had chiefly come from England; they were those of Shelley, Mrs Browning, the Rossettis. In 1884 Frans Netscher began to imitate with avidity the French naturalists. For some time, then, the new Dutch literature became a sort of mixture of Shelley and Zola, very violent, heady, and bewildering. In 1885 the *Persephone* of Albert Verwey and the *Hovering Butterflies* of Pol de Mont (born 1859) introduced two lyrical poets of real merit to Holland; Emants published his *Gondakker's Illusions*. This was the great flowering moment of the new school. It was at this juncture that the principal recent writer of Holland, Louis Couperus (born 1863), made his first definite appearance. Born in The Hague, the opening years of his boyhood were spent in Java, and he had preserved in all his nature a certain tropical magnificence. In 1884 a little volume of lyrics, and in 1886 the more important *Orchids*, showed in Couperus a poet whose sympathies were at first entirely with the new school. But he was destined to be a novelist, and his earliest story, *Eline Vere* (1889), already took him out of the ranks of his contemporaries. In 1890 he published *Destiny* (known as *Footsteps of Fate* in the English version), and in 1892 *Ecstasy*. This was followed in 1894 by *Majesty*, in 1896 by *World-wide Peace*, in 1898 by *Metamorphosis*, a delicate study of character, in 1899 by *Fidessa*, and in 1901 by *Quiet Force*. Of all these later books by Couperus, it is perhaps *Ecstasy* in which the peculiar quality of his work is seen at present to the greatest advantage. This is an extreme sensitiveness to psychological phenomena, expressed in terms of singular delicacy and beauty. The talent of Couperus is like a rich but simple tropical flower laden with colour and odour. He separated himself, as he developed, from the more fanatical members of the group, and addressed himself to the wider public. Another writer, of a totally different class, resembling Couperus only in his defiance of the ruling system of æsthetics, is the prominent Ultramontane politician, E. J. A. M. Schaepmann (born 1844), whose poem of *Aja Sofia* originally appeared in 1886. Recent novelists of some polemical vigour are H. Borel and van Hulzen. A very delightful talent was revealed by Frederick van Eeden in *Little Johnny* (1887), a prose fairy-tale; in *Ellen* (1890), a cycle of mysterious and musical elegies; and in *From the Cold Pools of Death* (1901), a very melancholy novel. Another poet of less refinement of spirit, but even greater sumptuousness of form, appeared in Helène Swarth-Lapidoth (born 1859), whose *Pictures and Voices* belongs to 1887. In that year also, in which Dutch literature reached its height of fecundity, was published the powerful and scandalous naturalistic novel, *A Love*, by L. van Deyssel, who had hitherto been known chiefly as a most uncompromising critic. Since 1887 the condition of modern Dutch literature has been comparatively stationary, and even within the last decade of the 19th century definitely declining. In 1889, it is true, a new poet, Herman Gorter, made his appearance with a volume of strange verses called *May*, eccentric both in prosody and in treatment. He held his own without any marked advance towards lucidity or variety. Since the recognition of Gorter, however, no really remarkable talent has made itself prominent in Dutch poetry, unless we except P. C. Boutens, whose *Verses* in 1898 were received with great respect. Willem Kloos, still the acute and somewhat turbulent leader of the school, collected his poems in 1894 and his critical essays in 1896. L. van Deyssel, though an effective reviewer, continued to lack the erudition which years should have brought to him. Among the pure poets, the Fleming, Pol de Mont, with his *Claribella* (1893) and his *Iris* (1894), possibly showed the most definite advance. Gorter remained tenebrous, Helène Swarth-Lapidoth still gorgeous; the others, with the exception of Couperus, showed symptoms of sinking into silence. The entire school, now that the struggle for recognition is over, and its members are accepted as little classics and the tyrants of taste, rests on its triumphs and seems to limit itself to a repetition of its old experiments. In drama almost the only notable products are those of De Koo, whose *Tobias Bolderman* (1900) and *Vier Ton* (1901) are effective comedies. Dutch literature presented features of remarkable interest between 1882 and 1888, but since that time the general heightening of the average of merit, the abandonment of the old dry conventions, and a recognition of the artistic value of words and forms, are more evident to a foreign observer than any very important single expression of the national genius in literary art. An exception should be made in favour of the powerful peasant-stories of Steijn Streuvels, a young baker by trade, whose *Summer Land* (1901) is a most promising production.

Interesting observations on the development of the new school in Dutch literature will be found in Willem Kloos, *Veertien Jaar Literatuur-Geschiedenis*, 2 vols., 1896, and in L. van Deyssel, *Verzamelde Opstelen*, 4 vols., 1890–97. (E. G.)

Holland, NORTH and SOUTH, two adjoining provinces of the Netherlands, between the Zuyder Zee, the most southerly branch of the Meuse, and the North Sea. The surface is mostly beneath sea-level, but is protected by dykes; the soil is fertile and diligently cultivated. The chief towns in North Holland are Amsterdam, Haarlem, Alkmaar, Heeder, Hoorn, and Zaandam. In South Holland the principal towns are Rotterdam, The Hague, Leyden, Delft, Schiedam, and Gouda. The Hook of Holland, the new approach to Central Europe from Harwich, occupies almost the extreme south-western point of a promontory of South Holland. (For statistics see HOLLAND: *Geography*.)

Holland, a city of Ottawa county, Michigan, U.S.A., on a navigable inlet at the mouth of the Black River, and on the Chicago and West Michigan Railway, at an altitude of 609 feet. It is a summer resort, and the seat of Hope College, founded in 1865, which in 1899 had 15 instructors and 214 students, of whom 27 were women. Population (1880), 2620; (1890), 3945; (1900), 7790, of whom 2075 were foreign-born.

Holland, Josiah Gilbert (1819–1881), American author and editor, was born in Belchertown, Massachusetts, 24th July 1819. He studied medicine in the Berkshire Medical College (no longer in existence) at Pittsfield, in the same state; was for a brief period superintendent of schools in Vicksburg, Mississippi; but in 1849 became one of the editors and owners of the Springfield (Massachusetts) *Republican*, with which he retained his connexion for seventeen years. In 1870, having resigned his position upon that journal and travelled in Europe, he removed to New York and established *Scribner's Monthly* (the title of which was later changed to *The Century*) by developing an earlier magazine of more limited scope, and gave it a character of its own, in which were combined readableness, literary tone, and social helpfulness. Dr Holland's numerous books, partly reprints

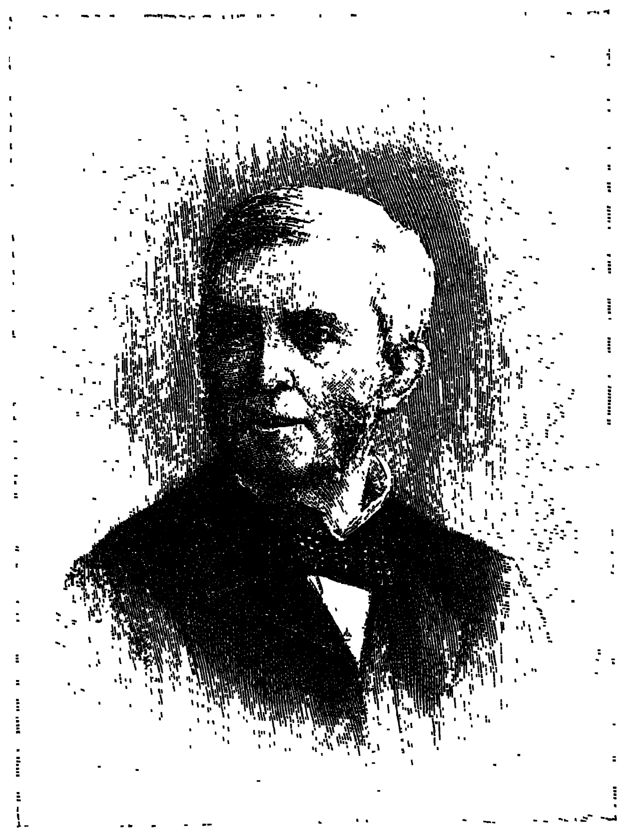
of his contributions to the *Republican* and *Scribner's Monthly*, long enjoyed a wide popularity. These writings fall into four classes: history and biography, represented by a *Life of Abraham Lincoln* (1865), of which more than 100,000 copies were sold soon after the assassination of the President; fiction, of which *Miss Gilbert's Career* (1860) and *The Story of Sevenoaks* (1875) remain faithful pictures of village life in Eastern America; poetry, of which the easily-moving narratives, *Bitter-Sweet* (1858) and *Kathrina, Her Life and Mine* (1867), were widely read; and a series of homely and suggestive essays on the art of living, of which the most characteristic were *Letters to Young People, Single and Married* (1858), *Gold Foil, hammered from Popular Proverbs* (1859), *Letters to the Joneses* (1863), and *Every-Day Topics* (two series, 1876 and 1882). While a resident of New York, where he died 12th October 1881, Dr Holland identified himself with measures for good government and school reform, being at one time president of the Board of Education.

Holloway, Thomas (1800–1883), English patent-medicine vendor and philanthropist, was born at Devonport, 22nd September 1800, of humble parents. Until his twenty-eighth year he lived at Penzance, where he assisted his mother and brother in the baker's shop which his father, once a warrant officer in a militia regiment, had left them at his death. On coming to London he made the acquaintance of Felix Albinolo, an Italian, from whom he obtained the recipe for the ointment which was to carry his name all over the world. The secret of his enormous success in business was due almost entirely to advertisement, in the efficacy of which he had great faith. He soon added the sale of pills to that of the ointment, and began to devote the larger part of his profits to advertising. Holloway's first newspaper announcement appeared on 15th October 1837, and in 1842 his yearly expenses for publicity had reached the sum of £5000; this expenditure went on steadily increasing as his sales increased, until it had reached the figure of £50,000 per annum at the time of his death. It is, however, chiefly by the two princely foundations—the Sanatorium and the College for Women, endowed by Holloway towards the close of his life—that his name will be perpetuated, more than a million sterling having been set apart by him for the erection and permanent endowment of these institutions. In the deed of gift of the college the founder credited his wife, who died in 1875, with the advice and counsel that led him to provide what he hoped might ultimately become the nucleus of a university for women. The Holloway Sanatorium was the first to be opened, in June 1885, eighteen months after the founder's death. It is an asylum for patients of the middle class, of both sexes, afflicted with mental disorders, and is intended to be to a considerable extent self-supporting, a moderate charge being made for the reception of inmates whose families can afford to pay. The institution and the surrounding grounds include some forty acres situated at St Anne's Heath, near Virginia Water, the building containing about 600 rooms, disposed on four floors, and capable of accommodating about 250 patients. All the structural and decorative features are on a grand scale and of a highly artistic nature, devised with the purpose of giving wearied brain-workers an opportunity of recovering their faculties. The Royal Holloway College for Women at Mount Lee, Egham, was opened by Queen Victoria in July 1886. The building, surrounded by grounds 95 acres in extent, stands on a picturesque wooded slope, commanding a splendid view; it contains nearly a thousand rooms, and has accommodation for 250 students and an ample staff. The recreation hall is an art gallery, containing pictures which cost upwards of £90,000. Like the sanatorium, it was furnished throughout in the most sumptuous manner, and, also like that institution, it is mainly self-supporting. It is unsectarian, the management being vested in a representative body of governors. The philanthropic and somewhat eccentric donor (he had an unconcealed prejudice against doctors, lawyers, and parsons) died of congestion of the lungs on 26th December 1883.

Holmes, Oliver Wendell (1809–1894), American writer and physician, was born 29th August 1809 at Cambridge, Massachusetts. His father, Abiel Holmes, was a Calvinist clergyman, the writer of a useful history, *Annals of America*, and of much very dull poetry. His mother (the second wife of Abiel) was Sarah Wendell, of a distinguished New York family. Through her Dr Holmes was descended from Governors Thomas Dudley and Simon Bradstreet of Massachusetts, and from her he derived his cheerfulness and vivacity, his sympathetic humour and wit. From Phillips Academy he entered Harvard College in the "famous class of '29," made further illustrious by the charming lyrics which he wrote for the anniversary dinners from 1851 to 1889, closing with the touching "After the Curfew." After graduation he studied law perfunctorily for a year and dabbled in literature, winning the public ear by a spirited lyric called forth by the order to destroy the old frigate *Constitution*. These verses were sung all over the land, and induced the Navy Department to revoke its order and save the old ship. Turning next to medicine, and convinced by a brief experience in Boston that he liked it, he went to Paris in March 1833. He studied industriously under Louis and other famous physicians and surgeons in France, and in his vacations visited the Low Countries, England, Scotland, and Italy. Returning to Boston at the close of 1835, filled with a high professional ambition, he sought practice, but achieved only moderate success. Social, brilliant in conversation, and a writer of gay little poems, he seemed to the grave Bostonians not sufficiently serious. He won prizes, however, for professional papers, and lectured on anatomy at Dartmouth College. He wrote two papers on homœopathy, which he attacked with trenchant wit; also a valuable paper on the malarial fevers of New England. In 1843 he published his essay on the *Contagiousness of Puerperal Fever*, which stirred up a fierce controversy and brought upon him bitter personal abuse; but he maintained his position with dignity, temper, and judgment; and in time he was honoured as the discoverer of a beneficent truth. The volume of his medical essays holds some of his most sparkling wit, his shrewdest observation, his kindliest humanity. In 1840 he married Amelia Lee Jackson, daughter of the Hon. Charles Jackson, Associate Justice of the Supreme Judicial Court of Massachusetts, a lady of rare charm alike of mind and character. She died in the winter of 1887–88. Their first-born child, Oliver Wendell Holmes, afterwards became Chief Justice of that same bench on which his grandfather sat. In 1847 Dr Holmes was appointed Professor of Anatomy and Physiology in the Medical School of Harvard University, the duties involving the giving of instruction also in kindred departments, so that, as he said, he occupied "not a chair, but a settee in the school." He delivered the anatomical lectures until November 1882, and in later years these were his only link with the medical profession. They were fresh, witty, and lively; and the students were sent to him at the end of the day, when they were fagged, because he alone could keep them awake. In later years he made few finished contributions to medical knowledge;

his eager and impetuous temperament caused him to leave more patient investigators to push to ultimate results the suggestions thrown out by his fertile and imaginative mind.

In 1836, being in that year the Phi Beta Kappa poet at Harvard University, he published his first volume of poems, which afterwards reached a second edition. Among these earlier lyrics was "The Last Leaf," one of the most delicate combinations of pathos and humour in literature. His collected poetry fills three volumes. In 1856–57 a Boston publishing house (Phillips, Sampson, and Co.) invited James Russell Lowell to edit a new magazine, which he agreed to do on condition that he could secure the assistance of Dr Holmes. By this urgent invitation the Doctor was equally surprised and flattered, for heretofore he had stood rather outside the literary coterie of Cambridge and Boston. He accepted with pleasure, and at once threw himself into the enterprise with zeal. He christened it *The Atlantic Monthly;* and, as Mr Howells afterwards said, he "not only named but made" it, for in each number of its first volume there appeared one of the papers of the *Autocrat of the Breakfast Table.* The opening of the *Autocrat*—"I was just going to say when I was interrupted"—is explained by the fact that in the old *New England Magazine* (1831 to 1833) the Doctor had published two *Autocrat* papers, which, by his wish, have never been reprinted. In the commercial panic of 1857 the new magazine would inevitably have failed had it not been for these fascinating essays. Their originality of conception, their wit and humour, their suggestions of what then seemed bold ideas, and their expression of New Englandism, all combined to make them so popular that the most harassed merchant in that gloomy winter purchased them as a dose of cheering medicine. Thus Dr Holmes made *The Atlantic Monthly*, which in return made him. A success so immediate and so splendid settled the rest of his career; he ceased to be a physician, and became an author. These twelve papers were immediately (1858) published as a volume. No sooner was the *Autocrat* silent than the *Professor* (1859) succeeded him at the breakfast table. The *Professor* was preferred by more thoughtful readers, though it has hardly been so widely popular as the *Autocrat.* Its theology, which seemed in those days audacious, frightened many of the strict and old-fashioned religionists of New England, though to-day it seems mild enough. Twelve years later, in 1871, the Landlady had another boarder, who took the vacant chair—the *Poet* (published 1872). But here Holmes fell a little short. In these three books, especially in the *Autocrat* and the *Professor*, the Doctor wrote as he talked at many a dinner table in Boston, but less well. The animation and clash of talk roused him. The dinners of the Saturday Club are among Boston's proudest traditions, as they were the chief pleasure of Dr Holmes's life. There he met Emerson, Longfellow, Whittier, Lowell, Sumner, Agassiz, Motley, and many other charming talkers, and among them all he was admitted to be the best.



OLIVER WENDELL HOLMES.
(From a photograph by Elliott and Fry, London.)

There were characters and incidents, but hardly a story, in the *Autocrat* and the *Professor.* Holmes had an ambition for more sustained work, and in 1861 his novel, *Elsie Venner*, at first called *The Professor's Story*, was published. The book was illuminated throughout by admirable pictures of character and society in the typical New England town. But the rattlesnake element was unduly extravagant, and in other respects the book was open to criticism as a work of art. It was written with the same purpose which informed the greatest part of the Doctor's literary work, and which had already been scented and nervously condemned by the religious world. By heredity the Doctor was a theologian; no other topic enchained him more than did the stern and merciless dogmas of his Calvinist forefathers. His humanity revolted against them, his reason condemned them, and he set himself to their destruction as his task in literature. The religious world of his time was still so largely under the control of old ideas that he was assailed as a freethinker and a subverter of Christianity; though before his death opinions had so changed that the bitterness of the attacks upon him seemed incredible even to some of those who had most vehemently made them. None the less, undaunted and profoundly earnest, he returned, six years later, to the same line of thought in his second novel, *The Guardian Angel* (published 1867). This, though less well known than *Elsie Venner*, is in many respects better. No more lifelike and charming picture of the society of the New England country town of the middle third of the 19th century has ever been drawn, and every page sparkles with wit and humour. In 1884 and 1885 it was followed, still in the same line, by *A Mortal Antipathy*, a production inferior to its predecessors.

Holmes generally held himself aloof from politics, and from those "causes" of temperance, abolition, and woman's rights which enthralled most of his contemporaries in New England. The Civil War, however, aroused him for the time; finding him first a strenuous Unionist, it quickly converted him into an ardent advocate of emancipation. His interest was enhanced by the career of his elder son, who was three times severely wounded, and finally rose to the rank of lieutenant-colonel in the Northern army. He wrote some ringing war lyrics, and in 1863 delivered the Fourth of July oration in Boston, which showed a masterly appreciation of the stirring public questions of

the day. In 1878 Dr Holmes wrote a memoir of the historian John Lothrop Motley, an affectionate tribute to one who had been his dear friend. In 1884 he contributed the life of Emerson to the American Men of Letters Series. He admired the "Sage of Concord," but was not quite in intellectual sympathy with him. Both were Liberals in thought, but in widely different ways. But in spite of this handicap, the volume proved very popular. In 1888 he began the papers which he happily christened *Over the Tea Cups.* As a *tour de force* on the part of a man of nearly fourscore years they are very remarkable.

After his return from Paris in 1835 Dr Holmes lived in Boston, with summer sojournings at Pittsfield and Beverly Farms, and occasional trips to neighbouring cities, until 1886. He then undertook a four months' journey in Europe, and in England had a sort of triumphal progress. On his return he wrote *Our Hundred Days in Europe* (1887), a courteous recognition of the hospitality and praise which had been accorded to him. During this visit Cambridge University made him Doctor of Letters, Edinburgh University made him Doctor of Laws, and Oxford University made him Doctor of Civil Law. Already, in 1880, Harvard University had made him Doctor of Laws. He died on 7th October 1894, and was buried from King's Chapel, Boston, in the cemetery of Mount Auburn.

(J. T. Mo.)

Holmfirth, a town in the Holmfirth parliamentary division of Yorkshire, England, on the Holme and Ribble, 6 miles south of Huddersfield and on the Lancashire and Yorkshire Railway. There are a town-hall, a drill-hall, and a technical institute, three churches, and several chapels. Woollen manufactures form the principal industry. In the neighbourhood there is picturesque scenery. Area (urban district), 7094 acres. Population (1901), 8976.

Holtzendorff, Joachim Wilhelm Franz Philipp von (1829–1889), German jurist, born at Vietmannsdorf, in the Mark of Brandenburg, on 14th October 1829, was descended from a family of the old nobility. He was educated at Berlin and at Pforta, afterwards studying law at the universities of Bonn, Heidelberg, and Berlin. He saw the struggles of 1848 with youthful enthusiasm, and remained for the rest of his life a strong advocate of political liberty. In 1852 he graduated LL.D. at Berlin; in 1857 he became a *privat-docent*, and in 1860 he was nominated a professor extraordinary. The predominant party in Prussia regarded his political opinions with mistrust, and he was not offered an ordinary professorship until February 1873, after he had decided to accept a chair at the university of Munich. At Munich he passed the last nineteen years of his life. During the thirty years that he was professor he successively taught several branches of jurisprudence, but he was chiefly distinguished as an authority on criminal and international law. He was especially well fitted for organizing collective work, and he has associated his name with a series of publications of the first value. While acting as editor he often reserved for himself, among the independent monographs of which the work was composed, only those on subjects distasteful to his collaborators on account of their obscurity or lack of importance. Among the compilations which he superintended may be mentioned his *Encyclopädie der Rechtswissenschaft* (Leipzig, 1870–71, 2 vols.; fifth edition, 1890), his *Handbuch des deutschen Strafrechts* (Berlin, 1871–77, 4 vols.), and his *Handbuch des Völkerrechts auf Grundlage Europäischer Staatspraxis* (Berlin, 1885–90, 4 vols.). Among his many independent works may be mentioned: *Das irische Gefängnisssystem* (Leipzig, 1859), *Französische Rechtszustände* (Leipzig, 1859), *Die Deportation als Strafmittel* (Leipzig, 1859), *Die Kürzungsfähigkeit der Freiheitsstrafen* (Leipzig, 1861), *Die Reform der Staatsanwaltschaft in Deutschland* (Berlin, 1864), *Die Umgestaltung der Staatsanwaltschaft* (Berlin, 1865), *Die Principien der Politik* (Berlin, 1869), *Das Verbrechen des Mordes und die Todesstrafe* (Berlin, 1875), *Rumäniens Uferrechte an der Donau* (Leipzig, 1883; French edition, 1884). He also edited or assisted in editing a number of periodical publications on legal subjects. From 1866 to the time of his death he was associated with Rudolf Ludwig Carl Virchow in editing *Sammlung gemeinverständlicher wissenschaftlicher Vorträge* (Berlin). Von Holtzendorff died at Munich on 4th February 1889. (E. I. C.)

Holyhead, a seaport and naval station on the north-east shore of an island of the same name lying off the west coast, and part of the county, of Anglesea, Wales. In 1885 its parliamentary representation was merged in that of the county. There are a hospital, a sailors' home, and almshouses. Area of urban district, 732 acres. Population (1881), 8680; (1901), 10,072. The island is about 7½ miles long, with a breadth varying from 4 miles to half a mile. On the north-west is the "head," a serpentine mass 719 feet high, and off this are two rocks, the North and South Stacks, with lighthouses.

Holyoake, George Jacob (1817–——), English secularist and co-operator, was born at Birmingham, 13th April 1817. At an early age he became an Owenite lecturer, and in 1841 was the last person convicted for blasphemy in a public lecture, though this had no theological character and the incriminating words were merely a reply to a question addressed to him from the body of the meeting. He nevertheless underwent six months' imprisonment, and upon his release invented the inoffensive term "secularism" as descriptive of his opinions, and established *The Reasoner* in their support. He was also the last person indicted for publishing an unstamped newspaper, but the prosecution dropped upon the repeal of the tax. His later years were chiefly devoted to the promotion of the co-operative movement among the working classes. He wrote the history of the Rochdale Pioneers (1857), the *History of Co-operation in England* (1875), and *The Co-operative Movement of To-day* (1891). He also published (1892) his autobiography, under the title of *Sixty Years of an Agitator's Life.*

Holyoke, a city of Hampden county, Massachusetts, U.S.A., on the west bank of the river Connecticut, 8 miles north of Springfield, at an altitude of 114 feet. The plan of the city is regular and divided into seven wards. It derives its water supply by gravity from lakes in the adjacent hills. It is on the Boston and Maine, and the New York, New Haven, and Hartford railways. Hadley Falls, in the Connecticut, have a fall of about 60 feet, and furnish valuable water-power, the utilization of which has made Holyoke an important manufacturing city. In 1900 it had 433 manufacturing establishments, employing 13,454 hands, and producing goods valued at $26,283,964. Of these, paper and wood pulp were the most important products, having a value of $8,109,485. Cotton goods to the value of $3,764,848, and woollen goods valued at $1,424,897, were also produced. The assessed valuation of real and personal property in 1900 was $39,735,580; the net debt of the city was $1,739,868; and the rate of taxation was $16·40 per $1000. Population (1880), 21,915; (1890), 35,637; (1900), 45,712, of whom 18,921 were foreign-born and 40 negroes. The death-rate in 1890 was 22·8; in 1900 it was 17·9.

Homburg vor der Höhe, a famous watering-place of Prussia, in the province of Hesse-Nassau, at the south-east foot of the Taunus Mountains, 12 miles by rail north-north-west of Frankfort-on-Main, frequented by more than 10,000 visitors annually. In 1897 a Russian (Orthodox Greek) chapel was built, and in 1892 a marble bust of the Emperor Frederick III. was unveiled. A new bath-house was built in 1887–90, and a new salt spring bored in 1898. There is also a new Roman Catholic church (1895). In 1900 the ancient Roman castle of the Saalburg was converted into an imperial museum. Population (1885), 8857; (1900), 9636.

Homer, Winslow (1836–——), American painter, was born in Boston, U.S.A., 24th February 1836. At the age of nineteen he was apprenticed to a lithographer. Two years later he opened a studio in Boston, and devoted much of his time to making drawings for wood-engravers. In 1859 he removed to New York, where he studied in the night-school of the National Academy of Design. During the American Civil War he was with the troops at the front, and contributed sketches to *Harper's Weekly*. The war also furnished him with the subjects for the first two pictures which he exhibited (1863), one of which was "Home, Sweet Home." His "Prisoners from the Front"—perhaps his most generally popular picture—was exhibited in New York in 1865, and also in Paris in 1867, where he was spending the year in study. Among his other paintings in oil are "Snap the Whip" (which was exhibited at the Philadelphia Centennial Exposition of 1876, and, in company with "The Country Schoolroom," at the Paris Salon the following year), "Eating Water-melon," "The Cotton Pickers," "Visit from the Old Mistress, Sunday Morning," "The Life-Line," and "The Coming of the Gale." His genius, however, has perhaps shown better in his works in water-colour, among which are his marine studies painted at Gloucester, Mass., and his "Inside the Bar," "The Voice from the Cliffs" (pictures of English fisherwomen), "Tynemouth," "Wrecking of a Vessel," and "Lost on the Grand Banks." His work, which principally consists of *genre* pictures, is characterized by strength, rugged directness, and unmistakable freshness and originality, rather than by technical excellence, grace of line, or beauty of colour. He was little affected by European influences. His types and scenes, apart from his few English pictures, are distinctly American—soldiers in blue, New England children, negroes in the land of cotton, Gloucester fishermen and stormy Atlantic seas. Besides being a member of the Society of Painters in Water-colour, New York, he was elected in 1864 an associate and the following year a member of the National Academy of Design.

Homestead, a borough of Allegheny county, Pennsylvania, U.S.A., on the river Monongahela, 8 miles south-east of Pittsburg, at an altitude of 759 feet. It is on the Pennsylvania and the Pittsburg and Lake Erie Railways. It is known chiefly as the site of the great iron and steel works of the Carnegie Company, and as the scene, in 1892, of a serious labour strike, which was quelled only by the calling out of the National Guard of the state. Population (1880), 592; (1890), 7911; (1900), 12,554, of whom 3604 were foreign-born and 640 were negroes.

Homœopathy.—The system of therapeutics which bears the name of Homœopathy is based upon the law *similia similibus curentur*, the originator of which was Hahnemann, a native of Meissen in Germany, who discovered his new principle while he was experimenting with cinchona bark in 1790, and announced it in 1796. The essential tenets of homœopathy are that the cure of disease is effected by drugs that are capable of producing in a healthy individual symptoms similar to those of the disease to be treated, and that to ascertain the curative virtues of any drug it must be "proved" upon healthy persons—that is, taken by individuals of both sexes in a state of health in gradually increasing doses. The manifestations of drug action thus produced are carefully recorded, and this record of "drug-diseases," after being verified by repetition on many "provers," constitutes the distinguishing feature of the homœopathic materia medica, which, while it embraces the sources, preparation, and uses of drugs as known to the orthodox pharmacopœia, contains, in addition, the various "provings" obtained in the manner above described. Within the past few years an interesting controversy has been carried on between the members of the homœopathic school as to the proper construction of the Latin motto which constitutes its acknowledged basis. For many years the verb at the conclusion of the sentence was used in the indicative mood, *curantur*, thus making the sentence a positive one. After extended research it has been discovered that Hahnemann himself never employed the word *curantur* as descriptive of his law of cure, but always wrote *curentur*, which greatly modifies the meaning of the phrase. If the subjunctive mood be used, the motto reads, "Let similars be treated by similars," or "Similars should be treated by similars." The reading *similia similibus curentur* was officially adopted as the correct reading of the sentence by the American Institute of Homœopathy at its session held in Atlantic City, N.J., 20th June 1899; and the words are so inscribed on the monument erected to the memory of Hahnemann and unveiled in Washington, D.C., on 23rd June 1900, and also are those carved upon the tomb of Hahnemann in Père-la-Chaise, Paris.

Besides the promulgation of the doctrine of similars, Hahnemann also enunciated a theory to account for the origin of all chronic diseases, which he asserted were derived either directly or remotely from psora (the itch), syphilis (venereal disease), or sycosis (fig-wart disease). This doctrine, although at first adopted by some of the enthusiastic followers of Hahnemann, was almost immediately discarded by very many who had a firm belief in his law of cure. In the light of advancing science such theories are entirely untenable, and it was unfortunate for the system of medicine which he founded that Hahnemann should have promulgated such a hypothesis. It served as a target for the shafts of ridicule showered upon the system by those who were its opponents, and even at the present time there still exists in the minds of many misinformed persons the conviction that homœopathy is a system of medicine that bases the origin of all chronic disease on the itch or on syphilis or fig-warts.

Another peculiar feature of homœopathy is its posology or theory of dose. It may be asserted that homœopathic posology has nothing more to do with the original law of cure than the psora (itch) theory has, and that it was one of the later creations of Hahnemann's mind. Most homœopathists believe more or less in the action of minute doses of medicine, but it must not be considered as an integral part of the system. The dose is the corollary, not the principle. Yet in the minds of many, infinitesimal doses of medicine stand for homœopathy itself, the real law of cure being completely put into the background. The question of dose has also divided the members of the homœopathic school into bitter factions, and is therefore a matter for careful consideration. Many employ low potencies,[1] *i.e.*, mother tinctures, first,

[1] Two methods of preparing medicines are recognized, one on the decimal, the other on the centesimal scale. The pure tinctures are denominated "mother tinctures," and represented by the Greek ϕ. To make a first decimal dilution or first decimal trituration, 10 drops of

second, sixth dilutions, &c., while others use hundred-thousandths and millionths.

Some homœopathists of the present day still believe with Hahnemann that, even after the material medicinal particles of a drug have been subdivided to the fullest extent, the continuation of the dynamization or trituration or succussion develops a spiritual curative agency, and that the higher the potency, the more subtle and more powerful is the curative action. Hahnemann says (*Organon*, third American edition, p. 101), "It is only by means of the spiritual influence of a morbific agent that our spiritual vital power can be diseased, and in like manner only by the spiritual operation of medicine can health be restored." This is absolutely denied by others. Thus at the present time there exist two schools among the adherents of homœopathy. On the one hand there are the Hahnemannians, the "Purists" or "High Potency" men, who still profess to regard the *Organon* as their Bible, who believe in all the teachings of Hahnemann, who adhere in their prescriptions to the single dose, the single medicine, and the highest possible potency, and regard the doctrine of the spiritual dynamization acquired by trituration and succussion as indubitable. On the other side there are the "Rational" or "Low Potency" men, who believe in the universality of the law of cure, but think that it cannot always be applied, on account of an imperfect materia medica and a lack of knowledge on the part of the physician. They believe that in many cases of severe and acute pain palliatives are required, and that they are free to use all the adjuvants at present known to science for the relief of suffering humanity—massage, balneology, electricity, hygiene, &c. The American Institute of Homœopathy, the national body of the United States, has adopted the following resolution and ordered it to be published conspicuously in each number of the *Transactions* of the society:—"A homœopathic physician is one who adds to his knowledge of medicine a special knowledge of homœopathic therapeutics. All that pertains to the great field of medical learning is his by tradition, by inheritance, by right."

The effect produced upon both the laity and the general profession of medicine by the introduction of homœopathy was salutary in many ways. It diminished the quantity of medicine that was formerly considered necessary for the eradication of disease, and thus revealed the fact that the *vis medicatrix naturæ* is often sufficient, with occasional and gentle assistance, to cure many diseases, especially those fevers that run a definite and regular course. In addition it prepared the medical mind for the reception of truths soon to be revealed by the aid of the microscope by Schwann, Pasteur, Chevreul, Davine, and Lister. The trend of the belief in the law *similia similibus curentur* is now forcibly shown by the rapidly increasing adoption of the serum therapy, which consists in the treatment of the most malignant diseases (diphtheria, lock-jaw, typhoid fever, tuberculosis, bubonic plague) by introducing into the system a modified form (similar) of those poisons that produce them in the healthy individual. Progressive physicians at the present time do not hesitate to acknowledge the homœopathic doctrine as true under certain conditions, their only objection to it being that it is "sectarian." It has been publicly announced that if the homœopathists would abolish the name "homœopathy," and remove it from their periodicals, colleges, hospitals, dispensaries, and asylums, they would be received within the fold of the regular profession. These conditions have been accepted by a few homœopathists who have become members of the most prominent medical association in the United States.

Homœopathy as it exists to-day can, in the opinion of its adherents, stand by itself, and its steady progress for a century in face of prolonged and determined opposition appears to its upholders to be evidence of its truth. There are still, indeed, in both schools of medical thought, men who stand fast by their old principles. There are homœopathists who can see nothing but evil in the practice of their brothers of the orthodox school, as there are allopathists who still regard homœopathy as a humbug and a sham. There are, however, liberal-minded men in both schools, who look upon the adoption of any safe and efficient method of curing disease as the birthright of the true physician, and who allow every man to prescribe for his patients as his conscience may dictate, and, provided he be educated in all the collateral branches of medical science, are ready to exchange views for the good of suffering humanity.

Great Britain.—Homœopathy is not rapidly extending in Great Britain, and its recognition has been slow. The first notice taken of the new system of therapeutics was by the Medical Society of London in 1826. In 1827 the physician of Prince Leopold of Saxe-Coburg, Dr Quin, who had previously studied homœopathy in Germany and practised it in Italy, came to England, and it was through his efforts that the system was introduced. Three other physicians, Dr Belluomini, Dr Romani, and Dr Tagliani, claimed priority, but careful research established Dr Quin's title. Quin was a successful man professionally and socially, and brought upon himself in a short time the anathema of the Royal College of Physicians. In 1844 Dr Henderson, professor of pathology in the University of Edinburgh, embraced the Hahnemannian system. A storm of opposition arose, and Professor J. Y. Simpson (the discoverer of chloroform anæsthesia) published a volume, with the alliterative title, *Homœopathy, its Tenets and Tendencies, Theoretical, Theological, and Therapeutical.* This brochure was answered by Professor Henderson, the title of his book being *Homœopathy Fairly Represented.* From 1827 to 1837 there were but a dozen practitioners of homœopathy in London, but during 1837 to 1847 the number increased to between seventy and eighty. In 1857 there were upwards of two hundred practitioners in the kingdom, with thirty-three institutions in which the law of similars was used as a basis of practice. In 1867 the increase was not so rapid, the number being 261. A society was formed about this period for "the protection of homœopathic practitioners and students," which proved of great value in binding the sect together. In 1870 congresses were established and annual meetings held, which have continued to the present time. In 1901 there were over three hundred homœopathic physicians in the British Isles, of whom between seventy and eighty were in London alone. There were seventy-nine chemists, of whom seventeen were located in London, and eighty-two towns and cities in the country contained from one to ten homœopathic practitioners each, together with many established chemists for dispensing homœopathic medicines. The British Homœopathic Medical Society, founded by Quin in 1844, is in a flourishing condition, having two hundred and eight members, thirty-four fellows, and thirty-one corresponding members in all portions of the world, including Australia, India, and Tasmania. The London Homœopathic Hospital was founded in 1850, and a few years afterwards moved to Great Ormond Street. During the cholera epidemic of 1854 the statistics of this hospital showed a mortality of 16·4 per cent., against 51·8 per cent. of other metropolitan charities. The London Homœopathic Hospital has a convalescent home under its management at Eastbourne. There are also dispensaries in Ealing and West Middlesex, Kensington, Notting Hill, and Bayswater. Similar institutions, all in a flourishing condition, are located in Bath, Birkenhead, Birmingham, Bootle, Bournemouth, Brighton, Bristol, Bromley, Cheltenham, Cheshire, Croydon, Dublin, Eastbourne, Edinburgh, Folkestone, Hastings and St Leonards, Ipswich, Leeds, Leicester, Liverpool, Newcastle, Northampton, Norwich, Oxford, Plymouth, Torquay, Tunbridge

the mother tincture, or 10 grains of a crude substance, are mixed with 90 drops of alcohol, or 90 grains of *saccharum lactis* (sugar of milk) respectively. The liquid is thoroughly shaken, or the powder carefully triturated, and the bottles containing them marked 1 X, meaning first decimal dilution or trituration. To make the 2 X potency, 10 drops or 10 grains of this first dilution or trituration are mixed with 90 drops of pure alcohol, or 90 grains of milk sugar, and are succussed or triturated as above described and marked 2 X dilution or trituration. This subdivision of particles may be continued to an indefinite degree. On the Hahnemannian or centesimal scale the medicines are prepared in the same manner, the difference being that 1 drop or grain is mixed with 99 drops or grains, to make the first centesimal, which is marked 1 c or 1 simply, and so on for the second and higher dilutions.

Wells, Weston-super-Mare. The journals now in existence are the *Homœopathic World*, the *Monthly Homœopathic Review*, the *London Homœopathic Hospital Reports*, and the *Journal of the British Homœopathic Society*. There are also several of lesser note. The *British Journal of Homœopathy* was first published in 1843, and was edited by Drs Drysdale, Russell, and Black. For many years it was the foremost homœopathic journal in the world. Its motto was *In certis unitas, in dubiis libertas, in omnibus charitas*. One reason why homœopathy has not advanced as rapidly in the British Isles as in America is said to be the discrimination exercised against it by the General Medical Council, and another is want of cohesion amongst the homœopaths themselves. An effort is, however, being made to obtain an independent license-conferring school.

Canada.—The early history of homœopathy can be traced back nearly to 1850 in the province of Quebec. In the Dominion of Canada the various provinces control the licensing of physicians, excepting in Quebec, which is the only province having a separate homœopathic board of examiners. This is under the control of the Montreal Homœopathic Association, and is known as the College of Homœopathic Physicians and Surgeons of Montreal. Three examiners are annually appointed by the association. Successful candidates receive the diploma of the college, and are entitled to add to their degree the letters M.C.H.P.S. A certificate of successful examination is forwarded to the lieutenant-governor at Quebec, who, "if satisfied of the loyalty, integrity, and good morals of the applicant, may grant him a license to practise surgery, physic, and midwifery, or either of them, in the province of Quebec." The word "loyalty" has been decided by the provincial secretary to mean a British subject. This is the only Government medical license now issued in the British empire, the others being by provincial boards or colleges of physicians and surgeons. In this province there are seventeen active practitioners of homœopathy. In 1894 there was no homœopathic institution in the province; at present the Montreal Homœopathic Hospital, valued at $20,000, and possessing already an endowment fund of $11,000, is in active operation. The hospital has forty beds, is well equipped for surgical and medical work, and has maternity and nurses' home annexes. The revenue is derived from the private rooms, which are extensively used by both schools for the treatment of patients. The facilities for surgical work in this hospital are superior to those of others in the city. The Phillips Training School of the hospital has about twenty graduates. New Brunswick, Nova Scotia, and Halifax have each two representatives of the system. In British Columbia there are four homœopathists, and in Manitoba four. Two homœopathic papers are published monthly — the *Homœopathic Record* in Montreal, and the *Homœopathic Messenger* in Toronto.

In 1870, in the province of Ontario, the three schools, allopathic, homœopathic, and eclectic, united for examining purposes into one board called the medical council, seventeen members representing the old school and five the two other systems. Besides these, the medical colleges sent eight representatives. Finally the eclectics were merged in the old school, the board appointing five of Hahnemann's followers for examining purposes; these designate two examiners in the branches of medicine bearing especially upon the homœopathic doctrine. There are eighty homœopathic physicians in the province, twenty of whom reside in Toronto. The homœopathic physicians are appointed on the staffs of the different allopathic hospitals and other public charities. There are homœopathic eye and ear specialists in London, Hamilton, and Toronto. Grace Hospital, with a capacity of 120 beds, is an imposing structure, and was begun as a dispensary in 1887. The hospital was incorporated in 1890, and in 1892 the present structure was erected.

Into Newfoundland, Prince Edward's Island, and the Labrador coast the system of Hahnemann has not penetrated.

Australia.—Homœopathy has been practised in Victoria since 1850 at least. It was introduced by a layman, who afterwards emigrated to India, there also to introduce the doctrine. The system is very popular in Adelaide, where there are at present eight homœopathic physicians. At Melbourne there are nine physicians of the new school, and a homœopathic hospital. In Sydney there are a dozen doctors practising the system, and ten chemists who dispense homœopathic medicines. Albury has one physician; Bendigo, one, and a chemist; Brisbane, one; Casino, one; Geelong, one, a dispensary, and a chemist; Maitland, one; and Freemantle, one. There are also homœopathic physicians in Christchurch and Dunedin in New Zealand. In the towns of Tasmania there are five.

United States.—Homœopathy was introduced into the United States by Dr Hans Birch Gram, who was born in Boston. His father being Danish, Gram in his eighteenth year went to Copenhagen, where he graduated in 1814. In 1823 he became acquainted with homœopathy, and brought a knowledge of it to America in 1825 when he settled in New York. The first homœopathic association was formed in 1833 in Philadelphia, the second in New York, 1834, and homœopathy became known in the different states somewhat in the following order:—New York, 1825; Pennsylvania, 1828; Louisiana, 1836; Connecticut, 1837; Massachusetts, 1837–38; Maryland, 1837; Delaware, 1837; Kentucky, 1837; Vermont, 1838; Rhode Island, 1839; Ohio, 1839; New Jersey, 1840; Maine, 1840; New Hampshire, 1840; Michigan, 1841; Georgia, 1842; Wisconsin, 1842; Alabama, 1843; Illinois, 1843; Tennessee, 1844; Missouri, 1844; Texas, 1848; Minnesota, 1852; Nebraska, 1862; Colorado, 1863; Iowa, 1871. After 1871 the spread of the system was rapid throughout every state in the Union. In the United States there are to-day 12,000 homœopathic physicians, of whom 1158 are women. Their numerical relation to all other sects is about 12·51 per cent. There are nine national societies, of which the American Institute of Homœopathy is the largest, having 1900 members. There are two sectional societies, composed of members from four to eight states, 33 state societies with an aggregate of 4000 members, 88 local organizations with 4500 members, 22 medical colleges with alumni numbering nearly 14,000 (six having connected with them alumni associations numbering 4711), 42 clubs with 659 members, 90 general hospitals, 50 general private hospitals, 45 special public hospitals, 36 special private, and 50 other eleemosynary institutions. Of the hospital capacity, 195 contain 16,037 beds, or 6735 more than was reported in 1895. There are 58 dispensaries, treating 287,507 persons with 740,319 prescriptions annually, being 61,782 patients and 245,521 prescriptions more than in 1895. It is safe to say that the patrons of the system amount to several millions. Besides these it may be noted that departments of homœopathy are connected with the universities of Boston, Michigan, Iowa, Minnesota, and Kansas City. There are 33 medical journals in active operation, and text-books and monographs for homœopathic students in all departments of medicine and surgery, written by members of the homœopathic school.

Germany.—In 1810 Hahnemann published his *Organon*, which was the starting-point of homœopathy in Germany. In 1811 an endeavour was made to found an institution in Leipzig in which practitioners might learn the new method of treatment theoretically and practically, but it was not a success, as the entire tide of professional opinion was against the system. In 1829, at the celebration of the fiftieth anniversary of Hahnemann's doctorate, the German Central Society was organized, holding its first meeting in 1830. In the university hospital of Munich some experiments were made to test the efficacy of homœopathic medicines, but these were not successful. In 1831 the Government prohibited homœopathists from dispensing their own medicines; this was a severe blow to the system. In 1834 there was a division among the homœopathists themselves, which much retarded the progress of the school. A homœopathic hospital was established about this time (January 1833) in Leipzig, but there was such constant wrangling among the physicians connected with it that its sphere of usefulness was curtailed, and it was finally converted into a dispensary. The Baden Homœopathic Society was established in 1834. The homœopathic hospital in Munich was established in 1836, but suffered a similar fate to that of Leipzig, and was converted into a dispensary. The rather equivocal success of these hospitals in Saxony and Bavaria was in direct contrast to the fate of two newly established hospitals in Austria, one in Vienna and the other in Linz, which were very successful, and aroused great interest both among physicians and laymen. During the political confusion of 1846 and 1849 there was complete stagnation of everything medical in Germany. But during all these years, though the public institutions were few, the literature on homœopathic subjects became very extensive, and exercised a significant influence upon the system in all parts of the world. Hahnemann died in 1843, and on the 10th of August 1851 a bronze monument to him was unveiled at Leipzig. The Leipzig dispensary lived thirty-three years. From 1842 to 1874 there were treated in this institution 65,106 patients. In 1901 there were about 250 homœopathic physicians in Germany; they appeared to be strongest at Berlin, in the province of Brandenburg, in Pomerania and Westphalia, Saxony, Hessen, and in Würtemberg. The homœopathic hospital at Leipzig, which was reorganized some years ago, is in successful operation; its patronage is large, its polyclinics are well attended, and its dispensaries good. At Berlin ground has been purchased upon which to erect a magnificent hospital. The polyclinic at Charlottenburg is well directed, and is under the patronage of distinguished personages. Homœopathic physicians give instruction in homœopathy to medical students during the various semesters, and have published a large volume on homœopathic materia medica. There is also issued at Berlin *Die Zeitschrift des Berliner Vereins homöopatischer Aerzte*, and at Leipzig *Die Allgemeine Homöopatische Zeitung*, besides several popular homœopathic newspapers for laymen. There is a homœopathic hospital in Munich, supported by the Homœopathic Hospital Society (comprising 86 members) and by small fees charged for treatment at the clinics. Neither the state of Bavaria nor the city contributes to the maintenance of this institution. There are eight homœopathic physicians in Munich, four in Augsburg, two in Nuremberg, and one

each in Regensburg, Landshut, Gassan, Rosenheim, Ulm, and Fürth, making a total of twenty. There is one homœopathic central pharmacy in Munich, two in Augsburg, one in Regensburg, and one in Metzingen, where there is also a homœopathic institution for poor patients. Homœopathy is patronized in most of the cities as well as in the country among the peasantry, especially in the Alpine regions. Since the death of the last holder, the professorship of homœopathy at Munich has been abolished.

Belgium.—In Antwerp there are three homœopathic physicians, and it is the only city in Belgium where there is an official homœopathic dispensary for the poor. This institution was founded by the municipality in 1891, and the physicians are paid from the public funds. In 1892 the annual prescriptions numbered 2922; in 1899 they had increased to 11,224. In Brussels there are fifteen homœopathic physicians. In 1897 a homœopathic polyclinic was founded, which in 1898 issued 7673 prescriptions, and in 1899 the number increased to 9128. In Ghent there are six homœopathic physicians and a private dispensary. In all the other cities of Belgium there are one or more physicians of the new school, their number being thirty-five. There are two homœopathic societies in Belgium, and an excellent medical journal.

Austria-Hungary.—Homœopathy was introduced into Austria about 1817, and in 1819 its practice was forbidden by law. Shortly afterwards the physician attending the Archduke John became a homœopath. In 1825 the doctrine was introduced into Vienna. To test the efficacy of the system Francis I. ordered that experiments be made with homœopathic medicines, and for this purpose a ward furnished with twelve beds was allotted. The results were satisfactory to the new system, and it made gigantic strides in Vienna. During the cholera epidemic of 1836 an increased impetus was given to the new school by the reported brilliant successes of the treatment. Societies were founded and journals published. In 1846 a second hospital was founded. In 1850 a third hospital was opened, and clinical lectures upon the system were delivered. In 1873 the Society of Homœopathic Physicians was formed. Between the years 1873 and 1893 homœopathy declined. In 1901, in thirty-seven cities and towns there were to be found about fifty physicians and two hospitals, and it was estimated that about seventy-five more were scattered in Moravia, Bohemia, Tirol, Salzburg, and the coast provinces. In Hungary the situation remains about the same as in former years. There is still a professorship of homœopathy at the University of Budapest, now held by Dr Bakody, and homœopathic clinics are held at the new Rochus Hospital in Ulloi Street, and also in the homœopathic department of the Hospital Bethesda of the Reformed Community. The Elizabeth Hospital, exclusively homœopathic, has existed for many years. There are societies of homœopathic physicians in successful operation, but on the whole the people appear to be much more indifferent to the system than in Germany, where a great number of societies and laymen interest themselves in homœopathy, and where homœopathic physicians deliver popular lectures upon their creed. The members of such societies in case of illness procure homœopathic remedies from the pharmacies of their respective organizations. There is a homœopathic hospital of some importance and also a children's hospital flourishing in Vienna. The physicians of the new school number less than a dozen.

Russia.—The homœopathic system of medicine was introduced into Russia in 1823. In 1825 great impetus was given to the new doctrine by the conversion of Dr Bigel, physician to the Grand Duke Constantine. In 1829 the grand duke ordered a series of experiments to be conducted to prove the truth or fallacy of homœopathy, and they demonstrated the success of the new school. In 1841 a hospital was established in Moscow, and in 1849 similar institutions were founded in Níjni-Novgorod. In St Petersburg from 1835 to 1845 there were sixteen homœopathic physicians. From 1845 to 1855 there was neither increase nor decrease in the number. From 1855 to 1865 the number had decreased to thirteen. In Moscow about the year 1875 there were thirty physicians practising homœopathy. In 1901 there were seventeen physicians in St Petersburg, three pharmacies, three dispensaries, and twelve hospitals. Homœopathy, it is said, continues to gain credit, penetrating to the remoter corners of the empire, while the number of its followers increases amongst all classes; but as will be seen by the foregoing figures, the number of homœopathic physicians rather decreases. There are at present 73 doctors who are practising the homœopathic method: In St Petersburg 17, Moscow 7, Odessa 7, Warsaw 6, Kiew 3, Riga 3, Charkow 2, Vilna 3, Tiflis 3, Dwinsk 2, Jitomir 2, and one each in Lodz, Lublin, Tilsit, Viatka, Yalta, Astrachan, Ekaterinoslaw, Gorodischtche, Gory, Gotopulow, Grodno, Insar, Kamenetz-Podolsk, Kanzeropol, Maikop, Pensa, Rostov, Saratow, Schidlovietz, Simferopol, Taganrog, Trostianetz. The number of medical men not being sufficient to satisfy the demand, in many places apothecaries and amateurs are acting as physicians; indeed, in many portions of Russia, especially in the villages, the followers of homœopathy are thrown upon their own resources. The number of homœopathic pharmacists has increased since 1896 from 17 to 26, *i.e.*, at St Petersburg 5, Moscow 2, Warsaw 2, Odessa 2, Charkow 2, Riga 2, Vilna 2, Rostow on Don 1, Novotcherkaosk 1, Taganrog 1, Kiew 1, Berditetew 1, Tiflis 1, Jitomir 1, Taratars 1, Viatka 1. Homœopathic societies are in more or less successful operation in the following cities: St Petersburg 3, Odessa 2, Charkow, Warsaw, Kiew, Moscow, Tiflis, Vilna, Stavropol, Jalta, Poltawa, and Thsernigow each 1. Two of the societies in St Petersburg, the "Hahnemann" in Odessa, and those in Warsaw and Charkow, possess pharmacies of their own, yielding fair profits and affording the possibility of increasing their means independently of private charity. There are two homœopathic journals, one of them published at St Petersburg and the other at Charkow. St Petersburg counts five dispensaries and one hospital. In 1881 the civil engineers proposed to commemorate the virtues of the Emperor Alexander II. by the erection of a hospital; a committee for collecting funds was created, and 58,064 roubles were handed to the Charity Society of the followers of homœopathy at St Petersburg for the erection and founding of a homœopathic hospital. The foundation stone of the edifice was laid on 19th June 1893, the Emperor Alexander III. giving 5000 roubles. The inauguration of a new dispensary and a pharmacy took place on the 19th of April 1898, and the hospital itself, intended originally for fifty beds, was opened on the 1st of November 1898. There are sixteen free beds, three of them being in the name of the Emperor Nicholas, the Empress Maria Feodorovna, and the Emperor Alexander III. On the 28th of January 1899 an imperial edict was issued granting the rights of public service to the doctors of the hospital and dispensaries of the Charity Society, thus placing them on an equality with the doctors of the prevailing medical school.

France.—Homœopathy was first introduced into France in 1830 by Count de Guidi, doctor of medicine, doctor of science, and inspector of the university, who practised in Lyons. About the same year Dr Antoine Petroz, widely known by his *Grand Dictionnaire des Sciences Médicales*, began practising homœopathy in Paris, and his establishment became the headquarters of the new system there. In 1835 Hahnemann himself came to the capital. In 1832 the homœopathic method of treating disease was introduced into the Hospice de Choisy, and in 1842 into the hospital of Carentan. Tessier practised the new doctrine in his wards in the Hospital St Marguérite, and in the Children's Hospital up to the year 1862, when he retired. The first homœopathic society was established in 1832 (the Société Gallicain), Hahnemann becoming president in 1835; in 1845 the Société de Médecine Homéopathique was organized; and in 1860 the two were united for the better interests of the school. This society is still in existence. The first public lecture in the new system was given in January 1835, the course being continued annually to 1869, when it was suspended. In 1901 there were at Paris three hospitals—the Hospital St Jacques with fifty-five beds, the Hahnemann Hospital with thirty-five beds, and the new Protestant Hospital for Children with twenty-five beds. The number of patients treated during the year 1900 at the three hospitals united averaged 630. At Lyons there is the Hospital St Luc, which is in a prosperous condition. The free consultations at the numerous dispensaries have remained stationary for the past few years. The medical journals published in French are *L'Art Médical*, *La Revue Homéopathique Belge*, *Journal Belge d'Homéopathie*, *La Thérapeutique Intégrale*, *La Revue Homéopathique Française*. Important scientific works have appeared on pathology and materia medica and tuberculosis. There are 56 physicians now practising homœopathy in Paris, and 151 in the provinces, making a total of 207. There are 22 dispensaries scattered through the republic. Pharmacies are numerous in all the larger cities and towns. In the year 1900 the medical officers of the republic having supervision over the medical department of the International Exhibition officially recognized the members of the homœopathic school, and arranged for the proper accommodation and reception of the International Congress of Homœopathic Physicians held in June. On the 30th of that month, with appropriate ceremonies, the remains of Hahnemann were removed from the cemetery of Montmartre and deposited in Père-la-Chaise, and a monument bearing a suitable inscription was erected to the memory of the founder of homœopathy.

Italy.—The Austrians when they entered Naples in 1821 brought homœopathy into Italy, the general in command of the army being a devoted friend of Hahnemann. In 1828 Dr Count Sebastian de Guidi came from Lyons and assisted in spreading the doctrine. During the period from 1830 to 1860 many physicians practised homœopathy, and the literature on the subject became extensive. A homœopathic clinic was established and a ward opened in Trinity Hospital at Naples, and a homœopathic physician was appointed to the Count of Syracuse. During the severe cholera epidemics of 1854, 1855, 1865 the success of homœopathic treatment of that disease was so marked under the care of Dr Rubini that the attention of the authorities was directed to the

system. In 1860 the homœopathic practice was introduced into the Spedale della Cesarea, and since that period homœopathy has been recognized with more or less favour in most of the cities. In the villages and smaller towns it is practically unknown, as indeed is all advanced medical therapeutics. At the present time the Italian Homœopathic Institute is recognized by royal warrant as an established institution, and its regulations are approved by the Government. It is composed of about fifty members, the greater part of whom are physicians and the remainder laymen, representing the majority of those following homœopathy in Italy. In Turin, the legal seat of the Homœopathic Institute, there is a hospital under the management of the State Association. A bequest of 150,000 francs has been made to the town of Verona for the establishment of ten charity beds in the general hospital for special homœopathic treatment, and Genoa also has obtained 20,000 francs as the nucleus of a fund for a similar purpose. Free dispensaries are now in operation in Rome, Florence, Naples, Milan, and Turin. The Academy of Medicine at Palermo provides a good dispensary for the care of the sick. The number of physicians who practise homœopathy has not increased for some years, but the former opposition and ridicule of the old-school physicians have entirely ceased. Apart from the allo-homœopathic pharmacies, which generally do not inspire great confidence, there are homœopathic pharmacies in Rome (1), Naples (4), Palermo (1), and Florence, Milan, and Turin (each 1). In Rome there are 5 practitioners; Naples, 12; Turin, 6; Milan, 3; Bologna, 1; Palermo, 3; Messina, 1; Florence, 1; Bavagua, 2; Casale, 1; Laloggia, Bellante, Noto, Melitello, Vittoria, Senorbi (Sardinia), each 1. The homœopathic medical press consists of the *Revista Omiopatica*, established in 1855, and *L' Omiopatico in Italia*, which is the organ of the Italian Homœopathic Institute, and first appeared in 1884. At Turin there is a small hospital with ten beds under the direction of homœopathic physicians.

Spain.—Homœopathy was introduced into Spain in 1829 by a physician to the Royal Commission sent by the king of Naples to attend the marriage of Maria Christina with Don Ferdinand VII. Shortly after this, a merchant of Cadiz visited Hahnemann in Coethen, and was cured of a serious disorder; he returned to Spain with a supply of homœopathic literature, and immediately sent a medical student to Leipzig to study the new system. In 1843 many cases of cholera were treated homœopathically in Madrid. The civil war, which did not terminate until 1840, arrested all medical investigation in Spain, but in 1843 there still existed in Madrid five pharmacies and a number of homœopathic physicians. About this time Dr Tosi Nuñez returned from an investigation of the new system with Hahnemann, and owing to his success in the treatment of disease was created one of the physicians of the bedchamber to the queen, who soon afterwards conferred upon him the title of marquis, with the grand crosses of the Charles III. and of the Civil Order of Beneficiencia. This recognition by high authority gave an impetus to homœopathy which has continued ever since. In Barcelona to-day there are no fewer than 44 homœopathic physicians and 3 pharmacies. The public institutions are the Academia Homœopatica, the Clinica Homœopatica, and the Dispensario Homœopatica, the last being under the supervision of the Academy. There are 3 veterinary surgeons in the city. In Madrid there are 10 physicians of the new school, 3 homœopathic chemists, and 2 homœopathic hospitals. In Valencia there are 7 physicians who practise the system. In Seville the Institut del Dessert is exclusively homœopathic, while there are between 60 and 70 physicians scattered throughout the provinces. In the Balearic Islands a journal devoted to the interests of the school was published, and in the Antilles the system is known and practised.

Denmark.—Homœopathy was unknown in Denmark until the year 1821, when Hans Christian Lund, a medical practitioner, adopted it. Hahnemann, however, had been both before and after that time consulted by Danes, and consequently homœopathic therapeutics was recognized in different parts of the country. Lund translated many of Hahnemann's works into Danish, as well as those of other eminent members of the new school. The spread of the system, however, has been very slow, and in many portions of the country it is unheard of. There are 8 homœopathic physicians in Denmark, 5 being in Copenhagen, 1 in Aarhus (in Jutland), 1 in Vester Broenderslev (Jutland), and 1 on the island of Bornholm. There is at present no hospital wherein homœopathy is practised, but £15,000 has already been subscribed for the purpose of erecting one, which will be built when the fund reaches £20,000 or £25,000. There is no special homœopathic pharmacy in Copenhagen, as all the chemists dispense homœopathic medicines. There are two homœopathic veterinary surgeons in Copenhagen.

Holland.—In Holland homœopathy makes but little progress, but there are now in every large town at least one homœopathic practitioner and several dispensaries. One homœopathic newspaper is published at Rotterdam. Amsterdam, Alfen, Apeldoorn, Haarlem, Nimeguen, Utrecht, Zaandam, and Zwolle have each a homœopathic physician. At The Hague there are two, and at Rotterdam two. At Utrecht the Society for the Propagation of Homœopathy in the Netherlands is in a flourishing condition.

Sweden and Norway.—In Sweden and Norway but little is known of the new system at present. It was introduced into Sweden in 1826. In 1855 an attempt was made to open a homœopathic polyclinic in Stockholm, which was unsuccessful. In 1865 an American physician settled in Norrköping and expounded Hahnemann's doctrine, and in 1868, after considerable opposition, a polyclinic was opened at Stockholm, but it was not of long continuance.

Switzerland can boast of but few physicians espousing the doctrine of Hahnemann. In the late 'fifties it excited some attention, and polemic articles were published in 1864 and 1865 to defend it from attacks by the professors of the university at Bern. A society was also established in the latter city, and a second in Aarau for the promulgation of homœopathy. A work on materia medica was issued in 1866, and in 1868 a journal devoted to the interests of the new system was issued. Since that period the system has seemed to stagnate. In Basel there is a small homœopathic hospital containing twelve beds. According to the latest information, the physicians of the new school are distributed as follows:—Aarau, 1; Basel, 4; Bonne, 4; Biel, 1; Geneva, 2; Grundelwald, 1; Mouthey, 1; Mithlenen (Bernese Oberland), 4; St Gallen, 1; Hun, 1; Zurich, 3.

South America.—In South America the system of Hahnemann is best known in Brazil, although there are homœopathic physicians scattered throughout the different states. It was introduced in 1818, and for a long time had a precarious existence. The Homœopathic Institute of Brazil was founded in 1842, with 56 members; and soon afterwards a special school for homœopathic instruction was opened, with a scheduled course of lectures. In 1847 dissension among the professors of homœopathy divided the old society, and a new organization was formed by the seceders, called the Academia Medico Homœopatha, but the record reads, "like nearly all the other institutions and societies in Brazil, it died of the chronic maladies of selfishness and envy." Bahia and Rio de Janeiro have witnessed many struggles in their efforts to place homœopathy on a sound footing in South America. Among the periodicals published representing the new school methods were the *Sciencia* and the *Hahnemannesta*, in 1846; the *Homœopatha*, in 1850; the *Medico Populao*, in 1851; and the *Athleta*, in 1852. In 1873 cholera raged in Rio, and the Government organized temporary infirmaries for the treatment of the disease. Some of these were placed under homœopathic supervision, and their work was fairly commendable. Of late years there has been little extension of the homœopathic principle in South America. There are at present homœopathic physicians in Amazonas, Pard-Belem, Maranhão, Pernambuco, Bahia, Rio de Janeiro (Campos), Maje, Marica, São Joao da Barra Nictheroy, Rio de Janeiro (capital), São Paulo, Campinas, São Paulo-Capital, Rio-Claro Tatuhij, Santos, Santa Catharina, São-Pedro, Pelotas, Porto Alegre, Rio Grande, and San Gabriel.

West Indies.—In Barbados there are five homœopathic physicians, an oculist, and an aurist.

Cuba.—Homœopathy was brought into Havana in 1842. In 1856 there was a weekly journal published in that city and also one in Santiago. In 1876 there were sixteen homœopathic physicians practising in Havana. There were also a Casa de Salud, or private hospital, where the system was practised, and one special homœopathic pharmacy. Homœopathy has declined in Cuba. In 1901 there were only four homœopathic physicians in Havana.

India.—Homœopathy is practised in Calcutta, and has a moderate clientèle. In that city alone are thirty homœopathic physicians and seven chemists. There are two journals published in the interests of the school, one the *Indian Review*, the other the *Calcutta Journal of Medicine*. A school of homœopathy and a hospital are in full operation. The Maitra Homœopathic Dispensary is doing serviceable work. Books have been published on the treatment of cholera, on the therapeutics of the plague, besides several homœopathic works in the Bengali language. There are homœopathic physicians in a few of the large towns, and a number of native-born Indians have at different times been sent to the homœopathic colleges in the United States to obtain medical degrees.

China.—There are two homœopathic physicians at Ningpo, where there is also a hospital and medical school, but it is impossible to obtain accurate information on the status of homœopathy in the various sections of the vast Chinese empire.

Cape Colony.—In Cape Town there are three physicians practising homœopathy, and in Kimberley one. (W. T. H.)

Honduras, a country of Central America, lying between 13° 10′ and 16° 2′ N., and 83° 20′ and 89° 30′ W. Here, as in other Central American states, there are but two seasons, the wet, from May to

November, and the dry, from November to May. On the moist lowlands of the Atlantic coast the heat is oppressive, but on the highlands of the interior the climate is delightful. At Tegucigalpa, on the uplands, a year's observations showed the maximum temperature to be 90° F. in May, and the minimum to be 50° F. in December, the range of variation during the whole year being within 40° F. The area is estimated at 46,250 square miles, and the population in 1900 was 587,500. The population of each of the fifteen departments was as follows in 1895: Tegucigalpa, 58,984; El Paraíso, 31,245; Choluteca, 33,665; Valle, 24,133; La Paz, 20,616; Comayagua, 21,713; Yoro, 16,424; Cortéz, 13,665; Santa Barbara, 26,008; Copán, 44,798; Gracias, 35,533; Intibucá, 18,957; Olancho, 35,737; Colón, 13,409; Bay Islands, 3990. The number of foreigners within the Republic was put at 6021. The European element in the population is small, the mass of the inhabitants being of Indian and mixed blood. The chief towns, with their populations in 1895, are: Tegucigalpa, the capital, 18,000; Juticalpa, 8000; Choluteca, Nacaome, and Santa Rosa, 7000 each; Gracias, 6000; Yoro, Yuscaran, and Comayagua, 5000 each; Truxillo, 3000.

The constitution, as amended in 1880, provides for a Legislative Chamber, consisting of deputies chosen for four years by direct popular vote. The number of deputies should be in the proportion of one for every 10,000 inhabitants, but, pending the formation of electoral districts, each department returns three, except the Islands, which return one. The President of the Republic is chosen for four years by direct popular vote, but failing an absolute majority, the Legislative Chamber chooses one of the three that received most votes. The President is eligible for a second, but not for a third consecutive term. The members of the cabinet are appointed by the President; they may take part in the discussions of the Chamber, but have no vote. The governors of the fifteen departments are appointed by the President.

Justice.—Justice is administered by a supreme court of five judges at Tegucigalpa, four appeal courts, courts in the departmental capitals, and subordinate local tribunals.

Religion and Instruction.—Though the prevailing faith is Roman Catholic, all forms of religion are free, and the state does not contribute to the support of any.

Primary instruction is obligatory, gratuitous, and secular. In 1898–99 there were within the Republic 627 primary schools, with 29,690 pupils. For secondary instruction there are 23 schools, with in all 718 pupils, and for manual and technical instruction there is a school directed by European masters at Tegucigalpa. In the capital there is also a central university, with faculties of law, medicine, science, and political science; at Comayagua there is a second faculty of law. In the year 1898–99 the sum of 110,060 pesos (£10,560) was devoted to instruction.

Defence.—Military service is obligatory from the twentieth to the thirtieth year of age in the active army; from the thirtieth to the fortieth in the reserve. The total force in 1898 amounted to 36,686 men. The Republic possesses two small steam revenue cutters.

Finance.—Of the revenue, 42 per cent. is derived from customs, and 34 per cent. from spirit and gunpowder monopolies, while war, finance, and public works demand the largest share of the expenditure. The revenue and expenditure for the years ending 30th June 1895, 1897, and 1899 were as follows (conversion being made at the rate of 23d. to the peso):—

	1895.	1897.	1899.
Revenue	£208,584	£229,296	£225,720
Expenditure	120,185	330,426	228,340

For the year 1900–01 (at the same conversion rate) the revenue was estimated at £232,610 and the expenditure at £232,015.

The existing external debt was contracted by a conversion loan in 1867, and three railway loans, 1867, 1869, and 1870, the total outstanding principal amounting in 1900 to £5,398,570. No interest has been paid since 1872, and the principal and arrears of interest together in 1900 amounted to £18,298,258. The official statement respecting the public debt on 31st July 1899 put its amount at 1,800,812 pesos, or £172,880, the entire external debt being simply ignored.

Production.—Bananas are the principal agricultural produce of Honduras. This fruit is easily, cheaply, and quickly grown, and its cultivation is steadily extending on the northern coast. Coffee is also grown, but as the bushes require some time to come to maturity, and the market prices of the product have for some years been low, coffee planting does not extend. The high prices obtained for rubber have aroused interest. Tobacco of fine quality is grown, but in such small quantities that there is none for export. Other products are cocoa-nuts, furniture wood, and sarsaparilla. The cattle industry is usually prosperous, large numbers of living animals and of hides being exported. Gold and silver mining are carried on successfully, but the annual output is not on the increase. Of local industries, the manufacture of straw hats is the most conspicuous.

Commerce.—The imports consist mostly of articles of common use or consumption—cotton goods, hardware, flour, provisions, with agricultural implements and mining machinery; while the exports consist of agricultural and mineral products. In 1898 the total imports amounted to the value of £273,080; in 1899, to £280,804. In 1898 the exports were valued at £257,572; in 1899, at £231,014. The exports in 1899 comprised bananas, £89,068; coffee, £10,644; cocoa-nuts, £13,181; cedar and mahogany, £8652; cattle, £26,136; mineral products, £67,696. The exports of gold in the year 1897–98 amounted to the value of £2780; in 1898–99, £2310; of bar silver in 1897–98, £92,860; in 1898–99, £55,466. The trade is mostly with the United States, which in 1899 sent 73 per cent. of the imports and took 83 per cent. of the exports. Germany sent 12 per cent. of the imports and Great Britain 8 per cent. In 1900 the British exports to Honduras amounted to £52,205, and the imports into the United Kingdom from Honduras to £2967.

Communications.—Means of communication are very defective. The only railway in the country is that from Puerto Cortez to La Pimienta, a distance of about 68 miles. This is a section of the proposed inter-oceanic railway for which the external debt of the Republic was incurred. For the completion of the line concessions, one after another, were granted, and expired or were revoked. The contract now in force (ratified 26th May 1900) grants a twenty-five years' lease of the already constructed line at an annual rent of 15,000 pesos gold (£3000) to an American syndicate, which undertook to complete the railway to the Pacific within seven years. Other railways, including one along the Atlantic coast, are projected. The capital is connected with other towns by fairly well made roads, which, however, are not kept in good repair. To Tegucigalpa from San Lorenzo the journey takes about three days, and from San Pedro Sula about seven days. Other roads have been contracted for, but at present in the country generally all travelling and transport are by mules and ox-carts over roads which defy description.

Honduras joined the Postal Union in 1879. In the year 1898 there were 241 post offices, and 1,106,034 pieces were handled. The telegraph lines, which are Government property, had in 1899 a length of 3186 miles, and were served by 155 telegraph offices, through which 538,941 messages passed in the course of the year.

Money and Credit.—There is at present only one bank, the Banco de Honduras at Tegucigalpa. It has the privilege of issuing bills, which are legal tender for all duties, taxes, and debts due to the Government; but there is no paper currency. The monetary unit is the silver peso, weighing 25 grammes, ·900 fine, and worth about 22d.

The metric system of weights and measures was introduced by law 1st April 1897, but the old Spanish system continues in general use.

AUTHORITIES.—H. W. BATES. *Central and South America.* London, 1882.—J. M. CACERES. *Geografia de Centro-America.* Paris, 1882.—C. CHARLES. *Honduras.* Chicago, 1890.—THOMAS R. LOMBARD. *The New Honduras.* New York, 1887.—C. SAPPER. *Das nördliche Mittel-Amerika. Reisen und Studien, 1888–98.* Brunswick, 1899.—MARIA SOLTERA. *A Lady's Ride across Spanish Honduras.* London, 1884.—MANUEL LEMUS and H. G. BOURGEOIS. *Breve Noticia sobre Honduras.* Tegucigalpa, 1897.—HENRY JALHAY. *La République de Honduras.* Antwerp, 1898.—*Report of the Council of the Corporation of Foreign Bondholders.* Appendix for 1900. London, 1900.—*Mensaje del Señor Presidente de la Republica de Honduras.* Tegucigalpa, 1900.—*Anuario Estadistico de la Republica de Honduras.* Tegucigalpa.—*United States Consular Reports.* Washington.—*British Diplomatic and Consular Reports.* London.—*Handbook of Honduras.* Bureau of the American Republics. Washington, 1892.

(W. W. R.)

Honduras, British, a British colony in Central America, on the eastern side of the base of the peninsula of Yucatan, with an area, including outlying cays, of

7562 square miles, lying between 18° 29′ and 15° 54′ N., and 89° 10′ and 87° 50′ W. It consists of a low-lying coast-line, intersected by rivers and lagoons, and fringed by cays, rising to higher ground in the interior, the Cockscomb mountains reaching a height of 4000 feet. The characteristic soils of the colony are known as Cahoon ridge (the vegetable alluvium along the river valleys), the Pine ridge (sandy tracts covered with pines, scrub, and wire grass), and Broken ridge (intermediate between these two). Besides these, there are swamp, savannah, and mountain. The Pine and Cahoon ridges afford abundant pasturages for cattle. Of the land in the colony, 50,000 acres are returned as cultivated and 4,573,870 as uncultivated. About 3,102,843 acres of land are in private ownership, and 1,736,565 remain ungranted—the latter area including lagoons, &c. Population (1900), 36,998; death-rate per thousand, 24·055. The population consists of (1) native Indians, to be found chiefly in forest villages in the west and north of the colony away from the sea-coast; (2) descendants of the English buccaneers, mixed with Scottish and German traders; (3) the woodcutting class known as "Belize Creoles," of more or less pure descent from African negroes imported, as slaves or as labourers, from the West Indies; (4) the Caribs of the southern districts, descendants of the population deported in 1796 from St Vincent, who were of mixed African and Carib origin; (5) a mixed population in the south, of Spanish-Indian origin, from Guatemala and Honduras; and (6) in the north another Spanish-Indian group which came from Yucatan in 1848. The mean maximum summer temperature is 90°. The maximum in 1900 was 94·8 (in May) and the minimum 51·8 (in February). The rainiest months are generally those from June to November. The average annual rainfall at Belize is about 80 inches. The value of the imports in 1900 was £239,754, and of the exports £260,113. The following are the principal articles of export, and their values in that year: mahogany, £87,717; logwood, £86,507; bananas, £18,221; cocoa-nuts, £5209; cedar, £3943; plantains, £3599.

BELIZE, the capital, at the mouth of the river of the same name, with a good roadstead for ships, is situated in 17° 29′ N. and 88° 8′ W.

The colony has fine soil, adapted to many kinds of tropical products, but most of it is covered by primeval forest or bush. There are no good roads, but there is excellent river and sea-coast communication. No minerals exist in sufficient quantities to justify mining, and an attempt made to develop a sponge industry was abandoned. The chief industry (now 200 years old) is the cutting of mahogany and logwood; other woods are cedar, rosewood, bullet-tree, fustic, lignum vitæ, santa maria, ironwood, &c. After timber, the principal products are bananas (exported to the United States), sugar, and rum (for home consumption only), Indian corn, cocoa-nuts, plantains, and cacao. The revenue in 1900 was £57,945 (of which £34,050 came from customs), and the expenditure was £49,240. The public debt was £33,763. The standard of currency is the gold dollar of the United States, British gold being legal tender. Subsidiary silver and bronze currency is coined specially for the colony, and there is a Government note issue. The tonnage of vessels (nearly all British, American, or Norwegian) entered during 1900 was 170,917 (sailing 24,371, steam 146,546), and cleared 169,180 (sailing 22,919, steam 146,261). The churches represented are Roman Catholic, Anglican, Wesleyan, Baptist, and Presbyterian; but none of them receives assistance from public funds. The bishopric of British Honduras is part of the West Indian Province of the Church of England. School-fees are charged at and grants-in-aid are made to elementary schools, which since 1894 have been under the control of a board, on which the religious bodies managing the schools are represented. In 1900 there were 38 schools, with 3391 children on the books and 2383 in average daily attendance. There are two police forces, the British Honduras constabulary consisting of 50 officers and men (of whom 18 are mounted), all stationed in the northern district; and the British Honduras police (an unmounted force) distributed in the other districts, consisting of 75 officers and men. There is a volunteer force (the Belize Light Infantry Corps) of 177 officers and men, and a volunteer fire brigade of 335 officers and men. There are no railways or telegraphs; in 1900 the revenue from the post office was £2211, and the number of mail pieces 254,451; the money order system is in force. In 1884 letters patent were proclaimed constituting the office of governor and commander-in-chief of British Honduras, which rendered the colony independent of Jamaica, to which it had been attached since its development from a settlement into a colony in 1862. The Legislative Council consists of the governor, with three official and five unofficial members nominated by the Crown. The Executive Council consists of the governor and five members (three *ex officio* and two nominated). The English common law extends to the colony, subject to modification by local ordinances. (F. CU.)

Honfleur, French town, in the arrondissement of Pont l'Évêque, department of Calvados, north-east of Caen, with terminal station on railway 124 miles from Paris. The port comprises the tidal harbour, floating basin of the west, basin of the centre, basin of the east, and fourth basin. The depth of water, ordinary spring tide, on the bar of the tidal harbour is 21 feet, and on the sill of the three first-named basins, respectively, 16·7, 20, and 22 feet. The total length of quayage is 10,915 feet. There entered in 1899 348 vessels of 146,646 tons (from England 260, of 76,097 tons), and cleared 352, of 150,993 tons; besides which there entered, in connexion with the coasting trade, 357 vessels of 16,724 tons, and cleared 354, of 16,730 tons. Population (1881), 9012; (1901), 9610.

Hong Kong, an important trading centre and military and naval position, belonging to Great Britain, situated on the south side of the Chinese province of Kwang-Tung. It is separated from the mainland by a narrow pass of about a quarter of a mile. A good military road, about 22 miles long, encircles the island. Hong Kong or Victoria harbour constantly presents an animated appearance, as many as 240 guns having been fired as salutes in a single day. Its approaches are strongly fortified. The steaming distance from Singapore is 1520 miles. Victoria, the capital, often spoken of as Hong Kong (population over 166,000, of whom about 6000 are European or American), stretches for about 4 miles along the north coast. Its breadth varies from half a mile in the central portions to 200 or 300 yards in the eastern and western portions. The town is built in three layers. The "Praya" or esplanade, 50 feet wide, is given up to shipping. Under the Praya reclamation scheme the land frontage will be extended by 250 feet and a depth of 20 feet secured at all states of the tide. A further extension of the naval dockyard was begun in 1902, and a new commercial pier was opened in 1900. The main commercial street runs inland parallel with the Praya. Beyond the commercial portion, on each side, lie the Chinese quarters, wherein there is a closely packed population. In 1888, 1600 people were living in the space of a single acre, and over 100,000 were believed to be living within an area not exceeding half a mile; and the overcrowding does not tend to diminish, for in one district, in 1900, it was estimated that there were at the rate of 640,000 persons on the square mile. The average, however, for the whole of the city is 126 per acre, or 80,640 per square mile. The second stratum of the town lies ten minutes' climb up the side of the island. Government House and other public buildings are in this quarter. There abound "beautifully laid out gardens, public and private, and solidly constructed roads, some of them bordered with bamboos and other delicately-fronded trees, and fringed with the luxuriant growth of semi-tropical vegetation." Finally, the third layer, known as "the Peak," and reached by a cable tramway, is dotted over with private houses and bungalows, the summer health resort of those who can afford them; here a new residence for the governor was begun in 1900. Excellent water is supplied to the town from the Pokfolun and Tytam

reservoirs, the former containing 68 million gallons, the latter 390 millions.

Climate.—The temperature has a yearly range of from 45° to 99°, but it occasionally falls below 40°, and ice occurs on the Peak. In January 1893 ice was found at sea-level. The wet season begins in May, after showers in March and April, and continues until the beginning of August. During this period rain falls almost without intermission. The rainfall varies greatly, but the mean is about 90 inches. In 1898 only 57·025 inches fell, while in 1897 there were 100·03 inches; in 1899, 72·7 inches, and in 1900, 73·7 inches. The damp is extremely penetrating. During the dry season the climate is healthy, but dysentery and intermittent fever are not uncommon. Bilious remittent fever occurs in the summer months, and smallpox prevails from November to March. The death-rate for 1899 was 23·8 per thousand, but the average was raised by an outbreak of plague, which caused 1428 deaths, and in 1900 it was 23·9; the birth-rate in the same years being 4·3 and 3·3 per thousand respectively.

Population, &c.—The following table shows the increase of population:—

Year.	Eur. and Amer. Civil.	Chinese Civil.	Total (inc. Mil and Naval Establishments and Indians, &c).
1881	3040	148,850	160,402
1891	4195	208,383	221,441
1897	5532	233,280	246,880

The floating population was in 1897 given as 31,752, a slight reduction since 1891. In 1901 the population, including 13,237 on the military and naval establishment, amounted to 297,212. This is exclusive of 100,000, all Chinese, in the new territory.

There were, in 1900, 104 schools open (13 Government and 91 grant-in-aid), with an average attendance of about 6000 scholars The Queen's College provides secondary education for about 135 boys. There are several hospitals, one of which is a Government institution. There were in 1899 over 3000 accounts in the Hong Kong Savings Bank, with deposits amounting to about $1,100,000. The total strength of the police force in 1899 was 827 (114 European, 350 Indian Sikhs, and 221 Chinese). In 1899 the strength of the military garrison was 3226.

Industries.—Beyond the cultivation of vegetable gardens there is practically no agricultural industry in the colony. But although only 400 acres are cultivated on Hong Kong island, and the same number of acres in Kowloon, there are 90,000 acres under cultivation in the new territory, of which over 7000 acres were in 1900 planted with sugar-cane. Granite quarries are worked. The chief industries are sugar-refining, the manufacture of cement, paper, bamboo and rattan ware, carving in wood and ivory, working in copper and iron, gold-beating and the production of gold, silver, and sandal-wood ware, furniture-making, umbrella- and jinricksha-making, and industries connected with kerosene oil and matches. The manufacture of cotton has been introduced, and 12,000 spindles are already at work. Ship- and boat-building, together with subsidiary industries, such as rope- and sail-making, appear less subject to periods of depression than other industries.

Trade.—Hong Kong being a free port, there are no official figures as to the amount of trade; but the value of the exports and imports is estimated as about £50,000,000 in the year. Among the principal goods dealt with are tea, silk, opium, sugar, flax, salt, earthenware, oil, amber, cotton and cotton goods, sandal-wood, ivory, betel, vegetables, live stock, and granite. The following are the figures of ships cleared and entered:—

Year.	Tonnage.	British.
1880	8,359,994	3,758,160
1890	13,676,293	6,994,919
1898	17,265,780	8,705,648
1899	18,101,309	8,665,828
1900	18,445,133	9,155,198

The Chinese junks rank next to British ships in the amount of trade. In 1899, 77,722 of these represented a tonnage of 4,664,162, and in 1900 their tonnage was 3,500,128. German and Japanese ships followed next, the former with 1,917,744 tons in 1900.

Finance.—The revenue and expenditure are given below:—

Year.	Revenue.	Expenditure.
1880	$1,069,948	$948,014
1890	1,995,220	1,915,350
1898	2,918,159	2,841,805
1899	3,610,143	3,162,792
1900	4,202,587	3,628,447

The main sources of revenue are licences, rent of government property, the post-office, and land sales. The light dues were reduced in 1898 from 2½ cents to 1 cent per ton. There is a public debt of about £340,000, borrowed for public works, which is being paid off by a sinking fund. The only legal tender is the Mexican dollar, and the British and Hong Kong dollar, or other silver dollars of equivalent value duly authorized by the governor. There are small silver and copper coins, which are legal tenders for amounts not exceeding two dollars and one dollar respectively. There is also a large paper currency in the form of notes issued by the Chartered Bank of India, Australia, and China, the Hong Kong and Shanghai Banking Corporation, and the National Bank of China, Limited. The foundation of new law courts was laid in 1900.

Administration.—Hong Kong is a Crown colony, administered by a governor, executive council, and legislative council. The executive council consists of the holders of certain offices and of such other members as the Crown may nominate. In 1890 there were nine members. The legislative council consists of the same officials and of six unofficial members. Of these three are appointed by the governor (of whom one must be, and two at present are, members of the Chinese community); one is elected from the chamber of commerce, and one from the justices of the peace. Under the Peking Treaty of 1860 the peninsula of Kowloon (about 5 miles in area) was added to Hong Kong. The population is about 27,000. There are several docks and warehouses, and manufactures are being developed. Granite is quarried in the peninsula.

New Territory.—An agreement was entered into in 1898 whereby China leased to Great Britain for ninety-nine years the territory behind Kowloon peninsula up to a line drawn from Mirs Bay to Deep Bay, and the adjoining islands, including Lantao. The new district, which extends to 376 square miles in area, is mountainous, with extensive cultivated valleys of great fertility, and the coast-line is deeply indented by bays. The alluvial soil of the valleys yields two crops of rice in the year. Sugar-cane, indigo, hemp, peanuts, potatoes of different varieties, yam, taro, beans, sesamum, pumpkins, and vegetables of all kinds are also grown. The mineral resources are as yet unknown. The population was estimated at about 100,000 in 1899. It consists of Puntis (or Cantonese), Hakkas ("strangers"), and Tankas. The Puntis are agricultural and inhabit the valleys, but they make excellent traders. The Hakkas are a hardy and frugal race, belonging mainly to the hill districts. The Tankas are the boat people or floating population. In the government of the new territory the existing organization is being as far as possible utilized.

AUTHORITIES.—Sir G. W. DES VŒUX. *Report on Blue-book of 1888.*—*A Handbook to Hong Kong.* Hong Kong, 1893.—*The China Sea Directory*, vol. iii., 3rd edition. 1894.—HENRY NORMAN. *The Peoples and Politics of the Far East.* London, 1895.—Sir E. HERTSLET. *Treaties between Great Britain and China and China and Foreign Powers.* London, 1896.—A. R. COLQUHOUN. *China in Transformation.* London, 1898.—*Treaty Series, No. 16.* 1898. —*The Chronicle and Directory for China, Japan, &c.* Hong Kong, 1899.—*Colonial Possessions Report, No. 84;* and other *Colonial Annual Reports.* (H. E. EG.)

Honiton, a municipal borough, market town, and railway station, in the Honiton parliamentary division of Devonshire, England, 16 miles east-north-east of Exeter. The old church has been restored. An attempt has been made to revive the lace industry, in which only about 250 women and children are now engaged, as compared with some 2000 employed in 1880. There is an important trade in butter. Area, 3134 acres. Population (1881), 3358; (1901), 3271.

Honolulu, the capital of the Hawaiian Islands, situated on the south-eastern coast of Oahu, at the mouth of the valley of Nuuanu, which runs back 6 miles to the famous pass in the Koolau range of mountains known as the "Pali." It has a small but safe harbour, and its central position at the "Cross-roads of the Pacific" makes it an important port of call. It is connected by lines of steamers with San Francisco, Vancouver, Japan, Manila, and the Australian states, and by lines

of sailing vessels with Hamburg, Bremen, and Liverpool, as well as with Boston, New York, and other American ports. In the year 1899 its exports were valued at $15,369,664, and its imports at $16,709,534, so that the total foreign commerce of this port amounted to $32,079,198. In 1900 the population was 39,306, including some 10,000 Hawaiians, upwards of 15,000 Asiatics, nearly or quite 5000 Portuguese, and 8000 other whites. The taxable property of the city is assessed at twenty-four million dollars, but its actual value is probably 50 per cent. greater than this. There are five banks, several hotels, two theatres, and many substantial buildings of brick and stone in the business quarter. The public buildings would do credit to any civilized country. It possesses a well-equipped paid fire department, public water-works, and both public and private electric light works. There are also a telephone system with 1200 subscribers, and a system of street tramcars. The city contains fifteen churches, the services in which are conducted in five different languages. It also maintains several hospitals, a maternity home, the Lunalilo Home for aged Hawaiians, and an asylum for the insane. It is the chief educational centre of the islands, having more than sixty schools, public and private, attended by 6000 pupils of all nationalities. The admirable Bishop Museum of Polynesian ethnology and the Honolulu Public Library of 14,000 volumes deserve special mention. The city also boasts a flourishing Art League, which exhibits twice a year, and a long list of benevolent, literary, social, and political societies. Numerous publications are issued daily, weekly, and monthly in five different languages. Honolulu combines the conveniences of a progressive American city with the charms of a mild and equable climate and a tropical flora. (W. D. A.)

Hood of Avalon, Arthur William Acland Hood, Baron (1824–1901), English admiral, born on 14th July 1824, was the younger son of Sir Alexander Hood of St Andries, Somerset, 2nd baronet, and grandson of Captain Alexander Hood, R.N., who, when in command of the *Mars*, fell in action with the French 74-gun ship *Hercule*, 21st April 1798. At the age of twelve Hood entered the navy, and whilst still a boy saw active service on the north coast of Spain, and afterwards on the coast of Syria. After passing through the established course of gunnery on board the *Excellent* in 1844–45, he went out to the Cape of Good Hope as gunnery mate of the *President*, the flagship of Rear-Admiral Dacres, by whom, on 9th January 1846, he was promoted to be lieutenant. As gunnery lieutenant he continued in the *President* till 1849; and in the following year he was appointed to the *Arethusa* frigate, then commissioned for the Mediterranean by Captain Symonds, afterwards the well-known admiral of the fleet. The outbreak of the Russian war made the commission a very long one; and on 27th November 1854 Hood was promoted to be commander in recognition of his service with the naval brigade before Sebastopol. In 1855 he married Fanny Henrietta, daughter of Sir C. F. Maclean. In 1856 he commissioned the *Acorn* brig for the China station, and arrived in time to take part in the destruction of the junks in Fatshan creek on 1st June 1857, and in the capture of Canton in the following December, for which, in February 1858, he received a post-captain's commission. From 1862 to 1866 he commanded the *Pylades* on the North American station, and was then appointed to the command of the *Excellent* and the government of the Royal Naval College at Portsmouth. This was essentially a gunnery appointment, and on the expiration of three years Hood was made Director of Naval Ordnance. He was thoroughly acquainted with the routine work of the office and the established armament of the navy, but he had not the power of adapting himself to the changes which were being called for, and still less of initiating them; so that during his period of office the armament of the ships remained sadly behind the general advance. In June 1874 he was appointed to the command of the *Monarch* in the Channel Fleet, from which he was relieved in March 1876 by his promotion to flag rank. From 1877 to 1879 he was a junior lord of the Admiralty, and from 1880 to 1882 he commanded the Channel Fleet, becoming vice-admiral on 23rd July 1880. In June 1885 he was appointed first sea lord of the Admiralty. The intense conservatism of his character, however, and his antagonistic attitude towards every change, regardless of whether it was necessary or not, had much to do with the alarming state of the navy towards 1889. In that year, on attaining the age of sixty-five, he was placed on the retired list and resigned his post at the Admiralty. After two years of continued ill-health, he died on 15th November 1901, and was buried at Butleigh on the 23rd. He had been promoted to the rank of admiral on 18th January 1886; was made K.C.B. in December 1885; G.C.B. in September 1889; and in February 1892 was raised to the peerage as Lord Hood of Avalon, but on his death the title became extinct. (J. K. L.)

Hood, John Bell (1831–1879), American soldier, was born in Owingsville, Bath county, Kentucky, on 1st June 1831, and graduated at the U.S. Military Academy in 1853. Transferred to the cavalry service in 1855, he fought the Indians, and while first lieutenant was (1859–60) cavalry instructor at West Point. In 1861 he resigned to enter the Confederate service, and was rapidly promoted from colonel to lieutenant-general, serving throughout the Virginia campaigns of 1862 and 1863. He was severely wounded at Gaines's Mills and Gettysburg. With a great reputation for fighting, he was next sent to Tennessee to reinforce General Braxton Bragg, and at the battle of Chickamauga, September 1863, he lost a leg. Six months later he returned to duty undaunted, and in the spring of 1864 led a corps under General Joseph E. Johnston, whom he was selected to succeed when that prudent officer was relieved by President Jefferson Davis. General Sherman compelled his retreat from Atlanta, after several days of stubborn fighting; and when Sherman's march to the sea followed, Hood undertook a counter-movement into Tennessee. On the 30th of November Hood was repulsed with heavy loss at Franklin, but still pushing on, he was disastrously defeated by General George H. Thomas at Nashville on 16th December, and relieved of command. Hood was a bold and valiant officer, but too rash and wasteful of strength to command discreetly at this declining stage of the Confederacy. After the war he engaged in business in New Orleans, where he died of yellow fever on 30th August 1879.

Hoogeveen (*i.e.*, high fen or moor), a village and commune in the Dutch province of Drenthe, 12 miles north-east of Meppel. Among numerous other colonies for the culture of the moorlands of Holland, one was established here in 1772. The industries include factories for the cutting of peat by machinery. The supply of peat is, however, becoming exhausted, and the population (11,924) is beginning to decline.

Hooghly, or Hugli, a town and district of British India, in the Burdwan division of Bengal, taking their name from the river. The town, situated on the right bank of the Hooghly, 24 miles above Calcutta by rail, forms one municipality with Chinsura, the old Dutch settlement, lower down the river. Population

"Luff, Boy!" By J. C. Hook.

(By permission of B. Brooks and Sons.)

(1881), 31,177; (1891), 33,060. It contains a Government college with 181 students in 1896–97, two high schools with 575 pupils, a Mahommedan college with 66 pupils, a hospital with a Lady Dufferin branch for female patients, and twelve printing-presses, issuing one English and two vernacular periodicals. The DISTRICT comprises an area of 1223 square miles, with a population in 1881 of 1,015,005, and in 1891 of 1,076,710, giving an average density of 880 per square mile. Classified according to religion, Hindus numbered 842,077; Mahommedans, 189,469; Christians, 633, of whom 162 were Europeans; "others," 2117. In 1901 the population was 1,050,365. Land revenue and rates (including Howrah) were Rs.15,39,805; the number of police was 837; the number of boys at school in 1896–97 was 43,754, being 57·2 per cent. of the male population of school-going age; the registered death-rate in 1897 was 32·87 per thousand. The district is traversed for 40 miles by the main line of the East Indian Railway, with a branch of 22 miles to the pilgrim resort of Tarakeswar, whence a steam tramway has been constructed for a farther distance of 31 miles. The Eden canal irrigates about 6000 acres, and there are several embankments and drainage works. Silk and indigo are both decaying industries, but the manufacture of brass and bell-metal ware is actively carried on at several places, to the estimated value of Rs.2,56,000 a year. There are several jute mills, a large flour mill, two bone-crushing mills, and a brick and tile works, with an annual out-turn valued at Rs.1,78,000.

Hook, James Clarke (1819-——), English painter, was born in London, 21st November 1819. His father, James Hook, a Northumbrian by descent, Judge Arbitrator of Sierra Leone, married the second daughter of Dr Adam Clarke, the renowned commentator on the Bible, who gave to the painter his second name. Young Hook's first taste of the sea was on board the Berwick smacks which took him on his way to Wooler. He drew with rare facility, and determined to become an artist; and accordingly, without any supervision, he set to work for more than a year in the sculpture galleries of the British Museum. In 1836 he was admitted a student of the Royal Academy, where he worked for three years, and elsewhere learned a good deal of the scientific technique of painting from a nephew of Opie. His first picture, called "The Hard Task," was exhibited in 1837, and represented a girl helping her sister with a lesson. Unusual facility in portraiture and a desire to earn his own living took the student into Ireland to paint likenesses of the Waterford family and others: here he produced landscapes of the Vale of Avoca, and much developed his taste for pastoral art; later, he was similarly engaged in Kent and Somersetshire. In 1842 his second exhibited work was a portrait of "Master J. Finch Smith": in this year he gained silver medals at the Royal Academy, and in 1843 he was one of the competitors in the exhibition of cartoons in Westminster Hall, with a 10 by 7 feet design of "Satan in Paradise." In 1844 the Academy contained a picture of a kind with which his name was long associated, an illustration of the *Decameron*, called "Pamphilius relating his Story," a meadow scene in bright light, with sumptuous ladies, richly clad, reclining on the grass. The British Institution, 1844 and 1845, set forth two of Hook's idylls, subjects taken from Shakespeare and Burns, which, with the above, showed him to be cultivating those veins of romantic sentiment and the picturesque which were then in vogue, but in a characteristically fresh and vigorous manner. "The Song of Olden Time" (Royal Academy, 1845) marked the artist's future path distinctly in most technical respects. It was in this year Hook won the Academy gold medal for an oil picture of "The Finding the Body of Harold." The travelling studentship in painting was awarded to him for "Rizpah watching the Dead Sons of Saul," in 1846; and he went for three years to Italy, having married Miss Rosalie Burton before he left England. Hook passed through Paris, worked diligently for some time in the Louvre, traversed Switzerland, and, though he stayed only part of three years in Italy, gained much from studies of Titian, Tintoret, Carpaccio, Mansueti, and other Venetians. Their influence thenceforth dominated the coloration of his pictures, and enabled him to apply the principles to which they had attained to the representation (as Bonington before him had done) of romantic subjects and to those English themes of the land and sea with which the name of the artist is inseparably associated. "A Dream of Ancient Venice" (R.A., 1848)—the first fruit of these Italian studies—"Bayard of Brescia" (R.A., 1849), "Venice" (B.I., 1849), and other works assured for Hook the Associateship of the Royal Academy in 1851. Soon afterwards an incomparable series of English subjects was begun, in many pastorals and fine and brilliant idylls of the sea and rocks. "A Rest by the Wayside" and "A Few Minutes to Wait before Twelve o'clock" proved his title to appear, in 1854, as a new and original painter. After these came "A Signal on the Horizon," 1857; "A Widow's Son going to Sea," "The Ship-Boy's Letter," "Children's Children are the Crown of Old Men," "A Coast-Boy gathering Eggs," a scene at Lundy; the perfect "Luff, Boy!" (1859), about which Ruskin broke into a dithyrambic chant; "The Brook," "Stand Clear!" "O Well for the Fisherman's Boy!" (1860), "Leaving Cornwall for the Whitby Fishing," "Sea Urchins," and a score more as fine as these. The artist was elected a full Academician on the 6th March 1860, in the place of James Ward.

See A. H. PALMER. "J. C. Hook, R.A.," *Portfolio*, 1888.—F. G. STEPHENS. "J. C. Hook, Royal Academician: His Life and Work," *Art Annual*, London, 1888.—P. G. HAMERTON. *Etching and Etchers*, London, 1877.

Hooker, Sir Joseph Dalton (1817-——), English botanist and traveller, son of the famous botanist Sir W. J. Hooker, was born on 30th June 1817, at Halesworth, Suffolk. He was educated at Glasgow University, and almost immediately after taking his M.D. degree there in 1839 joined Sir James Ross's Antarctic expedition, receiving a commission as assistant-surgeon on the *Erebus*. The botanical fruits of the three years he thus spent in the Southern Seas were the *Flora Antarctica*, *Flora Novæ Zelandiæ*, and *Flora Tasmanica*, which he published on his return. His next expedition was to the northern frontiers of India, and the expenses in this case also were partially defrayed by the Government. The party had its full share of adventure. Hooker and his friend Dr Campbell were detained in prison for some time by the raja of Sikkim, but nevertheless they were able to bring back important results, both geographical and botanical. Their survey of hitherto unexplored regions was published by the Calcutta Trigonometrical Survey Office, and their botanical observations formed the basis of elaborate works on the rhododendrons of the Sikkim Himalaya and on the flora of India. Among other journeys undertaken by Hooker may be mentioned those to Palestine (1860), Morocco (1871), and the United States (1877), all yielding valuable scientific information. In the midst of all this travelling in foreign countries he quickly built up for himself a high scientific reputation at home. In 1855 he was appointed assistant-director of Kew Gardens, and in 1865 he succeeded his father as full director, holding the post for twenty years. At the early age of thirty he was elected

a fellow of the Royal Society, and in 1873 he was chosen its president; he received three of its medals—a Royal in 1854, the Copley in 1887, and the Darwin in 1892. He acted as president of the British Association at its Norwich meeting of 1868, when his address was remarkable for its championship of Darwinian theories. Of Darwin, indeed, he was an early friend and supporter: it was he who, with Lyell, first induced Darwin to make his views public, and the author of *The Origin of Species* has recorded his indebtedness to Hooker's wide knowledge and balanced judgment. Sir Joseph Hooker is the author of numerous scientific papers and monographs, and his larger books include, in addition to those already mentioned, a standard *Student's Flora of the British Isles* and a monumental work, the *Genera Plantarum*, based on the collections at Kew, in which he had the assistance of Bentham. On the publication of the last part of his *Flora of British India* in 1897 he was created G.C.S.I., having been created a knight commander of that order twenty years before.

Hoorn, a town in the Dutch province of North Holland, on the Hoornsch Hop, an inlet of the Zuyder Zee, 27 miles by rail north-north-east of Amsterdam. Though in a decadent state, the town has erected a museum and (1893) a statue of Jan Pietersz Koen, the founder of Batavia, and has tramways to Alkmaar and Medemblik. The port owns seventy-nine vessels engaged in the fisheries of the Zuyder Zee. Population (1900), 10,714.

Hoosick Falls, a village of Rensselaer county, New York, U.S.A., on the river Hoosick and the Fitchburg Railway, at an altitude of 425 feet. It has a hilly site, and its plan is irregular. Its chief industry is the manufacture of agricultural implements. Population (1880), 4530; (1890), 7014; (1900), 5671, of whom 1092 were foreign-born.

Hopkins, Mark (1802–1887), American educationalist and writer on Christian ethics and evidences, was born in Stockbridge, Massachusetts, 4th February 1802. He graduated at Williams College, 1824, where, six years later, he became Professor of Moral Philosophy and Rhetoric. In 1832 he was licensed to preach in Congregational churches, and was President of Williams College from 1836 until 1872, when he resigned, but continued to teach moral philosophy in the college. As a teacher and writer he was fresh, clear, and stimulating, and his volume of lectures on *The Evidences of Christianity* (1846) was long a favourite text-book in American colleges. Of his other writings, the chief were *Lectures on Moral Science* (1862), and *The Law of Love and Love as a Law* (1869), a pleasant and suggestive compendium of Christian ethics. His general tone of thought and line of argument are at once optimistic and transcendental. Dr Hopkins took a lifelong interest in Christian missions, and was for many years President of the American Board of Commissioners for Foreign Missions (the American Congregational Mission Board). He died at Williamstown, 17th June 1887.

Hopkinson, John (1849–1898), English engineer and physicist, was born in Manchester on 27th July 1849. Before he was sixteen he attended lectures at Owens College, and at eighteen he gained a mathematical scholarship at Trinity College, Cambridge, where he graduated in 1871 as senior wrangler and first Smith's prizeman, having previously taken the degree of D.Sc. at London University and won a Whitworth Scholarship. Although elected a fellow and tutor of his college, he stayed up at Cambridge only for a very short time, preferring to learn practical engineering as a pupil in the works in which his father was a partner. But there his stay was equally short, for in 1872 he undertook the duties of engineering manager in the glass manufactories of Messrs Chance Brothers and Company at Birmingham. Six years later he removed to London, and while continuing to act as scientific adviser to Messrs Chance, established a most successful practice as a consulting engineer. His work was mainly, though not exclusively, electrical, and his services were in great demand as an expert witness in patent cases. In 1890 he was appointed director of the Siemens laboratory at King's College, London, with the title of professor of electrical engineering. His death occurred prematurely on 27th August 1898, when he was killed, together with one son and two daughters, by an accident the nature of which was never precisely ascertained, while climbing the Petite Dent de Veisivi, above Evolena. Dr Hopkinson presented a rare combination of practical with theoretical ability, and his achievements in pure scientific research are not less intrinsically notable than the skill with which he applied their results to the solution of concrete engineering problems. His original work is contained in more than sixty papers, all written with a complete mastery both of style and of subject-matter. His name is best known in connexion with electricity and magnetism. On the one hand he worked out the general theory of the magnetic circuit in the dynamo (in conjunction with his brother Edward), and the theory of alternating currents, and conducted a long series of observations on the phenomena attending magnetization in iron, nickel, and the curious alloys of the two which can exist both in a magnetic and non-magnetic state at the same temperature. On the other hand, by the application of the principles he thus elucidated he furthered to an immense extent the employment of electricity for the purposes of daily life. As regards the generation of electric energy, by pointing out defects of design in the dynamo as it existed about 1878, and showing how important improvements were to be effected in its construction, he was largely instrumental in converting it from a clumsy and wasteful appliance into one of the most efficient known to the engineer. Again, as regards the distribution of the current, he took a leading part in the development of the three-wire system and the closed-circuit transformer, while electric traction had to thank him for the series-parallel method of working motors. During his residence in Birmingham, Messrs Chance being makers of glass for use in lighthouse lamps, his attention was naturally turned to problems of lighthouse illumination, and he was able to devise improvements in both the catoptric and dioptric methods for concentrating and directing the beam. He was a strong advocate of the group-flashing system as a means of differentiating lights, and invented an arrangement for carrying it into effect optically, his plan being first adopted for the catoptric light of the *Royal Sovereign* lightship, in the English Channel off Beachy Head. Moreover, his association with glass manufacture led him to study the refractive indices of different kinds of glass; he further undertook abstruse researches on electrostatic capacity, the phenomena of the residual charge, and other problems arising out of Clerk Maxwell's electro-magnetic theory. His original papers were collected and published, with a memoir by his son, in 1901.

Hopkinsville, capital of Christian county, Kentucky, U.S.A., on the Louisville and Nashville and the Illinois Central Railways. It contains a state hospital for the insane, and South Kentucky College, a Christian institution. Population (1890), 5833; (1900), 7280, of whom 103 were foreign-born and 3243 were negroes.

HOPS AND HOP-GROWING.

Acreage, Production, and Consumption.

THE cultivation of hops in the British Isles is restricted to England, where it is practically confined to half-a-dozen counties—four in the south-eastern and two in the west-midland districts. In 1901 the English crop was reported by the Board of Agriculture to occupy 51,127 acres. The official returns as to acreage do not extend back beyond 1868, in which year the total area was reported to be 64,488 acres. The largest area recorded since then was 71,789 acres in 1878; the smallest was 49,735 acres in 1898. The difference is 22,054 acres, which represents the considerable proportion of nearly one-third of the maximum acreage. The extent to which the areas of hops in the several hop-growing counties vary from year to year is sufficiently indicated in Table I., which shows the

TABLE I.—*Hop Areas of England, 1895 to 1901—Acres.*

County.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
Kent . . .	35,018	33,300	31,661	30,941	31,988	31,514	31,242
Hereford . . .	7,553	6,895	6,542	6,651	7,227	7,287	7,497
Sussex . . .	7,489	5,908	5,174	4,829	4,949	4.823	4,800
Worcester . .	4,024	3,800	3,591	3,567	3,788	3,964	4,029
Hants . . .	2,875	2,494	2,306	2,263	2,319	2,231	2,133
Surrey . . .	1,783	1,623	1,416	1,313	1,388	1,300	1,232
Salop . . .	150	140	129	126	138	138	144
Gloucester . .	38	49	40	40	42	47	46
Suffolk . . .	10	4	2	3	4	4	4
Monmouth . .	.	..	2	2	..	..	..
Berks . . .	..	4	..	..	..	..	..
Total area . .	58,940	54,217	50,863	49,735	51,843	51,308	51,127

annual acreages over a period of seven years, 1895 to 1901. The proportions in which the acres of hops are distributed amongst the counties concerned vary but little year by year, and as a rule over 60 per cent., or nearly two-thirds, belongs to Kent. Of the total acreage in 1901, for example, 61·1 per cent. was returned by Kent, 14·7 by Hereford, 9·4 by Sussex, 7·9 by Worcester, 4·2 by Hants, 2·4 by Surrey, and the residual 0·3 per cent. jointly by Salop, Gloucester, and Suffolk. Arranging the counties in two geographical groups, it is found that 77·1 per cent. of the hop acreage of 1901 was in the south-eastern counties, and 22·9 per cent. in the west-midland counties.

Whilst the official figures concerning acreage are available as far back as the year 1868, those relating to production were not collected for the first time till 1885. The official estimators appointed for the purpose send in estimates of the total production of hops in their several districts, and these, divided by the number denoting the acreage cultivated, give the estimated average yield per acre. The home production of hops is always supplemented by imported produce, so that, in order to arrive at the actual quantities available for consumption, the two must be added together. These various details, as far back as the whole of the data are obtainable, form the subject of Table II. The quantities available for home consumption are not shown with complete accuracy in the last column of this table, as the exports have not been deducted. These, however, are relatively very small, and only amounted in 1901, for example, to 22,702 cwt., of which 17,796 cwt. were home-grown and 4906 cwt. imported. The wide fluctuations in the home production of hops are worthy of note, as they exercise a powerful influence upon market prices. The largest crop tabulated is that of 776,144 cwt. in 1886, and the smallest is that of

TABLE II.—*Acreage, Estimated Home Produce, and Imports of Hops into the United Kingdom in each Year, 1885 to 1901.*

Year.	Area.	Estimated Home Produce.	Yield per Acre.	Imports.	Home Produce plus Imports.
	Acres.	Cwt.	Cwt.	Cwt.	Cwt.
1885 . .	71,327	509,170	7·14	266,952	776,122
1886 . .	70,127	776,144	11·07	153,759	929,903
1887 . .	63,706	457,515	7·18	145,122	602,637
1888 . .	58,494	281,291	4·81	216,606	497,897
1889 . .	57,724	497,811	8·62	199,384	697,195
1890 . .	53,961	283,629	5·26	188,028	471,657
1891 . .	56,142	436,716	7·78	195,266	631,982
1892 . .	56,259	413,259	7·35	187,507	600,766
1893 . .	57,564	414,929	7·21	204,392	619,321
1894 . .	59,535	636,846	10·70	189,155	826,001
1895 . .	58,940	553,396	9·39	217,161	770,557
1896 . .	54,217	453,188	8·36	207,041	660,229
1897 . .	50,863	411,086	8·08	164,154	575,240
1898 . .	49,735	356,816	7·17	244,136	600,952
1899 . .	51,843	661,373	12·76	180,233	841,606
1900 . .	51,308	347,894	6·78	198,494	546,388
1901 . .	51,127	649,387	12·70	116,042	765,429
Average, 17 years	57,228	478,850	8·40	192,555	671,405

281,291 cwt. in 1888, the former being more than $2\frac{1}{2}$ times the size of the latter. The crop of 1899, estimated at 661,373 cwt., was so large that prices receded to such an extent as to leave no margin of profit to the great body of growers, whilst some planters were able to market the crop only at a loss. The calculated annual average yields per acre over the seventeen years 1885 to 1901 are seen to range between 12·76 cwt. in 1899 and 4·81 cwt. in 1888, the former being 50 per cent. more and the latter nearly 50 per cent. less than the seventeen years' average of 8·4 cwt. No other staple crop of British agriculture undergoes such wide fluctuations in yield as are here indicated. How great may be the variation even in two consecutive years is shown in Table III., which sets out, county by

TABLE III.—*Estimated Total Produce of Hops in England in 1901 and in 1900.*

County.	1901.	1900.	Increase in 1901.	Proportion of Crop.	
				1901.	1900.
	Cwt.	Cwt.	Cwt.	Per cent.	Per cent.
Kent . .	390,429	230,028	160,401	60·0	66·1
Hereford .	93,988	32,680	61,308	14·5	11·4
Sussex . .	65,396	39,717	25,679	10·1	9·4
Worcester .	50,392	26,935	23,457	7·8	7·7
Hants . .	31,320	12,229	19,035	4·8	3·5
Surrey . .	15,918	5,311	10,607	2·5	1·6
Others, three .	1,938	932	1,006	0·3	0·3
Total .	649,381	347,894	301,487	100·0	100·0

county, the estimated production in 1900 and 1901, and the percentage which the several counties contributed to each year's crop. As a matter of fact, the size of the crop produced bears no relation to the acreage under cultivation. For example, the 71,327 acres in 1885 produced only 509,170 cwt., whereas the 51,843 acres in 1899 produced 661,373 cwt.—19,484 acres less under crop yielded 152,203 cwt. more produce.

Comparing the quantities of home-grown hops with those of imported hops, the figures at the foot of Table II. indicate that, of the total available for consumption, about 70 per cent. on the average is home produce and about 30 per cent. is imported produce. The imports, however, do

not vary so much as the home produce. The latter has ranged between 776,144 cwt. in 1886 and 281,291 cwt. in 1888; whilst the highest and lowest imports were 266,952 cwt. in 1885 and 145,122 cwt. in 1887, the latter in the year following the biggest home-grown crop on record. Of the imports of 198,494 cwt. in 1900, as much as 147,378 cwt., or 73 per cent., came from the United States, where the crop is chiefly grown in the states of California, Oregon, Washington, and New York. Since 1895, however, the production in the last-named state has steadily declined, whilst the Pacific coast production has increased.

During the twenty years 1881–1900 the annual values of the hops imported into England fluctuated between the wide limits of £2,962,631 in 1882 and £427,753 in 1887. In five other years besides 1882 the value exceeded a million sterling, the amounts being £1,615,309 in 1884, £1,141,294 in 1893, £1,089,246 in 1883, £1,030,140 in 1898, and £1,001,728 in 1885. Next to 1887, the lowest annual sums were £447,253 in 1886, £524,297 in 1897, £591,582 in 1896, and £644,505 in 1895. The annual average value over the whole period was £944,062, whilst the annual average import was 200,562 cwt., consequently the average value per cwt. was £4 : 14s. The quantities and values of English-grown hops exported in the five years 1897 to 1901 were the following:—

Year.	Quantity. Cwt.	Value.
1897	10,779	£43,841
1898	12,955	71,321
1899	11,310	65,325
1900	14,999	63,526
1901	17,796	78,034

These figures represent an annual average export of 13,568 cwt., valued at £64,409, which is equivalent to £4 : 15s. per cwt. The quantities and values of the imported hops that are again exported are almost insignificant. Thus, in the three years 1899–1901 the re-exports were:—

	1899.	1900.	1901.
Quantity . .	3297 cwt.	3586 cwt.	4906 cwt.
Value . . .	£16,715	£10,005	£8305

Cultivation.

As the county of Kent has always taken the lead in hop-growing in England, and as it includes about two-thirds of the hop acreage of the British Isles, the recent developments in hop cultivation cannot be better studied than in that county. They have been well summarized by Mr Charles Whitehead in his sketch of the agriculture of Kent,[1] wherein he states that the hop grounds—or hop gardens, as they are called in Kent—of poor character and least suitable for hop production have been gradually grubbed since 1894, on account of large crops, the importation of hops, and low prices. At the beginning of the 19th century there were 290 parishes in Kent in which hops were cultivated. A century later, out of the 413 parishes in the county, as many as 331 included hop plantations. The hops grown in Kent are classified in the markets as "East Kents," "Bastard East Kents," "Mid Kents," and "Wealds," according to the district of the county in which they are produced. The relative values of these four divisions follow in the same order, East Kents making the highest and Wealds the lowest rates. These divisions agree in the main with those defined by geological formations. Thus, "East Kents" are grown upon the Chalk, and especially on the outcrop of the soils of the London Tertiaries upon the Chalk. "Bastard East Kents" are produced on alluvial soil and soils formed by admixtures of loam, clay loams, chalk, marl, and clay from the Gault, Greensand, and Chalk formations. "Mid Kents" are derived principally from the Greensand soils and outcrops of the London Tertiaries in the upper part of the district. "Wealds" come from soils on the Weald Clay, Hastings Sand, and Tunbridge Wells Sand. As each "pocket" of hops must be marked with the owner's name and the parish in which they were grown, buyers of hops can, without much trouble, ascertain from which of the four divisions hops come, especially if they have the map of the hop-growing parishes of England, which gives the name of each parish. There has been a considerable rearrangement of the hop plantations in Kent within recent years. Common varieties, as Colegate's, Jones's, Grapes, and Prolifics, have been grubbed, and Goldings, Bramlings, and other choice kinds planted in their places. The variety known as Fuggle's, a heavy-cropping though slightly coarse hop, has been much planted in the Weald of Kent, and in parts of Mid Kent where the soil is suitable. In very old hop gardens, where there has been no change of plant for fifty or even one hundred years in some instances, except from the gradual process of filling up the places of plants that have died, there has been replanting with better varieties and varieties ripening in more convenient succession; and, generally speaking, the plantations have been levelled up in this respect to suit the demand for bright hops of fine quality. A recent classification[2] of the varieties of English hops arranges them in three groups—(1) early varieties (*e.g.*, Prolific, Bramling, Amos's Early Bird); (2) mid-season or main-crop varieties (*e.g.*, Farnham Whitebine, Fuggle's, Old Jones's, Golding); (3) late varieties (*e.g.*, Grapes, Colgate's).

The cost of cultivating and preparing the produce of an acre of hop land tends to increase, on account of the advancing rates of wages, the intense cultivation more and more essential, and the necessity of freeing the plants from the persistent attacks of insects and fungi. In 1893 Mr Whitehead estimated the average annual cost of an acre of hop land to be £35 : 10s., the following being the items:—

	£	s.	d.
Manure (winter and summer)	£6	10	0
Digging	0	19	0
Dressing (or cutting)	0	6	0
Poling, tying, earthing, ladder-tying, stringing, lewing	2	3	0
Shimming, nidgeting, digging round and hoeing hills	3	0	0
Stacking, stripping, making bines, &c. . . .	0	17	0
Annual renewal of poles	2	10	0
Expense of picking, drying, packing, carriage, sampling, selling, &c., on average crop of, say, 7 cwt. per acre	10	5	0
Rent, rates, taxes, repairs of oast and tacks, interest on capital	6	0	0
Sulphuring	1	0	0
Washing (often two, three, or four times) . .	2	0	0
Total . . .	£35	10	0

Seven years later the average cost per acre in Kent had risen to quite £37.

The hops in Kent are usually planted in October or November, the plants being 6 feet apart each way, thus giving 1210 hills or plant-centres per acre. Some planters still grow potatoes or mangels between the rows the first year, as the plants do not bear much until the second year; but this is considered to be a mistake, as it encourages wire-worm and exhausts the ground. Many planters pole hop plants the first year with a single short pole, and stretch cocoanut-fibre string from pole to pole,

[1] *Jour. Roy. Agric. Soc.* 1899.

[2] J. Percival, "The Hop and its English Varieties," *Jour. Roy. Agric. Soc.* 1901.

and grow many hops in the first season. Much of the hop land is ploughed between the rows, as labour is scarce, and the spaces between are dug afterwards. It is far better to dig hop land if possible, the tool used being the Kent spud. The cost of digging an acre ranges from 18s. to 21s. Hop land is ploughed or dug between November and March. After this the plants are "dressed," which means that all the old bine ends are cut off with a sharp curved hop-knife, and the plant centres kept level with the ground.

Manuring.—Manure is applied in the winter, and dug or ploughed in. London manure from stables and cowhouses is used to an enormous extent. It comes by barge or rail, and is brought from the wharves and stations by traction engines; it costs from 7s. 6d. to 9s. per load. Rags, fur waste, sprats, wool waste, and shoddy are also put on in the winter. In the summer, rape dust, guano, nitrate of soda, and various patent hop manures are chopped in with the Canterbury hoe. Fish guano or desiccated fish is largely used; it is very stimulating, and more lasting than some of the other forcing manures.

The latest investigations into the subject of hop-manuring are those made by Dr Bernard Dyer and Mr F. W. E. Shrivell, at Golden Green, near Tonbridge, Kent. In the 1901 report [1] it is stated that the object in view is to ascertain how far nitrate of soda, in the presence of an abundant supply of phosphates and potash, is capable of being advantageously used as a source of nitrogenous food for hops. An idea long persisted among hop-growers that nitrate of soda was an unsafe manure for hops, being likely to produce rank growth of bine at the expense of quality and even quantity of hops. During recent years, however, owing very largely to the results of these experiments, and of corresponding experiments based upon these, which have been carried out abroad, hop farmers have much more freely availed themselves of the aid of this useful manure; and there is little doubt that the distrust of nitrate of soda as a hop manure which has existed in the past has been largely due to the fact that nitrate of soda, like many other nitrogenous manures, has often been misused (1) by being applied without a sufficient quantity of phosphates and potash, or (2) by being applied too abundantly, or (3) by being applied too late in the season, with the result of unduly delaying the ripening period. On most of the experimental plots nitrate of soda (in conjunction with phosphates and potash) has been used as the sole source of nitrogen; but it is, of course, not to be supposed that any hop-grower would use year after year, as is the case on some of the plots, nothing but phosphates, potash, and nitrate of soda. Miscellaneous feeding is probably good for plants as well as for animals, and there is a large variety of nitrogenous manures at the disposal of the hop-farmer, to say nothing of what, in its place, is one of the most valuable of all manures, namely, home-made dung. These experiments were begun in 1894 with a new garden of young Fuggle's hops. A series of experimental plots was marked out, each plot being one-sixth of an acre in area. The plots run parallel with one another, there being four rows of hills in each. The climate of the district is very dry.

The subjoined statement shows the annual yield of hops per acre on each plot, and also the average for each plot over the five years 1896–1900 :—

Weight of Kiln-dried Fuggle's Hops per Acre.

Plot.	Annual Manuring per Acre.	1896.	1897.	1898.	1899.	1900.	Average of 5 Years.
		Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.
A.	Phosphates and potash	13½	7½	8¼	20¼	8	11½
B.	Phosphates, potash, and 2 cwt. nitrate of soda	16½	9¼	10¼	22¼	9¾	13½
C.	Phosphates, potash, and 4 cwt. nitrate of soda	16½	12	12½	23	11	15
D.	Phosphates, potash, and 6 cwt. nitrate of soda	15¼	13	13	22½	10½	14¾
E.	Phosphates, potash, and 8 cwt. nitrate of soda	15	13½	15¼	23½	11	15½
F.	Phosphates, potash, and 10 cwt. nitrate of soda	15	13	15	24½	10½	15¾
X.	30 loads (about 15 tons) London dung	13	8	9¾	24½	10¾	13¾

In only one year did the very large dressing of 10 cwt. of nitrate of soda per acre afford any better result than was produced by the less heavy dressing of 8 cwt. per acre, and this was in 1899, a season of such abundance and such low prices that it may be regarded as an abnormal season. If the effect of this one season on the average be eliminated, the best results, as regards quantity, were obtained on plot E, receiving 8 cwt. of nitrate of soda per acre. But plot C, with 4 cwt. only of nitrate of soda per acre, has been on the average not more than ½ cwt. per acre behind plot E.

Valuations of the hops made by merchants and factors show that, on the whole, the market quality of the produce is very little affected by manuring. Moreover, chemical investigation of the hops appears to indicate that the brewing quality is not in any constant or definite way influenced by the manuring, except where the quantity of nitrate of soda has amounted to the large dressing of 8 cwt. or more per acre, a quantity which in some seasons would seem to have been prejudicial, although in one season it happened that the highest brewing value appertained to a sample grown with as much as 10 cwt. per acre.

The results of modern investigation show that it is very largely to the presence and proportion of soft resin that hops owe their preservative value, although the quality of hops is by no means wholly dependent on this one feature. The resin percentages in the samples grown on the several plots in 1898, 1899, and 1900 were the following :—

Plot.	Annual Manuring per Acre.	1898.		1899.		1900.	
		Total Resin.	Soft Resin.	Total Resin.	Soft Resin.	Total Resin.	Soft Resin.
		Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
A.	Phosphates and potash	14·15	9·21	15·07	8·60	14·53	8·90
B.	Phosphates, potash, and 2 cwt. nitrate of soda	14·30	9·20	16·59	8·83	15·09	8·51
C.	Phosphates, potash, and 4 cwt. nitrate of soda	14·06	9·04	15·87	9·27	14·46	8·16
D.	Phosphates, potash, and 6 cwt. nitrate of soda	13·57	8·60	14·90	8·70	13·46	7·62
E.	Phosphates, potash, and 8 cwt. nitrate of soda	14·11	8·85	14·49	8·96	13·30	7·18
F.	Phosphates, potash, and 10 cwt. nitrate of soda	12·21	7·91	15·47	9·41	12·77	6·77
X.	30 loads (about 15 tons) London dung	13·93	8·66	14·92	8·80	14·78	9·07

The general results so far seem to show that the purchase of town dung for hops is not economical, unless under specially favourable terms as to cost of conveyance, and that it should certainly not be relied upon as a sufficient manure. Home-made dung is in quite a different position, as not only is it richer, but it costs nothing for railway carriage. As a source of nitrogenous manure, purchased

[1] *Six Years' Experiments on Hop Manuring.* London, 1901.

dung is on the whole too expensive. There is a large variety of other nitrogenous manures in the market besides nitrate of soda, such, for instance, as Peruvian and Damaraland guano, sulphate of ammonia, fish guano, dried blood, rape dust, furriers' refuse, horn shavings, hoof parings, wool dust, shoddy, &c. All of these may in turn be used for helping to maintain a stock of nitrogen in the soil; and the degree to which manures of this kind have been recently applied in any hop garden will influence the grower in deciding as to the quantity of nitrate of soda he should use in conjunction with them, and also to some extent in fixing the date of its application.

Dressings of 8 or 10 cwt. of nitrate of soda per acre, such as are applied annually to plots E and F, would be larger than would be put on where the land has been already dressed with dung or with other nitrogenous manures; and even, in the circumstances under notice, although these plots have on the average beaten the others in weight, the hops in some seasons have been distinctly coarser than those more moderately manured—though in the dry season of 1899 the most heavily dressed plot gave actually the best quality as well as the greatest quantity of produce.

With regard to the application of nitrate of soda in case the season should turn out to be wet, present experience indicates that, on a soil otherwise liberally manured, 4 cwt. of nitrate of soda per acre, applied not too late, would be a thoroughly safe dressing. In the case of neither dung nor any other nitrogenous fertilizers having been recently applied, there seems no reason for supposing that, even in a wet season, 6 cwt. of nitrate of soda per acre applied early would be otherwise than a safe dressing, considering both quantity and quality of produce. In conjunction with dung, or with the early use of other nitrogenous manures, such as fish guano, rape dust, &c., it would probably be wise not to exceed 4 cwt. of nitrate of soda per acre.

As to the date of application, April or May is the latest time at which nitrate of soda should, in most circumstances, be applied, and probably April is preferable to May. The quantity used should be applied in separate dressings of not more than 2 cwt. per acre each, put on at intervals of a month. Where the quantity of nitrate of soda used is large, and constitutes the whole of the nitrogenous manure employed, the first dressing may, on fairly deep and retentive soils, be given as early as January; or, if the quantity used is smaller, say in February; while February will, in most cases, probably be early enough for the first dressing in the case of lighter soils. The condition of the soil and the degree and distribution of rainfall during both the previous autumn and the winter, as well as in the spring itself, produce such varying conditions that it is almost impossible to frame general rules.

The commonly accepted notion that nitrate of soda is a manure which should be reserved for use during the later period of the growth of the bine appears to be erroneous. The summer months, when the growth of the bine is most active, are the months in which natural nitrification is going on in the soil, converting soil nitrogen and the nitrogen of dung, guano, fish, rape dust, shoddy, or other fertilizers into nitrates, and placing this nitrogen at the disposal of the plants; and it appears reasonable, therefore, to suppose that nitrate of soda will be most useful to the hops at the earlier stages of their growth, before the products of that nitrification become abundant. This would especially be so in a season immediately following a wet autumn and winter, which have the effect of washing away into the drains the residual nitrates not utilized by the previous crop.

The necessity, whether dung is used or not, and whatever form of nitrogenous manure is employed, of also supplying the hops with an abundance of phosphates, cannot be too strongly urged. The use of phosphates for hops was long neglected by hop-planters, and even now there are many growers who do not realize the full importance of heavy phosphatic manuring. On soils containing an abundance of lime, no better or cheaper phosphatic manure can be used than ordinary superphosphate, of which as much as 10 cwt. per acre may be applied without the slightest fear of harm. But if the soil is not decidedly calcareous—that is to say, if it does not effervesce when it is stirred up with some diluted hydrochloric (muriatic) acid—bone dust, phosphatic guano, or basic slag should be used as a source of phosphates, at the rate of not less than 10 cwt. per acre. On medium soils, which, without being distinctly calcareous, nevertheless contain a just appreciable quantity of carbonate of lime, it is probably a good plan to use the latter class of manures, alternately with superphosphate, year and year about; but it is wise policy to use phosphates *in some form or other* every year in every hop garden. They are inexpensive, and without them neither dung, nitrate of soda, ammonia salts, nor organic manures can be expected to produce both a full vigorous growth of bine and at the same time a well-matured crop of full-weighted, well-conditioned hops.

The use of potash salts, on most soils, is probably not needed when good dung is freely used; but where this is not the case it is safer in most seasons and on most soils to give a dressing of potash salts. On some soils their aid should on no account be dispensed with.

Experiments in hop-manuring have also, for some years past, been conducted in connexion with the South-Eastern Agricultural College, Wye, Kent. The main results have been to demonstrate the necessity of a liberal supply of phosphates, if the full benefit is to be reaped from applications of nitrogenous manure.

Tying, Poling, and Picking.—Tying the bines to the poles or strings is essentially women's work. It was formerly always piecework, each woman taking so many acres to tie, but it is found better to pay the women 1s. 8d. to 2s. per day, that they may all work together, and tie the plants in those grounds where they want tying at once. The new modes of poling and training hop plants have also altered the conditions of tying.

Many improvements have been made in the methods of poling and training hops. Formerly two or three poles were placed to each hop-hill or plant-centre in the spring, and removed in the winter, and this was the only mode of training. Recently systems of training on wires and strings fastened to permanent upright poles have been introduced. One arrangement of wires and strings much adopted consists of stout posts set at the end of every row of hop-hills and fastened with stays to keep them in place. At intervals in each row a thick pole is fixed. From post to post in the rows a wire is stretched at a height of half a foot from the ground, another about six feet from the ground, and another along the tops of the posts, so that there are three wires. Hooks are clipped on these wires at regular intervals, and cocoa-nut-fibre strings are threaded on them and fastened from wire to wire, and from post to post, to receive the hop-bines. The string is threaded on the hooks continuously, and is put on those of the top wire with a machine called a stringer. There are several methods of training hops with posts or stout poles, wire, and string, whose first cost varies from £20 to £40 per acre. The system is cheaper in the long run than that of taking down the poles every year, and the wind does not blow down the

poles or injure the hops by banging the poles together. In another method, extensively made use of in Kent and Sussex, stout posts are placed at the ends of each row of plants, and, at intervals where requisite, wires are fastened from top to top only of these posts, whilst cocoanut-fibre strings are fixed by pegs to the ground, close to each hop-stock, whence they radiate upwards for attachment to the wires stretching between the tops of the posts. This method is more simple and less expensive than the system first described, its cost being from £24 to £28 per acre. In this case the plants require to be well "lewed," or sheltered, as the strings being so light are blown about by the wind. These methods are being largely adopted, and, together with the practice of putting cocoanut-fibre strings from pole to pole in grounds poled in the old-fashioned manner, are important improvements in hop culture, which have tended to increase the production of hops. Where the old system of poling with two or three poles is still adhered to they are always creosoted, most growers having tanks for the purpose; and, in the new methods of poling, the posts and poles are creosoted, dipped, or kyanized.

At Wye College, Kent, previously mentioned, different systems of planting and training have been tried, the alleys varying in width from 10 feet down to 5 feet, and the distance between the hills varying quite as widely, so that the number of hills to the acre has ranged from 1210 down to 660. The biggest crop was secured on the plot where the hills were 8 feet apart each way. As a rule, indeed, a wide alley and abundant space between the plants, thus allowing the hops plenty of air and light, produced the best results, besides effecting some saving in the cost of cultivation, as there were only 660 or 680 hills per acre. Of the various methods of training, the umbrella system gave the biggest crop in each of the three years 1899, 1900, 1901; and it seemed to be the best method, except in seasons when washing was required early, in which case the plants were not so readily cleared of vermin.

Much attention is required to keep the bines in their places on the poles, strings, or wire, during the summer. This gives employment to many women, for whose service in this and fruit-picking there is considerable demand, and a woman has no trouble in earning from 1s. 6d. to 1s. 10d. per day from April till September at pleasant and not very arduous labour. The hop-picking follows, and at this women sometimes get 4s. and even 5s. per day. This is the real Kent harvest, which formerly lasted a month or five weeks. Now it rarely extends beyond eighteen days, as it is important to secure the hops before the weather and the aphides, which almost invariably swarm within the bracts of the cones, discolour them and spoil their sale, as brewers insist upon having bright, "coloury" hops. Picking is better done than was formerly the case. The hops are picked more singly, and with comparatively few leaves, and the pickers are of a somewhat better type than the rough hordes who formerly went into Kent for "hopping." Kent planters engage their pickers beforehand, and write to them, arranging the numbers required and the date of picking. Many families go into Kent for pea- and fruit-picking, and remain for hop-picking. Without this great immigration of persons, variously estimated at between 45,000 and 65,000, the crops of hops could not be picked; and fruit-farmers also would be unable to get their soft fruit gathered in time without the help of immigrant hands. The fruit-growers and hop-planters of Kent have greatly improved the accommodation for these immigrants.

Concerning the general question as to the advisability or otherwise of cutting the hop bine at the time of picking, Principal A. D. Hall, of Wye College, has ascertained experimentally that if the bine is cut close to the ground at a time when the whole plant is unripe there are removed in the bine and leaves considerable quantities of nitrogen, potash, and phosphoric acid which would have returned to the roots if the bine had not been cut until ripe. The plant, therefore, would retain a substantial store of these constituents for the following year's growth if the bine were left. Chemical analyses have shown that about 30 ℔ of nitrogen per acre may be saved by allowing the bines to remain uncut, this representing practically one-third of the total amount of nitrogen in the hops, leaf, and bine together. There are also from 25 ℔ to 30 ℔ of potash in the growth, of which nine-tenths would return to the roots, with about half the phosphoric acid and a very small proportion of the lime. It has been demonstrated that by the practice of cutting the bines when the hops are picked the succeeding crop is lessened to the extent of about one-tenth. As to stripping off the leaves and lower branches of the plant, it was found that this operation once reduced the crop 10 per cent. and once 20 per cent., but that in the year 1899 it did not affect the crop at all. The inference appears to be that when there is a good crop it is not reduced by stripping, but that when there is less vigour in the plant it suffers the more. Hence, it would seem advisable to study the plant itself in connexion with this matter, and to strip a little later, or somewhat less, than usual when the bine is not healthy.

Drying.—After being picked, the hops are taken in pokes—long sacks holding ten bushels—to the oasts to be dried. The oasts are circular or square kilns, or groups of kilns, wherein the green hops are laid upon floors covered with horsehair, under which are enclosed or open stoves or furnaces. The heat from these is evenly distributed among the hops above by draughts below and round them. This is the usual simple arrangement, but patent processes are adopted here and there, though they are by no means general. The hops are from nine to ten hours drying, after which they are taken off the kiln and allowed to cool somewhat, and are then packed tightly into "pockets" 6 feet long and 2 feet wide, weighing one and a half cwt., by means of a hop-pressing machine, which has cogs and wheels worked by hand. Of late years more care has been bestowed by some of the leading growers upon the drying of hops, so as to preserve their qualities and volatile essences, and to meet the altered requirements of brewers, who must have bright, well-managed hops for the production of light clear beers for quick draught. The use, for example, of exhaust fans, recently introduced, greatly facilitates drying by drawing a large volume of air through the hops; and as the temperature may at the same time be kept low, the risk of getting over-fired samples is considerably reduced, though not entirely obviated. The adoption of the roller floor is another great advance in the process of hop-drying, for this, used in conjunction with a raised platform for the men to stand on when turning, prevents any damage from the feet of the workmen, and reduces the loss of resin to a minimum. The best results are obtained when exhaust fans and the roller floor are associated together. In such cases the roller floor, which empties its load automatically, pours the hop cones into the receiving sheets in usually as whole and unbroken a condition as that in which they went on to the kiln.

Pests of the Hop Crop.—In recent years the difficulties attendant upon hop cultivation have been aggravated, and the expenses increased, by regularly recurring attacks of aphis blight—due to the insect *Aphis* (*Phorodon*) *humuli* —which render it necessary to spray or syringe every hop

plant, every branch and leaf, with insecticidal solutions three or four times, and sometimes more often, in each season. Quassia and soft-soap solutions are usually employed; they contain from 4 ℔ to 8 ℔ of soft soap, and the extract of from 8 ℔ to 10 ℔ of quassia chips to 100 gallons of water. The soft soap serves as a vehicle to retain the bitterness of the quassia upon the bines and leaves, making them repulsive to the aphides, which are thus starved out. Another pest, the red spider, *Tetranychus telarius*—really one of the "spinning mites"—is most destructive in very hot summers. Congregating on the under surfaces of the leaves, the red spiders exhaust the sap and cause the leaves to fall, producing the effect known in Germany as "fire-blast." The hop-wash of soft soap and quassia, so effective against aphis attack, is of little avail in the case of red spider. Some success, however, has attended the use of a solution containing 8 ℔ to 10 ℔ of soft soap to 100 gallons of water, with three pints of paraffin added. It is necessary to apply the washes with great force, in order to break through the webs with which the spiders protect themselves. Hop-washing is done by means of large garden engines worked by hand, but more frequently with horse engines. Resort is sometimes had to steam engines, which force the spraying solution along pipes laid between the rows of hops.

Mould or mildew is frequently the source of much loss to hop-planters. It is due to the action of the fungus *Podosphæra castagnei*, and the mischief is more especially that done to the cones. The only trustworthy remedy is sulphur, employed usually in the form of flowers of sulphur, from 40 ℔ to 60 ℔ per acre being applied at each sulphuring. The powder is distributed by means of a machine drawn by a horse between the rows. The sulphur is fed from a hopper into a blast-pipe, whence it is driven by a fan actuated by the travelling wheels, and falls as a dense, wide-spreading cloud upon the hop-bines. The first sulphuring takes place when the plants are fairly up the poles, and is repeated three or four weeks later; and even again if indications of mildew are present. It may be added that sulphur is also successfully employed in the form of an alkaline sulphide, such as solution of "liver of sulphur," a variety of potassium sulphide. (W. FR.)

Höritz (the "Oberammergau of the Bohemian Forest"), a commune in the district of Krumau in the Bohemian Forest, South Bohemia, Austria, noted for the periodical performances of passion-plays by the peasantry, which attract as many as 20,000 visitors. Population (1890), 1094; (1900), 1232, all German.

Hořitz, a town in the government district of Königgrätz, Bohemia, Austria. Sugar refining is now carried on, in addition to its older textile, brewing, and milling industries. It possesses a monument to Ziska, the Hussite leader, who obtained a victory over the Bohemian nobles here in 1423. Population (1890), 6910; (1900), 7771, all Czech.

Hornby, Sir Geoffrey Thomas Phipps (1825–1895), British admiral of the fleet, son of Admiral Sir Phipps Hornby, the first cousin and brother-in-law of the 13th Earl of Derby, by a daughter of Lieutenant-General Burgoyne, commonly distinguished as "Saratoga" Burgoyne, was born on 20th February 1825. At the age of twelve he was sent to sea in the flagship of Sir Robert Stopford, with whom he saw the capture of Acre in November 1840. He afterwards served in the flagship of Rear-Admiral Josceline Percy at the Cape of Good Hope, was flag-lieutenant to his father in the Pacific, and came home as a commander. When the Derby ministry fell in December 1852 young Hornby was promoted to be a captain. Early in 1853 he married, and as the Derby connexion put him out of favour with the Aberdeen ministry, and especially with Sir James Graham, the first lord of the Admiralty, he settled down in Sussex as manager of his father's property. He had no appointment in the navy till 1858, when he was sent out to China to take command of the *Tribune* frigate and convey a body of marines to Vancouver Island, where the dispute with the United States about the island of San Juan was threatening to become very bitter. As senior naval officer there Hornby's moderation, temper, and tact did much to smooth over matters, and a temporary arrangement for joint occupation of the island was concluded. He afterwards commanded the *Neptune* in the Mediterranean under Sir William Fanshawe Martin, was flag-captain to Rear-Admiral Dacres in the Channel, was commodore of the squadron on the west coast of Africa, and, being promoted to rear-admiral in January 1869, commanded the training squadron for a couple of years. He then commanded the Channel Fleet, and was for two years a junior lord of the Admiralty. It was early in 1877 that he went out as commander-in-chief in the Mediterranean, where his skill in manœuvring the fleet, his power as a disciplinarian, and the tact and determination with which he conducted the foreign relations at the time of the Russian advance on Constantinople, raised his reputation to a very great height and won for him the K.C.B. He returned home in 1880 with the character of being perhaps the most able commander on the active list of the navy. His later appointments were to the Royal Naval College as president, and afterwards to Portsmouth as commander-in-chief. On hauling down his flag he was appointed G.C.B., and in May 1888 was promoted to be admiral of the fleet. From 1886 he was principal naval aide-de-camp to Queen Victoria, and in that capacity, and as an admiral of the fleet, was appointed on the staff of the German Emperor during his visits to England in 1889 and 1890. He died, after a short illness, on 3rd March 1895. By his wife, who predeceased him, he left several children, daughters and sons, one of whom, a major in the artillery, won the Victoria Cross in South Africa in 1900. His life has been written by his daughter, Mrs Fred. Egerton. (J. K. L.)

Horncastle, a market town and railway station in the Horncastle parliamentary division of Lincolnshire, England, on the Bain and Waring, 21 miles east of Lincoln. There are large horse, cattle, and sheep markets. Area of parish (an urban district), 1421 acres. Population (1881), 4818; (1901), 4038.

Horne, Richard Hengist (1803–1884), English poet and critic, was born in London on New Year's Day 1803. He was intended for the army, and entered at Sandhurst, but receiving no commission, he left his country and joined the Mexican navy. He served in the war against Spain, and underwent many adventures. Returning to England, he started upon a literary career, and in 1836–37 edited *The Monthly Repository*. In the latter year he published two tragedies, *Cosmo de Medici* and *The Death of Marlowe*, and in 1841 a *History of Napoleon*. The book, however, by which he alone lives in memory is his epic of *Orion*, which appeared in 1843. It was published originally at a farthing, was widely read, and passed through many editions. In the next year he set forth a volume of critical essays called *A New Spirit of the Age*, in the composition of which he was assisted by his friend Elizabeth Barrett, with whom, from 1839 to her marriage in 1846, he conducted a voluminous correspondence. In 1852 he went to Australia in company with William Howitt, and was away from England for seventeen years. On his return in 1869

he continued an industrious literary career, but none of his later works can be considered important. He died at Margate 13th March 1884. Horne's extraordinary versatility resulted in a lack of concentration in performance: he was industrious and talented, but, except in the case of *Orion*, he never attained to a very high degree of distinction. That poem, indeed, has much of the quality of fine poetry; it is earnest, vivid, and alive with spirit. But Horne early drove his talent too hard, and continued to write when he had little left to say. In criticism he had insight and quickness. He was one of the first to appreciate Keats and Tennyson, and he gave valuable encouragement to Elizabeth Barrett. His old age was rich in memories of the beginnings of the leading spirits of Victorian poetry. (A. WA.)

Hornellsville, a city of Steuben county, New York, U.S.A., on the river Canisteo, at an altitude of 1161 feet. It is on the Erie and the Pittsburg, Shawmut and Northern Railways. The car works of the Erie Railway are located here. Population (1880), 8195; (1890), 10,996; (1900), 11,918, of whom 1230 were foreign-born.

Horodenka, a district town and manufacturing centre in eastern Galicia, on a southern tributary of the Dniester. It has considerable corn trade, and manufacture of soap, candles, potash, &c. Population, chiefly Ruthenians (1890), 11,162; (1900), 11,615.

Hořowitz, the chief town of a government district in West Bohemia, Austria, a station on the railway between Prague and Pilsen. It has manufactures of enamelled wares and matches, corn-milling and brewing. Population, Czech (1900), 3570.

Horse-breeding. See AGRICULTURE.

Horse-racing.—GREAT BRITAIN. Horse-racing, usually described as "the national sport," has greatly advanced in general popularity. The effect of this is not wholly satisfactory, because of the large amount of gambling thus encouraged, with its inevitable evils; but there is no doubt that the best specimens of the English thoroughbred horse are the finest animals of their kind in existence. The value of an infusion of the blood for chargers, hunters, hacks, and other varieties is scarcely to be overestimated; and the only way of ascertaining what animals may be most judiciously employed for breeding purposes is to submit them to the tests of preparation for and performance on the Turf. Racing is therefore a practical necessity. On some accepted authority, the origin of which is not to be traced, five races run each season by three-year-olds are distinguished as "classic." Of these the chief, by universal consent, is the Derby, which takes place at Epsom during the week which includes the 31st May. The Epsom course, on which the Derby has been run since its origin in 1780, is by no means a good one, in consequence of the abrupt turn at Tattenham Corner; and the severe descent after this turn is made is also held to be a disadvantage, though a really good horse should be able to act on ascents, descents, and level ground with equal facility. In many respects the St Leger, run at Doncaster about the middle of September, is a better test, as here colts and fillies meet when both are presumably able to do themselves the fullest justice. September, indeed, has been called "the Mares' Month," for though fillies are eligible to run in the Derby, they are very frequently out of sorts and always more or less uncertain in their performances during the summer—only three have been successful in 121 contests for the stake—whereas in the autumn their numerous victories in the St Leger prove them to be at their best.

Classic races in England.

During the period 1884–94 fillies, who now carry 3 lb less than colts, won the St Leger on twelve occasions—an undue proportion, as not 15 per cent. of the runners were mares,—and it was the recognition of this fact which induced an alteration of the weights in the year 1882, previously to which fillies had carried 5 lb less than colts. The Doncaster course is superior for racing purposes to that at Epsom, where the Oaks, another of the "classic races," is run on the Friday following the Derby; the other two contests which come into this category being the Two Thousand Guineas for colts and fillies, and the One Thousand Guineas for fillies only. These races take place at Newmarket during the First Spring Meeting, the former always on a Wednesday, the latter on Friday. The expression "a Derby horse" is common, but has no precise significance, as the three-year-olds vary much in capacity from year to year. It is generally understood, for instance, that Ormonde, who won the Derby in 1886, must have been at least 2 stone superior to Sir Visto or Jeddah, who were successful in 1895 and 1898. By their ability to carry weight the value of horses is estimated on the Turf. Thus one horse which beats another by a length over a distance of a mile would be described as a 5-lb better animal.

The term "handicap horse" once had a significance which it does not now possess. In handicaps horses carry weight according to their presumed capacity, as calculated by handicappers who are licensed by the Jockey Club and employed by the directors of different meetings. The idea of a handicap is to afford chances of success to animals which would have no prospect of winning if they met their rivals on equal terms; but of late years the value of handicaps has been so greatly increased that few owners resist the temptation of taking part in them. Horses nowadays which do not run in this kind of contest are very rare, though a few, such as Ormonde, Isinglass, and Persimmon, never condescended to what may be regarded as an inferior class of sport. The late duke of Westminster did not hesitate to put his Derby winner Bend Or into some of the chief handicaps; and it is, of course, a great test of merit when horses run in these contests, and, carrying heavy weights, show marked superiority to rivals of good reputation more lightly burdened. St Gatien, who won the Derby in 1884; Robert the Devil, who won the St Leger in 1880 and on several occasions beat the Derby winner Bend Or; and La Flèche, who won the Oaks and the St Leger in 1892, added to the esteem in which they were held by their successes under heavy weights, the colts in the Cesarewitch, the filly in the Cambridgeshire. Of the chief handicaps of the year, special mention may be made of the City and Suburban, run at the Epsom Spring Meeting over a mile and a quarter; the Kempton Park Jubilee, over a mile; the Ascot Stakes, two miles, and the Royal Hunt Cup, one mile; the Stewards' Cup at Goodwood, six furlongs; the Cesarewitch Stakes and the Cambridgeshire Stakes at Newmarket, the former two miles and a quarter, the latter 2000 yards, otherwise described as "a mile and a distance"—a distance on the Turf being a fixed limit of 240 yards. The cups at Manchester and Liverpool are also handicaps of some note, though it may be remarked that the expression "a cup horse" is understood to imply an animal capable of distinguishing himself over a long distance at even weights against the best opponents. There are many other valuable stakes of almost equal importance, diminishing to what are known as "selling handicaps," the winners of which are always put up for sale by auction immediately after the race, in the lowest class of them the condition being that the winner is to be offered for £50. No stake

Handicap horses.

Park, where Memoir, La Flèche, Best Man, and other good animals were bred, has now been abandoned.

Trainers and jockeys. In many cases trainers have graduated from jockeys. The usual charge to an owner is 50s. a week per horse, but, as regards the cost of a horse in training, to this there are various additions irrespective of entrances to races, forfeits, travelling, jockeys' fees, &c. The recognized sum paid to a jockey is 3 guineas for a losing mount, 5 guineas for winning. In many cases special terms are made; the principal owners usually have a claim on a rider's services, and for this call as much as £5000 per annum, exclusive of the usual riding fees, has been given.

From time immemorial until within a very recent period jockeys rode in much the same style, though, of course, with varying degrees of skill. Many hundreds of boys exercise daily at Newmarket and other training grounds, all of them necessarily having a tight seat in the saddle, for the thoroughbred horse is, as a rule, high-couraged and apt to play violent tricks; but though most of these lads find chances to distinguish themselves in trials and races for apprentices, probably not five per cent. grow into professional jockeys, increasing weight keeping many from the business, as a jockey has few chances unless he can ride well under 9 stone. Knowledge of pace is a rare gift or acquisition which is essential to successful jockeyship. The rider must also be quick to perceive how his own horse is going—what he has "left in him"; he must understand at a glance which of his rivals are beaten and which are still likely to be dangerous; must know when the moment comes for the supreme effort to be made, and how to balance and prepare the horse for that critical struggle. At the beginning of the race the jockey used to stand in his stirrups, with the idea of removing weight from the horse's back and preserving perfect steadiness; towards the end of the race, if it were necessary to drive the animal home, he sat down "to finish."

This method used to be adopted in all countries, but recently a new system came into practice in America. Instead of putting the saddle in the middle of the horse's back, where it had always been placed previously, it was shifted forward on to the animal's withers. The jockey rode with very short stirrups, leaning forward over the neck and grasping the reins within a few inches of the horse's mouth. The appearance of this was ungainly in the extreme and an entire departure from ancient ways (though Fordham and a few other riders of great reputation had always sat much more forward than their contemporaries), but it was found to be remarkably effective. From the position thus adopted there was less resistance to the wind, and though the saving in this respect was largely exaggerated, in racing, where success or failure is frequently a matter of a very few inches, every little that helps is to be considered. The value of the discovery lay almost entirely in the fact that the horse carries weight better—and is therefore able to stride out more freely—when it is placed well forward on his shoulders. With characteristic conservatism the English were slow to accept the new plan. Several American jockeys, however, came to England. In all the main attributes of horsemanship there was no reason to believe that they were in the least superior to English jockeys, but their constant successes required explanation, and the only way to account for them appeared to be that horses derived a marked advantage from the new system of saddling. A number of English riders followed the American lead, and those that did so met with an unusual degree of success. Race-riding, indeed, was in a very great measure revolutionized in the closing years of the 19th century.

Foreign horses. In the ninth edition of the *Encyclopædia Britannica* it was noted of American horses that "on the whole they have not been very successful." This can be said no longer. Of late years American horses—bred, it must always be remembered, from stock imported from England—have won many races in England. Australian horses have also been sent to the mother country, with results remunerative to their owners, and the intermixture of blood which will necessarily result should have beneficial consequences. French horses—*i.e.*, horses bred in France from immediate or from more or less remote English parentage—have also on various occasions distinguished themselves on English racecourses. That coveted trophy, the Ascot Cup, was won by a French horse, Elf II., in 1898, it having fallen also to the French-bred Verneuil in 1878, to Boiard in 1874, to Henry in 1872, and to Mortemer in 1871. In the Cesarewitch Plaisanterie (3 yrs., 7 st. 8 ℔) and Ténébreuse (4 yrs., 8 st. 12 ℔) were successful in 1885 and 1888; and Plaisanterie also carried off the Cambridgeshire as a three-year-old with the heavy weight of 8 st. 12 ℔ in a field of 27 runners. In not a few respects racing in France is conducted with praiseworthy discrimination. There are scarcely any of the five- and six-furlong scrambles for horses over two years old which are such common features of English programmes.

Time. That the horses which have covered various distances in the shortest times on record must have been exceptionally speedy animals is obvious. The times of races, however, frequently form a most deceptive basis in any attempt to gauge the relative capacity of horses. A good animal will often win a race in bad time, for the reason that his opponents are unable to make him exert himself to the utmost. Not seldom a race is described as having been "won in a canter," and this necessarily signifies that if the winner had been pressed to gallop he would have completed the course more quickly. The following figures (from the *Sportsman*) show the shortest times that have been occupied in winning over various distances:—

		M.	S.
One mile	*a*Caiman	1	33⅕
Rowley Mile (1 m. 11 yds.)	*b*Galtee More	1	40⅗
One mile and a quarter	*c*Fancy Man	2	3⅕
One mile and a half	*d*Volodyovski	2	40⅘
,,	*e*Memoir	2	40⅘
,,	*f*Bend Or	2	40
,,	*g*Landrail	2	34
,,	*h*Carbiston	2	37⅖
,,	*i*Santoi	2	31
,,	*j*Avidity	2	30⅘
,,	*k*King's Courier	2	31⅖
One mile and three-quarters	*l*Florizel II	2	59⅕
Five furlongs	*m*Othery	0	57⅕
Six furlongs	*n*Master Willie	1	7⅛
One mile and three furlongs	*o*Fatherless	2	19⅖

a, At Lingfield, 13th July 1900. *b*, Two Thousand. Previous fastest, 1 min. 42⅕ secs. by Marco in Payne Stakes, Newmarket, 16th May 1895; 1 min. 42⅖ secs. by Kirkconnel and Isinglass; and 1 min. 42⅘ secs. by Amphion, who carried 10 st. 1 ℔, in the March Stakes in 1891. *c*, At Manchester, in Prince Edward Handicap, 28th September 1901. *d*, The Derby, 1901. *e*, The Oaks, 1890. *f*, At Epsom, in the Gold Cup, 1881. *g*, At Doncaster, 8th September 1899. *h*, At York, in Duke of York Stakes, 23rd August 1899. *i*, At Hurst Park, in Great Whitsuntide Handicap, 27th May 1901. *j*, At Doncaster, in Alexandra Plate, 13th September 1900. *k*, At Hurst Park, in September Handicap, 22nd September 1900. *l*, At Manchester, in the Cup, 7th June 1895. *m*, At Epsom, 19th April 1898. *n*, At Epsom, in Royal Stakes, 6th June 1901. *o*, At Nottingham, 1st October 1895.

As regards time in famous races, Ormonde, perhaps the best horse of the 19th century—one, at any rate, that can scarcely have had a superior—occupied 2 minutes 45⅗ seconds in winning the Derby; and Lonely, one of the worst mares that have won the Oaks, galloped the same mile and a half in 2 seconds less. Ormonde's St Leger time was 3 m. 21⅗ s., and Sir Visto, probably the poorest specimen of a winner of the great

Doncaster race, took 3 m. $18\frac{2}{5}$ s. Weight "brings horses together," as the phrase runs—that is to say, equalizes their chances; hence handicaps, the carrying of penalties by winners, and "maiden allowances": a horse that has never won, and is therefore known as a "maiden," often has an allowance of 7 lb.

Sport is carried on under the auspices of the Jockey Club, a self-elected body of the highest standing, whose powers are absolute and whose sway is judicious and beneficent. Three stewards, one of whom retires each year, when a successor is nominated, govern the active—and extremely arduous—work of the Club. They grant licenses to trainers and jockeys and all officials, and supervise the whole business of racing. The stewards of the Jockey Club are *ex officio* stewards of Ascot, Epsom, Goodwood, and Doncaster. All other meetings are controlled by stewards, usually well-known patrons of the Turf invited to act by the projectors of the fixture, who settle disputed points, hear and adjudicate on objections, &c., and, if special difficulties arise, report to the stewards of the Jockey Club, whose decision is final.

The Jockey Club.

Steeplechasing. — Steeplechasing has altered entirely since the first introduction of this essentially British sport. In early days men were accustomed to match their hunters against each other and ride across country to a fixed point near to some steeple which guided them on their way; and this is no doubt, in several respects, a class of sport superior to that now practised under the name of steeplechasing; for it tested the capacity of the horse to jump fences of all descriptions, and provided the rider with opportunities of showing his readiness and skill in picking the best line of country. But racing of this kind afforded spectators a very small chance of watching the struggle; and made-up steeplechase courses, the whole circuit of which could be viewed from the enclosures, came into existence. The steeplechase horse has also changed. The speed of the thoroughbred is so much greater than that of all other breeds that if one were in the field, if he only stood up and could jump a little, his success was certain; consequently, except in "point-to-point" races, organized by various hunts, where a qualification is that all starters must have been regularly ridden with hounds, none other than thoroughbred horses are nowadays ever found in races run under the rules of the National Hunt Committee, the body which governs the sport of steeplechasing. A considerable proportion of existing steeplechase horses have done duty on the flat. Members of certain equine families display a special aptitude for jumping; thus the descendants of Hermit, who won the Derby in 1867, are very frequently successful in steeplechases—Hermit's son Ascetic, the sire of Cloister, Hidden Mystery, and other good winners, is a notable case in point. The sons and daughters of Timothy and of several other Hermit horses often jump well. When a flat-race horse appears to have comparatively poor prospects of winning under Jockey Club rules, he is frequently, if he "looks like jumping," schooled for chasing, usually in the first place over hurdles, and subsequently over what is technically called "a country," beginning with small fences, over which he canters, led by some steady animal who is to be depended on to show the way. A great many steeplechase horses also come from Ireland. They are usually recognizable as thoroughbred, though it is possible that in some cases the name of an ancestor may be missing from the Stud Book. Irish horse-masters are for the most part particularly skilful in schooling jumpers, and the grass and climate of Ireland appear to have beneficial effects on young stock; but as a rule the imported Irish horse improves considerably in an English training-stable, where he is better fed and groomed than in most Irish establishments. All steeplechase courses must at the present time contain certain regulation jumps, the nature of which is specified in the National Hunt rules:—

Steeple-chase horses.

44. In all steeplechase courses there shall be at least twelve fences (exclusive of hurdles) in the first 2 miles, and at least six fences in each succeeding mile. There shall be a water jump at least 12 feet wide and 2 feet deep, to be left open, or guarded only by a perpendicular fence not exceeding 2 feet in height. There shall be in each mile at least one ditch 6 feet wide and 3 feet deep on the taking-off side of the fence, which ditch may be guarded by a single rail, or left open, and which fence must be 4 feet 6 inches in height, and, if of dead brushwood or gorse, 2 feet in width.

45. In all hurdle-race courses there shall be not less than eight flights of hurdles in the first 2 miles, with an additional flight of hurdles for every quarter of a mile or part of one beyond that distance, the height of the hurdles being not less than 3 feet 6 inches from the bottom bar to the top bar.

Natural fences would no doubt be desirable if they could be utilized; but it is obvious that fences must be made up, because when the same hedge is jumped frequently, and for the most part in the same place —as it is the object of riders to go the shortest way round—gaps would necessarily be made. The use of these made courses naturally renders the sport somewhat artificial, but under existing conditions this is unavoidable; and as a matter of fact, by reason of the conformation of the ground, the arrangement and make of the fences, courses do vary in no small degree. The steeplechase horse differs from the hunter in his method of jumping. In riding to hounds a man usually steadies his horse at a fence, and in almost every case the animal "dwells" more or less after the leap. In a steeplechase, where speed is everything, horses must be taught to dash resolutely at their jumps without hesitation, and to get away with no pause on the other side; as a rule, therefore, an old steeplechase horse who is employed as a hunter is rarely a pleasant mount for any but a bold rider. It has been remarked that steeplechase horses are usually in the first place schooled over hurdles, and many animals remain hurdle racers till the end. More speed is required for hurdles than for a steeplechase course, and there is more money to be won over hurdles than over "a country." No hurdle race is worth so much as the Grand National or the Lancashire Handicap Steeplechase, the two richest prizes now offered; but, with the exception of these, hurdle-race stakes are as a rule of greater value. Except as a spectacle, there is little to be said in defence of this mongrel business, which is neither one thing nor the other; but hurdle races are popular, and are therefore likely to continue. A few years ago an attempt was made to discriminate between what were called "hunters" and handicap steeplechase horses, and certain races were only open to the former class. It proved, however, to be a distinction without a difference; thoroughbred horses crept into the ranks of the so-called hunters, and when nominal hunters began to be entered for, and in some cases to win, the Grand National and other important steeplechases, for which they could be nominated by abandoning their qualification of hunter, the meaningless title was relinquished. Still more absurd were the hunters' flat races of a former day. In order to compete in these the rule was that an owner must produce a certificate from a master of hounds to the effect that his horse had been hunted. Thoroughbreds who lacked speed to win under Jockey Club rules used to be ridden to a meet, perhaps cantered across a field or two, and were then supposed to have become hunters. Animals which were genuinely and regularly utilized for the pursuit of foxes had of course no chance against these race-horses in shallow disguise. What are called National Hunt flat races still exist, the qualifica-

Jumping.

Hunters and steeple-chase horses.

tion being that a horse must have been placed first, second, or third in a steeplechase in Great Britain or Ireland, after having jumped all the fences and completed the whole distance of the race to the satisfaction of at least two of the stewards, to whom previous notice must have been given in writing. There are no handicaps for such animals, and none is allowed to carry less than 11 stone. No race under National Hunt rules can be of a shorter distance than 2 miles, and the lowest weight carried can never be less than 10 stone except in a handicap steeplechase of 3½ miles or upwards, when the lowest weight may be 9 st. 7 lb.

Riders.

Horses are ridden in these races either by gentlemen, or qualified riders, or jockeys. The first of these classes comprises officers on full pay in the army or navy, persons holding commissions under the Crown, bearing titles either in their own right or by courtesy, or members of certain social and racing clubs. Qualified riders may be farmers holding at least a hundred acres of land, their sons if following the same occupation, and persons elected by members of the National Hunt Committee, a proviso being that they must never have ridden for hire, but it is feared that this rule is in not a few cases evaded. Professional jockeys are paid £5 for each mount, or £10 if they win. The sport is governed by the National Hunt Committee, a body which receives delegated powers from the Jockey Club, and six stewards are elected every year to supervise the business of the various meetings. Steeplechases and hurdle races are either handicaps or weight-for-age races according to the following scale :—

For Steeplechases of 3 miles and upwards.

From the 1st of January to the 30th of June, both inclusive :—

4 yrs.	5 yrs.	6 and aged
10 st. 3 lb	11 st. 8 lb	12 st. 3 lb

From the 1st of July to the 31st of December, both inclusive :—

4 yrs.	5 yrs.	6 and aged
11 st.	11 st. 12 lb	12 st. 3 lb

For Steeplechases of less than 3 miles.

From the 1st of January to the 30th of June, both inclusive :—

4 yrs.	5 yrs.	6 and aged
10 st. 10 lb	11 st. 10 lb	12 st. 3 lb

From the 1st of July to the 31st of December, both inclusive :—

4 yrs.	5 yrs.	6 and aged
11 st. 6 lb	12 st.	12 st. 3 lb

For Hurdle Races.

From the 1st of January to the 31st of August, inclusive :—

4 yrs.	5 yrs.	6 and aged
11 st. 6 lb	11 st. 10 lb	12 st. 0 lb

From the 1st of September to the 31st of December, inclusive :—

3 yrs.	4 yrs.	5, 6, and aged
10 st. 7 lb	11 st. 12 lb	12 st. 3 lb

The Grand National.

The great test of merit in a steeplechase horse is success in the Grand National, which is always run at Liverpool during the first week of the flat-racing season. The course is 4½ miles, and includes thirty jumps, the fences being for the most part larger than are found elsewhere. The average time occupied is about ten minutes. The stake has varied in value since the race was originated in 1839; it now amounts to close on £2000. Only a very small percentage of steeplechase horses possess the speed and staying power to give them a chance in this race, and the number of entries year by year falls considerably short of a hundred, the prospects of many of these usually appearing hopeless to all but unduly sanguine owners. The average number of starters during the period 1860–1901 was rather over twenty. As many as thirty competed in 1866, when Salamander won; in 1883, when Zoedone, ridden by her owner, Count Kinsky, was successful, only ten went to the post. Mishaps are almost invariably numerous; in 1890, of sixteen starters no fewer than eleven fell. So severe is the task that for a long time many good judges of steeplechasing believed that no horse with more than 12 stone on his back could possibly win. In 1893, however, Cloister won in a canter by forty lengths carrying 12 st. 7 lb, and with the same weight Manifesto also won in 1899. The race which most nearly approaches the Grand National in importance is the Lancashire Handicap Steeplechase, run at Manchester over 3½ miles early in April. The stake is worth about £1750. An interesting steeplechase called the Grand Sefton takes place at Liverpool about the middle of November; the distance is 3 miles. During the winter, and extending into the spring, steeplechasing and hurdle racing are carried on at Sandown, Kempton, Gatwick, Lingfield, and Hurst Park; at Ludlow, Newmarket, Aldershot, Birmingham, Manchester, Windsor, and other places. A race called the National Hunt Steeplechase, under the immediate patronage of the National Hunt Committee, takes place annually; it is run over a 4-mile course, the stake being £1000. Managers of various courses bid for the privilege of having the race on their ground, and it is therefore run in different localities. A condition is that no horse who has ever won a race can compete; and, as few owners are willing to keep their animals with a view to success in this event, the field consists either of unknown horses or of those that have been beaten.

Australia.—Racing in Australia has its headquarters at Sydney, under the government of the Australian Jockey Club, the principal course being at Ranwick; and at Melbourne, where the Victoria Jockey Club is supreme, the principal course being at Flemington. In New Zealand sport is carried on under the authority of delegates from the chief racing clubs, who meet in conference. There is a Sydney Derby and a Victoria Derby, and a notable event at Flemington is the Champion Race, weight-for-age, for three-year-olds and upwards, which usually attracts the best horses in training, as the fee at which a sire stands depends in a great measure on his success in this contest. This race is over a distance of 3 miles, and to ensure a good pace there is a regulation that the time in which it is run must not exceed 5 minutes 40 seconds, though the stewards have power to extend this in case the ground should be made exceptionally heavy by rainy weather. The Melbourne Cup is regarded as one of the most important races in the state. This is a handicap, and in comparison with English races may perhaps be ranked with the Cesarewitch. The birth of horses dates from the 1st of August, which corresponds as nearly as possible to the 1st of February in England, so that the Australian horses are practically seven months younger than the English—a matter of some importance in the case of those sent to run in England. There are few races which close long before the date of decision, and practically all the good animals run in handicaps. The five- and six-furlong races for other than two-year-olds, so common in Great Britain, are extremely rare; and it is asserted by colonial sportsmen that their horses stay better than those bred in England, a circumstance which is largely attributed to the fact that mares and foals have much more liberty and exercise than is the case in the mother country. Horses brought to England from the colonies have certainly had a considerable share of success in recent years, though of course it must be assumed that only specially good ones, which have seemed likely to distinguish themselves, have been sent. The chief courses are carefully tended, the crowd not being permitted to stray upon them, and some distance from the members' stands is erected what is called a "silence post," beyond which the bookmakers are not

allowed to ply their calling. An electric timing clock is fixed on the judge's box, set in motion when the starter's flag falls, and stopped as the winner passes the post, for the edification of those who wish to know the precise duration of the contest. The steeplechase and flat racecourses run side by side at Ranwick and at most other places, separated by double rails, between which police patrol. The outer rail leans towards the horses, and is so shaped that a jockey can hardly meet with injury by having his leg crushed against it, and the steeplechase fences are high and strong; indeed, their strength is so considerable that many spectators are in the habit of sitting on them to watch the flat racing. Logs, palings, posts and rails, and other severe jumps occur, and as the going is usually very hard, falls are frequently attended by serious consequences.

Canada.—Canada is independent, and the racing there is in a very heterogeneous condition, though the Ontario Jockey Club leads the way and gives an excellent meeting every spring at Toronto.

United States.—Racing in the United States, though in a transitory condition, has gradually been assuming definite and coherent form. Owing to the vast size of the country, there are various centres of sport, which can be classified with reasonable accuracy as follows:—the Eastern States, dominated by the Jockey Club, founded in New York in 1894, and recognized by a state law in 1895; the Middle Western States, under the control of the Western Jockey Club, whose headquarters are in Chicago; the Pacific Coast, with San Francisco for its centre; and the Southern and South-Western States, with Louisville as the most important centre. The passage of the racing law in New York State marked the opening of a new era. Supreme even over the Jockey Club is a State Racing Commission of three, appointed by the governor of the state. While the Jockey Club is only recognized by law in its native state, it has assumed and maintains control of all racing on the eastern seaboard, within certain lines of latitude and longitude, extending as far north as the Canadian border and south to Georgia. There is small question that other states, both east and west, will follow suit and enact similar laws. The Western Jockey Club, though not recognized by law, controls practically all the racing through the middle west, south-west, and south; but the racing associations of the Pacific Coast have maintained a position of independence.

What New York is to the east, Chicago is to the middle west, and a very large proportion of American racing is conducted close to these centres. In New York State the Coney Island Jockey Club, at Sheepshead Bay; the Brooklyn Jockey Club, at Gravesend; the Westchester Racing Association, at Morris Park; the Brighton Beach Racing Association, at Brighton Beach; the Queen's County Jockey Club, at Aqueduct; and the Saratoga Racing Association, at Saratoga, are the leading organizations; and all these racecourses, with the exception of Saratoga, are within a radius of 20 miles of the city. The Empire City Jockey Club, near Yonkers, and a new club with headquarters near Jamaica, Long Island, are likely to be prominent in the near future. The Washington Park Club, at Chicago, is the leading Turf body of the West, and the only one on an equal footing with the prominent associations of New York State. With this single exception the most important and valuable stakes of the American Turf are given in the East; and so great has the prosperity of the Turf been since the Jockey Club came into existence, that the list of rich prizes is growing at a surprising rate. In this respect the principal fault is the undue encouragement given to the racing of two-year-olds. At the winter meetings held at New Orleans and San Francisco, two-year-olds are raced from the very beginning of the year; and under the rules of the Jockey Club of New York they run as early as March. The Westchester Racing Association, with which are closely identified some of the principal members of the Jockey Club, gives valuable two-year-old stakes in May. The Futurity Stakes, the richest event of the year—on one occasion it reached a value of $67,675—is for two-year-olds, and is run at Sheepshead Bay in the autumn. The institution of races, either absolutely or practically at weight-for-age, and over long courses, has engaged much attention. The Coney Island Jockey Club has the leading three-year-old stake in the Lawrence Realization, over 1 mile 5 furlongs, with an average value of about $30,000. The Westchester Racing Association's two principal three-year-old stakes, the Withers, over a mile, run in May, and the Belmont, 1 mile and 3 furlongs, run later in the same month, are of less value, but are much older-established and have a species of "classic" prestige, dating from the old Jerome Park racecourse in the 'sixties. The Coney Island Jockey Club's Century and the Annual Champion Stakes, both for three-year-olds and upwards, over a mile and a half and two miles and a quarter respectively, are fair specimens of the races the associations are now founding. At Saratoga a stake of $50,000 for three-year-olds and upwards, distance a mile and a quarter, has been opened, to be run for first in 1904. The hope is to wean owners from the practice of overtaxing their two-year-olds, which has resulted practically in a positive dearth, almost a total absence, of good four-year-olds and upward of late years. Handicaps play a more important part than in England. The principal events of this character, such as the Brooklyn Handicap at Gravesend and the Suburban at Sheepshead Bay, have for years drawn the largest attendances of the racing season.

Practically all flat racing in the United States is held on "dirt-tracks," *i.e.*, courses with soil specially prepared for racing, instead of turf courses. At Sheepshead Bay there is a turf course, but it is only used for a minority of races. Dirt-tracks, which are, like many other things in American racing, a legacy from the once hugely popular harness-racing, are conducive to great speed, but are costly in the extreme strain on horses' legs. Steeplechases are run on turf. This branch of the sport in the East is now flourishing under the administration of the National Steeplechase and Hunt Association, a sister body of the Jockey Club. Comparatively few races are, however, run under these rules, as the weather conditions render it impossible to have a separate season for cross-country sport and steeplechases, and hurdle races are incorporated in programmes of flat racing held through the spring, summer, and autumn, though the ground is frequently so hard as to be unsafe. Since the National Steeplechase and Hunt Association assumed control, regulation courses, practically similar in every respect to those used in England, have been insisted upon in the East, the "open ditch" figuring under the name of the "Liverpool." In the West and South there is not the same uniformity, and so far the sport has not flourished.

The American thoroughbred blood of to-day, of course, originally came from England. Unfortunately but little is known of what was done in the way of racing in the colonial days, and the present era can only be traced practically back to the importation into Virginia of Diomed, winner of the first English Derby. In spite of his advanced age, he was a prolific stock-getter, and the old American pedigrees abound in his name, his descendants being inbred continuously. Since Diomed's day the importation of English stock has been constant. St Blaise, another Derby winner, had a brilliant success for a while,

but failed later in other hands when mated with mares of less fashionable family. Ormonde, bought for $150,000 to go to California, was a total failure; but prior to these horses were many that built the American thoroughbred up to his present standard. Leamington was sent to America to race, but at the stud won undying fame, his blood "nicking" exactly with that of the American Lexington. Then there was Glenelg, the horse whose gameness until death "The Druid" told. His stock, in the female line especially, are invaluable. The French horses, Mortemer and Rayon d'Or, ended their days in the United States, and the former did grand service. From Australia Sir Modred, Darebin, Maxim, Cheviot, and others came, especially to California. The recruits drawn from England have been practically numberless. Blue Gown, Ossory, and some more died on the way; but American pedigrees are full of imported horses. Buckden was one of the comparatively early importations, and left a great mark. Galore, Meddler, and Atheling are among the later, and Meddler promises to be one of the great sires of the country. Many English horses of small reputation, such as Esher, or horses that were never raced in England, like Eothen, have done well when mated with American blood.

For the most part the betting system adopted in the United States is the same as in England. In New York State what are described as "personal wagers," *i.e.*, bets between individuals on racecourses, are legal so long as no odds are displayed. Through the western states and in Canada odds are displayed on small blackboards, which are part of the appurtenances of stands, each occupied by a bookmaker and his clerks. The *pari-mutuel* system was used, but is now practically abolished, being specifically named as illegal in the State of New York. The selling of pools at auction, which was once the medium of most of the big betting in America, is also discontinued; and this too is illegal in New York. There is not a weekly settling day, as in England, but accounts are usually settled within twenty-four hours, unless by special arrangement.

Trotting.

In the United States interest in trotting races rivals that felt in the contests of thoroughbred horses. In the year 1834 a horse called Andrew Jackson trotted a mile in 2 m. $42\frac{1}{2}$ s., that being the fastest time which had then ever been accomplished. This was regarded as something very remarkable, and when eleven days later, on 27th October, the horse improved the time by 4 seconds, some followers of the sport appear to have supposed that finality was reached. It was not until 1858 that any considerable reduction was made in the record, in that year Ethan Allen having trotted a mile in 2 m. 28 s. In August 1874 Mambrino Gift was credited with 2 m. 20 s. For a time Goldsmith Maid held prominence with figures which she reduced in 1874 from 2 m. 16 s. to 2 m. 14 s., and in 1878 came Rarus, who went a mile in a quarter of a second less, the small fraction being esteemed a great thing. Other notable performances reducing the record were St Julian in 1879, 2 m. $11\frac{3}{4}$ s.; Maud S., 1881, 2 m. $10\frac{1}{4}$ s.; Jay-Eye-See, in 1885, 2 m. $8\frac{3}{4}$ s.; Sunol in 1891, 2 m. $8\frac{1}{4}$ s.; Nancy Hanks in 1892, 2 m. 4 s.; and Alix in 1894, 2 m. $3\frac{3}{4}$ s. The record at the beginning of 1902 is the 2 m. $2\frac{1}{4}$ s. made by Cresceus in 1901. Improved times have doubtless been the result of improved methods, as well as of care in the breeding of the trotter. Some very severe training rules used to be sedulously observed; about 1870, for instance, a horse never had water the night before a race, and the system generally appears to have overtaxed the animals' strength. A prominent consideration in trotting races is the adjustment of toe-weights, which are fastened on to the horses' feet to equalize their action, and it is found that horses improve their time to the extent of several seconds when properly shod. The American trotter is declared to be practically a thoroughbred. Pacing races are also frequent in the United States. In trotting the action may be described as diagonal; the pacer moves both legs on the same side at the same time, and both feet stride as one. A similar "gait," to employ the American term, was called in England some centuries ago an "amble." The pacer moves more easily and with apparently less exertion than the trotter, and the mile record (made by Anaconda in 1901) stands at 2 m. $1\frac{3}{4}$ s. Trotting and pacing races are sometimes contested in the saddle, more frequently in wheeled vehicles of the lightest possible description specially constructed for the purpose.

France.—Racing in France as conducted on modern lines may be said to date from the year 1833, when the French Stud Book was originated, and a body formed, somewhat after the model of the English Jockey Club, under the title of the Société d'Encouragement pour l'Amélioration des Races de Chevaux en France. Races took place in the Champs de Mars, and an unsuccessful attempt was made in 1834 to arrange for a course, or "hippodrome" as it is termed in France, at Maisons Laffite. Chantilly was, however, fixed upon as the principal racing centre; on the 22nd April 1836 the first meeting was held there, with five races on the card, the principal being the Prix d'Orléans, a stake of 3500 francs, named after the duc d'Orléans, one of the chief promoters of the fixture. Next day the first race for the Prix du Jockey Club was run, and won by Frank, the property of Lord Henry Seymour, who was then taking a very active part in French sport. The Prix du Jockey Club was then worth 5000 francs; the value has since increased to 200,000 francs. This race occupies in France the place of the English Derby. The Prix de Diane, which corresponds to the English Oaks, was first run in 1843. Chantilly still continues an important centre of the French Turf, and a great many horses are trained in the district. Attempts had been made to popularize racing at Longchamps prior to the year 1856, when the Société d'Encouragement obtained a lease, erected stands, laid out the course, and held their first meeting on the 27th August 1857. Next season two meetings were held, one of four days in the spring and another of three in the autumn; at the present time the sport is vigorously carried on from March to the end of October, except during a summer recess. In 1857 meetings under the auspices of the Société d'Encouragement began to take place at Amiens, Caen, Nantes, Versailles, Moulins, and other towns; and there were stakes for two-year-olds in the spring, though of late years the appearance of the young horses has been postponed to the 1st of August. Progress was rapid, and in 1863 two important events were contested for the first time, the Prix du Prince Impérial, which was designed to balance the English St Leger, but for obvious reasons faded out of the programme, and the Grand Prix de Paris, an international race for three-year-olds, run at Longchamps over a distance of 1 mile 7 furlongs, and now the most valuable stake in Europe. In 1901 the prize was £10,812. The first Grand Prix fell to an English horse, Mr Savile's The Ranger; two years later it was won by Gladiateur, winner of the English Derby and the property of the comte de Lagrange who raced equally in France and in England; the duke of Beaufort's Ceylon was successful in 1866, and the marquis of Hastings' Earl in 1868. Mr Savile's Cremorne followed up his Derby victory by a victory at Longchamps in 1872, as did Mr Baltazzi's Kisber four years later. English horses were also victorious in 1874 (Mr W. R. Marshall's Trent), in 1878 (Prince Soltykoff's Thurio), in 1880 (Mr C. Brewer's Robert the Devil), in

1881 (Mr Keene's Foxhall, who, however, should rather rank as an American horse), in 1882 (Mr Rymill's Bruce), in 1885 (Mr Cloete's Paradox), and in 1886 (Mr Vyner's Minting). During the first 23 years of the Grand Prix (owing to the war, the race did not take place in 1871) the stake fell to English horses—if Kisber and Foxhall be included—on twelve occasions, and generally to English jockeys. In recent years, however, French owners have held their own. In not a few respects racing is managed more judiciously than in England. The courses, for one thing, are better tended and maintained. At Epsom and Ascot, for instance, the trampling of the multitude beats down and destroys the herbage, making the ground cruelly hard for the horses to gallop over; in France the crowd is not allowed to wander about the course, and in the hottest summer weather the circuit of Longchamps is never hard and always refreshingly green. The five- and six-furlong races for others than two-year-olds, which are so common at English meetings, are comparatively rare in France, and the value of the prizes in an average day's racing is considerably higher across the Channel than in England. A very large percentage of trainers and jockeys are English, and the former are, as a rule, quite as expert as at Newmarket and elsewhere, though the average seems somewhat lower in France than in England. Transatlantic methods have been introduced by American jockeys since 1899. From the middle of February until the middle of December a race meeting within easy reach of Paris takes place almost every day, except during August, when the sport is carried on in the provinces, notably at Deauville. Near Paris, the chief centre after Longchamps is Maisons Laffite. At Longchamps, early in October, a race called the Prix du Conseil Municipal, worth £4000, for three-year-olds and upwards, over a mile and a half, was organized in 1893, and has usually attracted English horses, Mr Wallace Johnstone's Best Man having been successful in 1894, and Mr Sullivan's Winkfield's Pride the following year. Except when the Whip is challenged for and the challenge decided over the Beacon Course at Newmarket, no race is run in England over a longer distance than two miles and a half; but in France the Prix Gladiateur, of £1200 and a work of art value £100, 3 miles 7 furlongs, creates considerable interest at Longchamps in the autumn. The *pari-mutuel*, by which most of the betting is carried on in France, though bookmakers pursue their business there as in England, except that they are relegated to the backs of the stands, is described under the head of BETTING.

Steeple-chasing in France.

The first recognized steeplechase in France took place on 1st April 1884, at Croix de Berny, and was won by the comte de Vaublanc's May-fly, all the horses at that time being ridden by gentlemen. Sport does not seem to have been carried on with much spirit, for it is said that the death of an animal called Barcha, in 1839, nearly led to the abandonment of the meeting; and it was not till 1863, when the Société des Steeplechases de France was founded, that the business was resolutely taken in hand. Gravelle and Vincennes were the principal centres until 1873, when the Société obtained possession of the ground at Auteuil, where the excellent course now in use was laid out. In 1874 twelve days' racing took place here, the card each day including three steeplechases and a hurdle race, the "hurdles," however, being small fences, as they are at present. The Grand Steeplechase d'Auteuil was then for a stake of 30,000 francs, at the time the most valuable offered in any country; but, as in racing on the flat, the stakes have enormously increased in value, and in 1901 the Paris Grand Steeplechase, as the chief event is now called, credited the winner with £6020, the hurdle race being worth rather more than half as much. In England there is scarcely any steeplechasing between March and November, except at hunt meetings, but in Paris cross-country sport is pursued almost all through the year, the chief races at Auteuil taking place in June, about the time of the Grand Prix, which is always run between the English Epsom and Ascot meetings. The Auteuil course is laid out in the shape of the figure 8, with varied fences, several of which really test a horse's jumping capacity; and variety is further obtained by starting the fields in different places and traversing the course in different ways. St Ouen, a meeting within half an hour's drive of the Louvre, is entirely devoted to steeplechasing; and jumping is also carried on at Vincennes, Colombes, Enghien, and elsewhere near Paris, as also at Nice in January, at Dieppe and other places in August. As a rule, the stakes run for, especially at Auteuil, are very much larger than in England. There are none of the clubs and special enclosures such as at Sandown, Kempton, Hurst, Lingfield, Gatwick, &c., though portions of the stand are set apart for privileged persons. A fee of 20 francs is charged for admission to the chief French racecourses, with half as much for a lady's voucher, and the tickets give access everywhere but to the very few reserved portions. At Vincennes, St Cloud, and some other courses trotting races are also contested.

Other Countries.—Racing in Germany is mainly conducted under the authority of the Union Club of Berlin, the principal course being the Hoppegarten. Two-year-olds do not run until the 1st of June, except in Saxony, where they appear a month earlier. During the month of August there are several days' racing at Baden-Baden, steeplechases as well as flat races being run. Some of the more valuable stakes are usually contested by a proportion of horses from France and other countries, a few being occasionally sent from England. For years past blood-stock has been imported from England. In Austria the two centres of racing are Vienna and Budapest, each of which has its Jockey Club. Racing in Belgium derives no little support from the contiguity of the country to France. The headquarters of the Belgium Jockey Club are in the Bois de la Cambre at Boisfort, and meetings are held at Ostend, Antwerp, Spa, Bruges, and elsewhere. Steeplechases take place at Groenenval and on other Belgian courses, but are not of high class. Racing has not reached a great degree of excellence in Italy, though attempts have been made to improve competitors by the purchase of Melton, who won the Derby of 1885, and of other notable animals. Meetings take place at Florence, Padua, Bologna, and other places, but the stakes are usually small. (A. E. T. W.)

Horsens, a market town of Denmark, at the head of Horsens Fjord, on the east side of Jutland, 32 miles by rail south-west of Aarhus. In 1899 it was entered by 668 vessels of 71,704 tons, and cleared by 695 of 74,679 tons. The exports are chiefly bacon and butter; the imports, iron, yarn, coal, and timber. Population (1880), 12,654; (1901), 22,243.

Horsforth, a township in the Pudsey parliamentary division of Yorkshire, England, on the Aire, 5 miles north-west of Leeds by rail. The church of St Mary was built in 1883, and there are Baptist, Wesleyan, Friends', and other places of worship. Public buildings include a temperance hall and a mechanics' institute. There are extensive woollen manufactures, and in the neighbourhood quarries. Area of urban district, 2801 acres. Population (1881), 6346; (1901), 7785.

Horsham, a market town and railway station in the Horsham parliamentary division (since 1885) of Sussex, England, 18 miles north-north-west of Brighton. The town-hall and grammar-school have been rebuilt, and a cottage hospital established. Population of urban district (1881), 6874; (1901), 9446.

Horsley, John Callcott (1817——), English painter, son of William Horsley, the musician, and grand-nephew of Sir Augustus Callcott, was born in London, 29th January 1817. He studied painting in the Academy

which we have been describing, may be gathered from the circumstances that it costs from £300,000 to £400,000, that it usually contains from 500 to 700 beds, and that the staff numbers from 350 to 500 persons. The medical superintendent lives in a separate house of his own. The nurses are provided with a home, consisting of several blocks of buildings under the control of the matron: the charge-nurses usually occupy the main block, where the dining and general sitting-rooms are placed; the day assistant-nurses another block; and lastly, by a most excellent arrangement, the night-nurses, 80 to 120 in number, have one whole block entirely given up to their use. The female servants have a second home under the control of the housekeeper, and the male servants occupy a third home under the supervision of the steward. The two main ideas aimed at are to disconnect the houses occupied by the staff from the infected area, and to place the members of each division of the staff together, but in separate buildings, under their respective heads. These objects are highly to be commended, as they have important bearings upon the well-being and discipline of the whole establishment, and constitute a lesson for all who have to do with buildings where a great number of people are constantly employed.

The circular ward is growing in favour. At the Great Northern Central Hospital, Holloway, where the site in a crowded district was most awkward, it fulfils a useful purpose, for by making some of the wards rectangular and others circular, the hospital was so planned as to give the same amount of cubic, wall, and superficial space per bed throughout the institution, irrespective of the shape of the wards. The first circular wards actually occupied by hospital patients were those of the Miller Hospital, Greenwich, shortly followed by the Municipal Hospital, Antwerp, the Victoria Hospital, Burnley, the Infirmary of the Hampstead Workhouse, two small military hospitals at Milton near Gravesend and Seaford near Liverpool, the Royal Infirmary at Liverpool, the Northern Hospital, Liverpool, and elsewhere. An important feature of this form of ward is its attachment to the main building, which should be by covered bridges with open spaces between the roof of one bridge and the floor of the one above. The centre space has been utilized as a nurses' room, as a ventilating shaft, or as a shaft for a spiral staircase leading to a flat roof used as a sun-room, but all these schemes are objectionable and often unsightly. A circular ward to be typical must be a ward only. To contain 12 beds it should have a diameter of about 42 feet, and in the centre there should be ventilators and flues with fireplaces, while for 20 beds the following should be the approximate dimensions:—Height, average, 13 feet (ceiling sloping up from periphery to centre); diameter, 57½ feet; wall space, 8·50 feet per bed; area, 128 feet per bed; cubic space, 1665 feet per bed; window area, 26·8 feet per bed. An octagonal ward has been tried at the Johns Hopkins Hospital, Baltimore, but has not proved satisfactory; it does not lend itself conveniently to the arrangement of the beds, and the dust catches the angles where the sides of the octagon join, so that the walls become speedily discoloured and unsightly.

Electricity is now a favourite agent for lighting hospital wards, but for many reasons it is desirable that it should always be supplemented by gas. In 1889, surgeons were on more than one occasion left in total darkness when performing an operation by electricity in a London hospital. As a system of illumination for hospitals it has great advantages, for it is cleanly, convenient, portable, and enables the surgeon to bring the light exactly where he wants it without moving his patient. Teak and maple are found to be the best wood for the floors. Wood has been superseded by terrazzo, but this in practice proves to be unsatisfactory, owing to its liability to crack when used for hospital purposes. These cracks may be seen in the terrazzo floors introduced into several of the recently erected modern hospitals. Very marked improvement has taken place in regard to hospital furniture. The bedsteads are ornamental, simple, and specially constructed for hospital purposes (Guy's Hospital pattern). Ward tables and lockers are glass-topped; and invalid chairs and ambulance litters have been generally adopted for ward use. The number of operations in a modern hospital in existing circumstances is at least four times as great as it was a few years ago. In consequence a demand has grown up for a large number of small operating theatres of new and aseptic types, which cost prodigious sums.

Persistent efforts have been made in favour of the plenum system of ventilation (see *Ency. Brit.*, 9th ed., vol. xxiv. p. 160) for British hospitals. Of the necessity for ventilation there can be no doubt, and upon the fundamental principles which determine the quantity of air to be supplied, the temperature it is to be supplied at, and the rate at which the air is to be changed, authorities are practically agreed. In the United States, and in most Continental countries, more especially in France, it is deemed necessary to adopt mechanical means for renewing the air of wards. In Great Britain, notwithstanding some instances of a contrary practice, or probably because of such instances, it is held that the most efficient ventilation is to be obtained by the use of the simplest means. Having regard to the temperate character of the English climate, artificial ventilation, whatever be the plan adopted, is not desirable, if it even be permissible, especially when entire reliance is placed upon such a system for the whole ventilation of the sick wards of any British hospital which is constantly filled with surgical and other cases requiring abundance of fresh air. The question is exhaustively treated in Burdett, *Hospitals and Asylums of the World*, vol. iv. pp. 43 *et seq.* The plenum system may be a necessity in operating theatres and in out-patient departments, but its application to English wards is neither necessary, nor desirable, nor economical.

The cottage hospital movement has spread to all parts of the United Kingdom, and is now making its way in the United States, and especially in New England. There are upwards of three hundred cottage hospitals in the United Kingdom at the present time. Everywhere they are becoming most efficient and complete hygienically; indeed, many are now as perfect as a single pavilion of a great modern hospital. The amount of good they have conferred upon residents in rural districts is very great. They benefit the community by affording all classes the best kind of skilled medical attendance, and so they attract the wealthy to out-of-the-way places by ensuring adequate treatment by skilled practitioners for operation, accident, and other cases. Thanks to them, residents in the country can nowadays obtain most of the medical advantages of residents in cities.

The attempt to introduce the pay hospital into England has proved successful, and since the Home Hospitals Association opened the first of these establishments at Fitzroy House, Fitzroy Square, in 1880, it has proved a boon to hundreds of surgeons and their middle-class patients. The St Thomas's Home, a wing of St Thomas's Hospital, has been given up to the accommodation of paying patients for several years, though the authorities, for some reason not very apparent, are desirous of discontinuing the system. The pay ward, though a common feature of Continental and American hospitals, has been adopted in a tentative way at Guy's Hospital and the Great Northern Central Hospital, where there is a separate wing set apart for paying patients. It is most desirable that pay wards should be erected in connexion with every general hospital of importance throughout the United Kingdom, but the medical staff should be paid for attendance on such cases. In that way hospital abuse would be abolished, and every patient would enjoy the right, which is undoubtedly his, to be attended by his own doctor, and to pay according to his means for the treatment he receives during his residence in hospital.

A revolution has taken place in nursing, which, once a calling, is now denominated a "profession." The duties of nurses are confined to attendance on the sick. They are housed in separate pavilions, have many fewer hours' work in the wards than formerly, and are allowed a reasonable time for recreation, longer holidays, and much better food. Their training extends over three years at least, and during their course they attend lectures and practical classes on bandaging, dressing, cooking, the elements of hygiene, practical surgery, and the elements of anatomy and physiology. The menial work of a hospital, such as scrubbing floors and housework generally, is entrusted to a staff of servants or ward maids employed exclusively for such purposes. Practical instruction is also made available for nurses in midwifery, fever nursing, the attendance on patients in private families, and mental nursing. The remuneration has increased quite 30 per cent., and private nurses sometimes earn as much as from £100 to £130 a year. The number, too, in hospitals has been enormously increased, the proportion in a well-regulated hospital now being one nurse to every four patients. In some hospitals there is one nurse to every two occupied beds, but this number is disproportionate if due regard be had to economical considerations.

Authorities.—Complete and statistical information in every form will be found in: Burdett. *Cottage Hospitals, General Fever and Convalescent, their Construction, Management, and Work.* London, 1877, 1880, and 1896.—Tollet. *Les Edifices Hospitaliers depuis leur Origine jusqu'à nos Jours.* Paris, 1892.—Burdett. *Hospitals and Asylums of the World,* with large portfolio of plans to a uniform scale. London, 1893. A supplement to this book is published every year, bringing the information up to date, entitled *Burdett's Hospitals and Charities.* London, 1901–02.—Billings. *The Principles of Ventilation, Heating, and their Practical Application.* New York, 1893.—Galton. *Healthy Hospitals.* London, 1893.—Tollet. *Les Hôpitaux au XIX*

Siècle. Paris, 1894.—BILLINGS and HURD. *Suggestions to Hospital and Asylum Visitors.* Philadelphia, 1895.—OSWALD KUHN. "Hospitals," *Handbuch der Architektur*, 4th part, 5th half-volume, part 1. Stuttgart, 1897. (H. BT.)

Hot Springs, capital of Garland county, Arkansas, U.S.A., on the Hot Springs Railway, at an altitude of 575 feet. The city was originally situated in a narrow water gap in one of the ridges of the Ozark Mountains, whence it has spread into the valleys north and south. Its plan is very irregular. The springs from which the city derives its name, and which have made it famous, are very numerous on the ridge on the east side of the gap, whence the water is piped into the town. They are of value in rheumatic, syphilitic, and cutaneous diseases, and thousands of sufferers visit the place yearly for relief. For their accommodation many large hotels have been constructed, and the United States has an army and navy hospital here. Population (1880), 3554; (1890), 8086; (1900), 9973, of whom 561 were foreign-born and 3102 were negroes.

Hottentots.—In recent years these aborigines have been carefully studied by Fritsch, Shrubsall, Hamy, and several other leading anthropologists, whose researches tend to show that they are not "totally distinct from all other African races," as was formerly generally supposed (*Ency. Brit.* vol. xii. p. 309). They are, on the contrary, now held to be, not so much a distinct or independent variety of mankind as the result of a very old cross between two other varieties—the Bantu Negro and the pigmy Negrito-Bushman. (See BUSHMEN.) Hamy calls them simply "Bushman-Bantu half-breeds," the Bushman element being of the two the more pronounced, as seen in the leathery colour, compared to that of the "sere and yellow leaf"; in the remarkably prominent cheek-bones and pointed chin, giving the face a peculiarly triangular shape; and lastly, in such highly specialized characters as the *tablier* and the *steatopygia* of the women, constant in the Bushman from infancy, but developed only in the adult Hottentot woman, and that not universally. The cranial capacity is also nearly the same (1331 c.c. in the former, 1365 c.c. in the latter), and on these anatomical grounds Shrubsall concludes that the two are essentially one race, allowing for the undeniable strain of Bantu blood in the Hottentot.

This view is further strengthened by the vast range in prehistoric times of the Hottentot variety, which, since the time of Lichtenstein (1800–04), was known to have comprised the whole of Africa south of the Zambezi, but has recently been extended as far north as the equatorial lake region. This important fact in African ethnology is due to the explorations of Oskar Neumann in the district between Lake Victoria and Mount Kilimanjaro, where this traveller came upon the *Wasandawi* people, a sort of Hottentot enclave in the midst of the Negroid-Bantu populations, speaking a non-Bantu language full of clicks like that of the Bushman-Hottentots, and presenting cranial characters—projecting upper jaw, orthodolicho head and low capacity—exactly like those of the Namas and other full-blood Hottentots.[1]

But very few of these full-blood Hottentots now survive even in their present restricted domain south of the Zambezi. Of the half-dozen groups that still call themselves *Khoi-Khoin* ("Men of Men") the Namas alone of Great and Little Namaqualand preserve the racial type and speech in tolerable purity. All the others are more or less degraded Hottentot-Dutch or Hottentot-Bantu half-breeds, mainly of debased Dutch speech, although the Koranas of the Upper Orange, Vaal, and Modder rivers still here and there speak a moribund Hottentot jargon flooded with Dutch and English words and expressions. This Korana jargon, like the "English" of the Liberian negroes, is so corrupt that it has become quite useless for any literary purposes, and is now no longer employed by the missionaries in their intercourse with the natives.

But Hottentot speech still survives in a tolerably pure state, not only amongst the Namas, but also in Damaraland, where it has long been spoken by the so-called "Hill Damaras" of the north-eastern uplands. These *Hau-Khoin* ("True Men"), or *Hau-Damop* ("True Damas"), as they call themselves, are not "true" Hottentots at all, but a Bantu people with a slight admixture of Hottentot blood, who were at some unknown period assimilated in speech to their Dama[2] conquerors. The fundamental connexion of this language with that of the Bushmen, already suggested by Bleek, is supported by further evidence advanced by the late G. Bertin. But its relation to ancient Egyptian, a view at one time generally accepted on the authority of Dr R. Lepsius, rests on no solid grounds, and indeed is now shown to be untenable. In Egyptian, a Hamitic tongue with remote Semitic affinities, there are no clicks, which form an essential element of Hottentot phonetics, and the two languages differ also fundamentally in their lexical and structural characters.

Subjoined is a tabulated statement of the surviving Hottentot groups, all of whom, except perhaps the Namas, are disappearing by a slow process of extinction or absorption amongst the surrounding Boer and native populations. No Hottentot-English half-breeds are yet spoken of in any part of South Africa:—

Tribal Groups.	Domain.	Population (1890–99).
Northern Namas	Great Namaqualand	12,000
Oerlams	" "	5,000
Southern Namas	Little Namaqualand	3,000
Hill Damaras	N.E. Damaraland	26,000
Koranas	Upper Orange, Vaal, and Modder rivers	15,000
Griquas	Griqualand East	4,000
Gonaquas	Kaffre Borderlands	35,000 ?
Dispersed	Cape Colony	80,000 ?
Total full-blood and half-castes		180,000

Some of these terms still need explanation. The *Oerlams* of Great Namaqualand came originally from Little Namaqualand in Cape Colony, whence perhaps their name, which is said to be a corruption of the Dutch *Oberlanders*. All now speak Dutch, have given up the tribal system, and form semi-civilized Christian communities, differing little from those of the other settled populations, from whom they will scarcely be distinguishable in a few generations.

The *Griquas*, called by the Dutch *Baastards*, are a cross between the early Boer settlers and their female Hottentot slaves. After forming a semi-independent state on the Roggeodde uplands about 1800, most of them were driven (1815) by the whites across the Orange to the district from them named Griqualand, now Griqualand West. Here they again set up for themselves till the discovery of diamonds, when the territorial rights of their chief, Waterboer, were surrendered to the Colonial Government for a sum of money and compensation elsewhere (1871). Thereupon the bulk of these western Griquas joined their eastern kindred in the district which was formerly known as Noman'sland, but took the name of Adam Kok's Land in 1862, when it was assigned by the British Government to this Griqua chief and his people, refugees from their Boer oppressors in the Orange Free State. Later Adam Kok's Land was incorporated in Cape Colony as a separate administrative division, and re-named Griqualand East to distinguish it from the diamantiferous Griqualand West, which had already been annexed to Cape Colony in 1880. The great majority of the Griquas are now settled in the eastern division, where they live in harmony with the surrounding Basuto and

[1] Dr R. Virchow, *Verhandl. Berl. Ges. f. Anthrop.* 1895, p. 59, and Dr Mies, *Centralbl. f. Anthrop.* 1896, p. 50. Of a Hottentot skull from a cave on the Orange-Transvaal frontier, Dr Mies states that "its form is orthodolichocephalic, as with the Wasandawi" (*ib.*).

[2] The dual fem. form *Damara* ("Two Dama Women"), whence the geographical term "Damaraland" (the *Hereroland* of the Germans), was due to a misapprehension, for which see A. H. Keane's *Africa*, vol. ii. p. 176.

white populations. Many, however, have sold their lands, and thus sunk to the position of proletariates.

The *Gonaquas*, *i.e.*, "Borderers," are descendants of a very old cross between the Hottentots and the Kaffres, which sprang up on the "ethnical divide" between the two races apparently before the advent of the whites. They have always been treated with contempt, and regarded as outcasts by the Ama-Xosa Bantus, and would have been exterminated during the Kaffre wars but for the intervention of the British. At present they live in settled communities under civil magistrates without any tribal organization, and in some districts could scarcely be distinguished from the other natives but for their broken Hottentot-Dutch-English speech.

All the other natives to whom the term Hottentot can be in any way applied are now dispersed throughout Cape Colony, where they find employment about the farmsteads and in the households in various menial services. They generally speak a Dutch jargon, which in some places is being replaced by an equally debased "pidgin English."

AUTHORITIES.—G. M'CALL THEAL. *History of South Africa*, 1888–91.—E. T. HAMY. "Les Races Nègres," in *L'Anthropologie*, 1897, pp. 257 *et seqq.*—F. SHRUBSALL. "Crania of African Bush Races," in *Jour. Anthrop. Inst.* November 1897.—W. H. J. BLEEK. *A Comparative Grammar of South African Languages*, 1862; and "Die Hottentoten Stämme," in *Petermann's Mit.* 1858, pp. 49 *et seqq.*—G. FRITSCH. *Die Eingeborenen Süd-Afrikas*, 1872; and "Schilderungen der Hottentoten," in *Globus*, 1875, pp. 374 *et seqq.* —G. BERTIN. "The Bushmen and their Language," in *Jour. R. Asiat. Soc.* xviii. Part I., and reprint. (A. H. K.)

Houghton, Richard Monckton Milnes, 1st BARON (1809–1885), English poet and man of letters, son of Robert Pemberton Milnes, of Fryston Hall, Yorkshire, by the Hon. Henrietta Monckton, daughter of the fourth Lord Galway, was born in London, 19th June 1809. He was educated privately, and entered Trinity College, Cambridge, in 1827. There he was at once drawn into a literary set, and became a member of the famous "Apostles" Club, which then included Tennyson, Hallam, Trench, Blakesley, and other men of uncommon promise. He took his M.A. degree in 1831, and travelled abroad, spending some time at Bonn University. Thence he went to Italy and Greece, and published in 1834 a volume of *Memorials of a Tour in some Parts of Greece*, describing his experiences. He returned to London in 1837, and was in that year elected to Parliament as member for Pontefract. His parliamentary career was marked by much strenuous activity. He interested himself particularly in the question of copyright and the conditions of reformatory schools. He left Peel's party over the Corn Law controversy, and was afterwards identified with Palmerston's politics. Church matters had always a claim upon him: he wrote a striking tract in 1841, which was praised by Newman; and took part in the discussion about "Essays and Reviews." His literary career was industrious and cultured, without being exceptionally distinguished. He published two volumes of verse in 1838, *Memorials of Residence upon the Continent* and *Poems of Many Years*, *Poetry for the People* in 1840, and *Palm Leaves* in 1844. He also wrote a *Life and Letters of Keats* in 1848, and contributed largely to the reviews. His poetry is meditative and delicate; some of his ballads were among the most popular of their day, and all his work was marked by refinement. But his chief distinctions were his keen sense of literary merit in others, and the judgment and magnanimity with which he fostered it. He was surrounded by the most brilliant men of his time, many of whom he had been the first to acclaim. He secured a pension for Tennyson, pressed the claims of Emerson in Great Britain, and was one of the earliest champions of Mr Swinburne. He was, in the old sense of the word, a patron of letters, and one who never abused the privileges of his position. Milnes married in 1851 the Hon. Arabella Crewe (who died in 1874), and was made a peer in 1863. He died at Vichy on the 11th of August 1885, and was buried at Fryston. (A. WA.)

Houghton-le-Spring, a township in the Houghton-le-Spring parliamentary division of county Durham, England, 6 miles north-east of Durham city. St Michael's Church is ancient, of Early English and Decorated styles, and has been recently restored. St Andrew's, built in 1876, was enlarged in 1883. There are also a Roman Catholic and various Nonconformist chapels. Bernard Gilpin, "the Apostle of the North," was rector of this parish from 1556 to 1583, and the founder of the grammar-school. There are almshouses, church institutes, and a town-hall and market-place. The Durham to Sunderland main road here passes through a romantic limestone rock cutting 80 feet deep. The district affords frequent evidence of ice activity in the Glacial Period. The town is the radiating centre of a large projected scheme of electrical tramways. The population is mainly dependent on the neighbouring collieries, but limestone quarrying is carried on to some extent. Area of township (an urban district), 1551 acres. Population (1881), 6041; (1901), 7858.

Hounslow, a town of England, 12 miles west by south of St Paul's, London, in the Brentford parliamentary division of Middlesex; stations on the London and South-Western and the Metropolitan District Railways. The town has two parish churches, Holy Trinity (1835) and St Paul's (1874), and a district church, St Stephen's (1876). A Roman Catholic church was built in 1886; there are Congregational, Baptist, Methodist, and other places of worship. The town hall was built in 1857, and the Urban District Council offices in 1889. The Middlesex County Council has here a polytechnic institute (1892). Hounslow Hospital (1881) was enlarged in 1893. Hounslow is partly in Isleworth parish and partly in Heston. Population (1881), 10,459; (1901), 11,377.

Houston, capital of Harris county, Texas, U.S.A., on Buffalo Bayou, at the head of navigation, at an altitude of 53 feet. The site of the city, which is the second in size in the state, is level, and the plan fairly regular. With its navigable bayou, giving water communication with the Gulf of Mexico, and ten railways communicating with all parts of the state, it has a very large trade, especially in cotton, cotton-seed oil, and lumber. It is a commercial rather than a manufacturing city. In 1890 its manufactures had a capital of $3,509,434, employed 3009 hands, and produced goods valued at $6,832,943. The assessed valuation of real and personal property in 1900 (on a basis of assessment of about two-thirds of the full value) was $27,480,898; the tax-rate was $29·47 per $1000, and the net debt was $2,785,721. Population (1880), 16,513; (1890), 27,557; (1900), 44,633, of whom 4415 were foreign-born and 14,608 were negroes.

Hovas. See MADAGASCAR.

Hove. See BRIGHTON.

How, William Walsham (1823–1897), English bishop, son of a Shrewsbury solicitor, was born 13th December 1823, and was educated at Shrewsbury School and Wadham College, Oxford. He was ordained in 1846, and for upwards of thirty years was actively engaged in parish work. He refused preferment on several occasions, but his energy and success made him well known, and in 1879 he became a suffragan bishop in London, under the title of bishop of Bedford, his province being the East End. He became the inspiring influence of a revival of Church work in that district. He founded the East London Church Fund, and enlisted a large band of enthusiastic helpers, his popularity among all classes being immense. He was particularly fond of children, and was commonly called "the children's bishop." In 1888 he was

made bishop of Wakefield, and in the north of England he continued to do valuable work. His sermons were straightforward, earnest, and attractive; and besides publishing several volumes of these, he was a vigorous and elegant writer of hymns and other verses. In the movement for infusing new spiritual life into the Church services, especially among the poor, Bishop Walsham How was a great force, his tact and geniality being of particular value. He died 10th August 1897. He had married Miss Frances A. Douglas in 1849, and his wife was of much assistance to him in his work, but she died in 1887.

Howard, Oliver Otis (1830- ——), American soldier, was born in Leeds, Me., on 8th November 1830. He graduated at Bowdoin College in 1850, and at the U.S. Military Academy in 1854. Resigning from the regular army in 1861 to take command of the 3rd Maine Regiment, he became, in September 1861, a brigadier-general of volunteers, and major-general in November 1862. He was twice wounded at Fair Oaks, 1st June 1862, losing his right arm; fought in 1863 at Chancellorsville and Gettysburg, and, transferred to the west, served at Chattanooga and during Sherman's operations (1864–65). He became a brigadier in the United States army on the 21st December 1864, was major-general in 1886, and retired in 1894. Howard University, established at Washington for the education of the negro race, was named in his honour.

Howe, Julia Ward (1819- ——), American poet and reformer, daughter of Samuel Ward, was born in New York, 27th May 1819. In 1843 she married Dr Samuel Gridley Howe (1801–1876), a pioneer in the education of the blind and of blind deaf-mutes, whose success in the instruction of Laura Bridgman attracted the attention of Charles Dickens and of many philanthropists. Mrs Howe wrote several volumes of poems, her best-known piece being the "Battle-Hymn of the Republic," which, set to the music of "John Brown's body lies a-mouldering in the grave," had great vogue in the Northern States of America during the war of 1861–65. She has engaged actively in movements on behalf of the anti-slavery cause and of woman-suffrage. Her poems were published under the titles of *Passion Flowers* (1854), *Words for the Hour* (1856), and *Later Lyrics* (1866); and she has also written *Sex in Education* (1874), *Modern Society* (1880), and *Margaret Fuller* (1883).

Howells, William Dean (1837- ——), American novelist, was born at Martinsville, Ohio, 1st March 1837. His father, William Cooper Howells, a printer-journalist, moved in 1840 to Hamilton, Ohio, and here the boy's early life was spent successively as type-setter, reporter, and editor in the offices of various newspapers. In the midst of routine work he contrived to familiarize himself with a wide range of authors in several modern tongues, and to drill himself thoroughly in the use of good English. In 1861, as assistant editor of the leading republican newspaper in Ohio, he wrote—in connexion with the Presidential contest—the campaign life of Lincoln; and in the same year he was appointed consul at Venice, where he remained till 1865. On his return to America he joined the staff of the *Atlantic Monthly*, and from 1871 to 1881 he was its editor-in-chief. Since 1885 he has lived in New York. For a time he conducted for *Harper's Magazine* the department called "The Editor's Study," and in December 1900 he revived for the same periodical the department of "The Easy Chair," which had lapsed with the death of George William Curtis. Of Mr Howells's many novels, the following may be mentioned as specially noteworthy: *Their Wedding Journey*, 1871; *The Lady of the Aroostook*, 1879; *A Modern Instance*, 1882; *The Rise of Silas Lapham*, 1885; *The Minister's Charge*, 1886; *A Hazard of New Fortunes*, 1889; *The Quality of Mercy*, 1892; *The Landlord at Lion's Head*, 1897. Mr Howells is by general consent the foremost representative of the realistic school of indigenous American fiction. From the outset his aim has been to portray life with entire fidelity in all its commonplaceness, and yet to charm the reader into a liking for this commonplaceness and into reverence for what it conceals. Though in his earliest novels his method was not consistently realistic—he is at times almost as personal and as whimsical as Thackeray—yet his vivid impressionism and his choice of subjects, as well as an occasional explicit protest that "dulness is dear to

William Dean Howells
(From a photograph by C. F. Conby, Boston.)

him," already revealed unmistakably his realistic bias In *A Modern Instance* (1882) he gained complete command of his method, and began a series of studies of American life that are remarkable for their loyalty to fact, their truth of tone, and their power to reveal, despite their strictly objective method, both the inner springs of American character and the sociological forces that are shaping American civilization. Mr Howells's method, as finally developed in his more serious fiction, is noteworthy for its restraint and its conscientious impersonality. He refuses to over-sophisticate or to over-intellectualize his characters, and he is very sparing in his use of psychological analysis. He insists on seeing and portraying American life as it exists in and for itself, under its own skies and with its own atmosphere; he does not scrutinize it with foreign comparisons in mind, and thus try to find and to throw into relief unsuspected configurations of surface. He keeps his dialogue toned down to almost the pitch of everyday conversation, although he has shown in his comedy sketches how easy a master he is of adroit and witty talk. His style is in general transparent and rigorously plain, and his humour impersonal and dramatic. That he is at times the victim of a superstition for the commonplace even his warmest admirers can hardly deny. Life in America has, after all, greater charm of manner and greater intellectual and social refinement than he seems willing to admit. He has

the air of obstinately choosing sordid material, as if he were ambitious to outdo the gods themselves in creating beauty. Yet, on the other hand, he has been again and again justified of his ambition, and has compelled some apparently quite prosaic bit of life to exhale a quaint poetic fragrance or to reveal a poignant tragic quality. Taken altogether, his novels doubtless offer a more penetrating and comprehensive interpretation of American life than can be found in the works of any other writer of fiction.

Howitt, Mary (1799–1888), English writer, daughter of Samuel Betham, was born at Coleford, Gloucestershire, 12th March 1799. She began to write verse when quite young, and in 1821 married William Howitt (see *Ency. Brit.* vol. xii. p. 324). She and her husband collaborated throughout a long literary career, Mrs Howitt's own contributions being of a varied and voluminous description, consisting of poems, songs, stories, &c. A month after her husband's death in 1877, Mrs Howitt was given a Civil List pension of £100 a year. Mary Howitt died 30th January 1888. Brought up as a Quaker, she left the Society of Friends in 1847; and after passing through a stage of spiritualism, she joined the Church of Rome in 1882.

Howrah, a city and district of British India, in the Burdwan division of Bengal. The city is situated opposite Calcutta, with which it is connected by a floating bridge. The municipal area is about 11 square miles; the population in 1881 was 105,628, in 1891 it was 116,606, and in 1901 it was 157,847, showing an increase of 35 per cent. Howrah is the terminus of the East Indian Railway, and of the Bengal-Nagpur and East Coast lines. A project has been under consideration for carrying all these railways into Calcutta by a permanent bridge across the river. Howrah is also the centre of two steam tramways, which run for 29 and 19 miles into the country. Further, it is the headquarters of the jute-manufacturing industry, with many steam presses and steam mills, and there are four cotton mills (see Bengal). There is a paper mill, employing 1000 hands, with an annual out-turn valued at Rs.14,00,000; six flour mills, employing 300 hands, with a yearly out-turn valued at Rs.30,00,000; several foundries and iron-works, one of which alone employs more than 3000 hands, with an annual out-turn valued at Rs.24,00,000; two oil mills; two large ropeworks; and factories of safety matches and umbrellas. Sibpur Engineering College lies on the outskirts of the town. There is a hospital, with a department for Europeans. The District of Howrah extends southwards down the right bank of the Hooghly to the confluence of the river Damodar. For revenue purposes it is included within the district of Hooghly. Its area is 476 square miles; the population in 1881 was 635,381, in 1891 it was 721,211, giving an average density of 1515 persons per square mile. In 1901 the population was 852,008. The number of police was 667; the number of boys at school in 1896–97 was 31,777, being 55 per cent. of the male population of school-going age; the registered death-rate in 1897 was 29·32 per thousand. In addition to the two steam tramways and the East Indian Railway, the district is crossed by the high-level canal to Midnapur, which communicates with the Hooghly at Ulubaria. The manufacturing industries of Howrah extend beyond the town into the district. One or two systems of draining low-lying lands are maintained by the Government.

Höxter, a town of Prussia, province of Westphalia, on the Weser, 32 miles north of Cassel. The town-house dates from 1466 and 1613, and there are churches of the 11th and 14th centuries, as well as numerous houses of the 16th. The town possesses various industries—cement, paper, gutta-percha, &c.—and an architectural school. It grew out of a royal estate which dates from 823, and eventually became a free imperial town and a member of the Hanseatic League, with a mint and staple of its own. Population (1885), 6046; (1900), 7625. Close to Höxter is the abbey of Corvey, one of the most famous Benedictine monasteries in Germany, founded in 822 and secularized in 1803; the "castle" contains a valuable old library of some 55,000 volumes. Hoffmann von Fallersleben, who was librarian from 1860 to 1874, is buried behind the abbey church.

Huallaga. See Amazon.

Huancavelica, an interior department of Central Peru. It has an area of 10,814 square miles, and (1896) a population of 223,796, or 20 persons to the square mile. It contains the four provinces of Tayacaja, Huancavelica, Angaraes, and Castrovireyna. The capital, Huancavelica, has a population of 8000.

Huanuco, an interior department of Central Peru. It has an area of 14,023 square miles, and a population (1896) of 145,309, or 10 persons to the square mile. It is divided into the three provinces of Huamalies, Dos de Mayo, and Huanuco. Its capital, Huanuco, is 170 miles north-north-east of Lima.

Hubli, a town of British India, in the Dharwar district of Bombay, 15 miles south-east of Dharwar town. Population (1881), 36,677; (1891), 52,595; (1901), 58,149. It is a railway junction on the Southern Mahratta system, where the lines to Bangalore and Bezwara branch off south and west. It is an important centre of trade and of cotton and silk weaving, and has a cotton mill with 18,880 spindles, employing 725 hands, eleven factories for ginning and pressing cotton, and a printing-press, issuing a newspaper in vernacular and English.

Hübner, Joseph Alexander, Count (1811–1892), Austrian diplomatist, was born in Vienna on 26th November 1811. His real name was Hafenbredl, which he afterwards changed to Hübner. He began his public career in 1833 under Metternich, whose confidence he soon gained, and who sent him in 1837 as attaché to Paris. In 1841 he became secretary of embassy at Lisbon, and in 1844 Austrian consul-general at Leipzig. In 1848 he was sent to Milan to conduct the diplomatic correspondence of Archduke Rainer, viceroy of Lombardy. On the outbreak of the revolution he was seized as a hostage, and remained a prisoner for some months. Returning to Austria, he was entrusted with the compilation of the documents and proclamations relating to the abdication of the Emperor Ferdinand and the accession of Francis Joseph. His journal, an invaluable clue to the complicated intrigues of this period, was published in 1891 in French and German, under the title of *Une Année de ma Vie, 1848–1849*. In March 1849 he was sent on a special mission to Paris, and later in the same year was appointed Ambassador to France. To his influence was in large measure due the friendly attitude of Austria to the Allies in the Crimean War, at the close of which he represented Austria at the Congress of Paris in 1856. He allowed himself, however, to be taken by surprise by Napoleon's intervention on behalf of Italian unity, of which the first public intimation was given by the French Emperor's cold reception of Hübner on New Year's Day, 1859, with the famous words: "I regret that our relations with your Government are not so good as they have hitherto been." He did not return to Paris after the war, and after holding the ministry of police in the Goluchowski cabinet from August to October 1859,

lived in retirement till 1865, when he became ambassador at Rome. Quitting this post in 1867, he undertook extensive travels, his descriptions of which appeared as *Promenade autour du Monde, 1871* (1873; English translation by Lady Herbert, 1874), and *Through the British Empire* (1886). Written in a bright and entertaining style, and characterized by shrewd observation, they achieved considerable popularity in their time. A more serious effort was his *Sixte-Quint* (1870; translated into English by H. E. H. Jerningham under the title of *The Life and Times of Sixtus the Fifth*, 1872), an original contribution to the history of the period, based on unpublished documents at the Vatican, Simancas, and Venice. In 1879 he was made a life-member of the Austrian Upper House, where he sat as a Clerical and Conservative. He had received the rank of Baron (Freiherr) in 1854, and in 1888 was raised to the higher rank of Count (Graf). He died at Vienna on 30th July 1892. Though himself of middle-class origin, he was a profound admirer of the old aristocratic *régime*, and found his political ideals in his former chiefs, Metternich and Schwarzenberg. As the last survivor of the Metternich school, he became towards the close of his life more and more out of touch with the trend of modern politics, but remained a conspicuous figure in the Upper House and at the annual delegations. That he possessed the breadth of mind to appreciate the working of a system at total variance with his own school of thought was shown by his grasp of British colonial questions. It is interesting, in view of subsequent events, to note his emphatic belief in the loyalty of the British colonies—a belief not shared at that time by many statesmen with far greater experience of democratic institutions. With strange inconsistency, he refused to apply these conclusions to the internal politics of his own country. (H. SY.)

Huddersfield, a municipal, county (1888), and parliamentary borough and market town in the West Riding of Yorkshire, England, on the Colne, 190 miles by rail north-north-west of London. The municipal borough was extended in 1890, and is now distributed into 13 wards under a mayor, 15 aldermen, and 45 councillors. St Mark's Church was erected in 1887, and Longwood Grammar School (1731) reorganized in 1892. There are now 18 board schools (the college higher grade having been acquired by the school board in 1893), 22 national, and 2 Roman Catholic schools. The reservoirs of the waterworks will hold 1,159,000,000 gallons, and two other reservoirs, now in course of construction, about 460,000,000 gallons. These works have cost over a million sterling. A new theatre was built in 1881. In 1891, 6258 males and 4845 females were employed in the manufacture of woollen cloth, 1295 males and 2195 females in the manufacture of worsted stuff, and 1144 males and 1252 females in the manufacture of cotton goods. There are two daily newspapers. Area, 11,852 acres. Population (1881), 86,502; (1901), 95,008.

Hudson, a town of Middlesex county, Massachusetts, U.S.A., on the Boston and Maine and the Fitchburg Railways. It has an area of 13 square miles of hilly surface, containing a village of the same name, situated on the Assabet, at an altitude of 226 feet. Population (1880), 3739; (1890), 4670; (1900), 5454, of whom 1225 were foreign-born.

Hudson, capital of Columbia county, New York, U.S.A., on the east bank of the Hudson river. It has three railways—the Boston and Albany, the New York Central and Hudson River, and the Kinderhook and Hudson—as well as steamboat lines on the river connecting it with New York and Albany. It has manufactures of varied character. Population (1880), 8670; (1890), 9970; (1900), 9528, of whom 1155 were foreign-born and 424 were negroes.

Hué, capital of Annam, near the mouth of Hué river, on the coast of Cochin-China, French Indo-China. Formerly closed to Europeans, French enterprise is now active in its midst. The royal palace, once forbidden ground, is to-day open to foreigners, and the citadel is occupied by French troops. The palace of the French resident-general, opposite the citadel on the right bank of the Hué—the *Song-Huon-Giang*—is connected with the citadel by a stationary bridge 1150 feet in length. A glass factory has been established, and a frequent service of steam launches connects the town with the ports of Tuan-an and Tourane. The population (1901) includes twenty-three Europeans (exclusive of officials), 50,000 Annamese, and 300 Chinese. Important suburbs have gathered round the official town, the villages of Dông-Bo, Bo-vinh, Gia-Ho, and Kim-Long forming a sort of commercial belt about the governmental city. The apostolic vicariate of northern Cochin-China is established near Kim-Long. (J. M. A. DE L.)

Huehuetenango, a city of Guatemala, capital of a department of the same name. It is situated in a fertile plain, watered by the Chiapas, a tributary of the Rio Grijalva, 106 miles north-west of Guatemala. In the neighbourhood there are lead mines, and at a short distance from the city, on a terrace surrounded by ravines, are important remains of an ancient Indian capital. Population, 12,000.

Huelva, a maritime province of south-western Spain. The area is 4122 square miles, divided into six administrative districts and seventy-seven parishes. The means of communication have been very much improved. A broad-gauge railway, 68 miles in length, has been opened between Seville and Huelva, and another, 112 miles long, from Huelva to Zafra, and other lines are in course of construction. There are, besides, 135 miles of narrow-gauge lines, connecting Huelva with the mines of Rio Tinto, Tharsis, Buitron, and Zalamea, and minor branches from Tharsis to La Zarza, and Cuervo to Sotul mines. There are 98 miles of first-class state roads, and very many useful provincial second- and third-class roads. Apart from vines, which cover 23,500 acres, the agriculture of the province is not very important, though 45,500 acres were devoted in 1898 to the culture of wheat, 26,000 to oats, rye, barley, 56,000 acres to pod fruit, and 37,000 to olives. Orange groves yield a good crop. In some parts of the province are pine, cork trees, oaks, chestnuts, and beeches. In 1898 there were 7796 horses, 7963 mules, 13,650 asses, 11,897 cattle, 82,612 sheep, 55,125 goats, and 28,011 pigs. The local industries include 241 manufactories of brandy (*aguardiente*), 78 brickworks, 152 oil mills, 12 soapworks, 18 candle factories, and 360 flour mills. The fisheries also afford a thriving industry, and there are 27 establishments for salting. The principal industry, however, is mining, 307 mines being productive and 717 unproductive. The productive mines, which include 288 copper mines, employed, in 1898, 9108 hands (7875 in the copper mines), and the works connected therewith employed 5078 additional hands. The output included 70,814 tons of sulphur, 15,829 tons of iron ore, 2,229,595 tons of copper ore, 70,000 of iron pyrites, 101,861 of manganese, and 1494 of argentiferous lead. Population (1887), 254,831; (1897), 253,970.

Huelva, capital of the above province. It is a rising and important port, and, with Bilbao and Barcelona, has an increasing trade with Great Britain. There are

few buildings of artistic merit, and the most notable public works are the port improvements, the splendid piers and quays, a bull-ring, the stations, and one of the business offices. The river has a deep channel, but the sandbanks in the river and estuary are serious drawbacks. The shipping returns for 1898 show 1257 vessels of 806,439 tons, 615 of 557,356 tons being British. The export trade in ores is most prosperous, but the wine export has decreased since France raised her scale of duties, the figures for 1898 being 119,836,400 pints, chiefly shipped to France. Among the exports Great Britain took, in 1898, 512,911 tons of cupreous sulphur ore pyrites, 5820 tons of washed ore, 29,972 tons of precipitate of copper, 15,919 of copper mat, 44,924 of iron pyrites, 4179 of manganese, and a considerable amount of corks. Great Britain stands at the head of the imports of manufactured goods, machinery, and breadstuffs, and in 1898 sent 65,768 tons of coal and 13,454 tons of coke. The total of imports during 1899 was 96,508 tons (of 1000 kilos), of which 33 per cent. came from Great Britain, whilst the total of exports for the same period amounted to 1,490,869 tons, 635,431 tons (42 per cent.) being shipped to Great Britain. In 1900 the total of imports was 111,350 tons, 99,252 of which (89 per cent.) were imported from Great Britain. The total of exports amounted to 1,571,257 tons, the total shipped to Great Britain being 622,208 tons (39 per cent.). Population (1887), 18,195; (1897), 19,423.

Huércal-Overa, a town of south-east Spain, in the province of Almeria, not far from the coast. The streets are broad, and there are three fine squares. The parish church has a fine nave and handsome altars. Near Huércal-Overa is the important mining district of Sierra Almagrera. Apart from the product of the mines, the local trade is chiefly agricultural. Population (1887), 15,631; (1897), 16,266.

Huesca, a frontier province of north-east Spain. Its area is 7530 square miles, divided into 8 administrative districts and 362 parishes. The railway from Saragossa to Barcelona runs through the province, and has branches from Tarelimta to Huesca and from Seigna to Barbastro. The Central Pyrenean Railway starts from Zuera on the Saragossa-Barcelona line by the valley of the Gallego, and has been extended to Canfranc, from which it will run to the Somport, the site of the tunnel through the Pyrenees, when France and Spain are in a position to carry out this railway and the Catalonia, Noguera, Pallares, and Ariège line which they undertook to execute simultaneously in 1882. The province of Huesca has 128 miles of first-class roads, and some good provincial and parish roads kept up at local expense. Trade is most active with France, where are sent timber, millstones, cattle, leather, brandy, and, above all, wine. The vineyards were quickly developed from 1882 to 1892, in the heyday of the exports of common red wines to France, but have much declined since. The forests of the Pyrenean region afford one of the most flourishing local industries, pine, fir, oak, and beech forests giving annually £160,000 worth of excellent timber. In some districts irrigation fertilized many thousand acres. The mineral resources remain almost entirely undeveloped. In 1898 there were 4864 horses, 44,170 mules, 30,796 asses, 45,611 cattle, 443,517 sheep, 83,348 goats, and 43,868 pigs. Agriculture is progressing owing to the enterprising spirit of the inhabitants. No less than 352,000 acres were devoted in 1898 to wheat, 30,000 acres to rye, oats, barley, and maize, 14,000 acres to pod fruit, 141,000 acres to vines, and 39,000 acres to olives. There is some emigration. Population (1897), 247,317.

Huesca, the capital of the above province. Considerable attention is paid to public education, and there are not only several good primary schools, but normal schools for teachers, an institute, a seminary, an artistic and archæological museum, and an economical society. A few manufactures and an active trade in agricultural products and wines have kept up its importance, despite the decline of its population consequent on emigration to France. Population (1887), 13,043; (1897), 11,204.

Huet. See Busken-Huet.

Huggins, Sir William (1824– ——), English astronomer, was born in London on 7th February 1824, and was educated first at the City of London School and then under various private teachers. Having determined to apply himself to the study of astronomy, he built a private observatory for that purpose at Tulse Hill, in the south of London, about 1855. At first he occupied himself with routine work on the ordinary lines followed by astronomers of the day, but he was far from satisfied with the scope which this afforded, and therefore seized eagerly upon the opportunity for research in a new direction which was offered by Kirchhoff's discoveries in spectrum analysis. The chemical constitution of the stars was the problem to which he turned his attention, and his first results, obtained in conjunction with Professor W. A. Miller, were presented to the Royal Society in 1863, in a preliminary note on the "Lines of some of the fixed stars." At the same time, by making use of photography, he introduced into the methods of astronomy an innovation which was destined ultimately to exert as potent an influence on the progress of the science as spectroscopy itself. Wet collodion was, however, the only process at first available, and the difficulties involved in its application to astronomical purposes were so enormous that it was used only to a very limited extent; the real triumphs of photographic astronomy began about 1875 with the invention of the gelatine dry plate. This enabled the observer to make his exposures as long as he might desire, and, through the cumulative action of light on his extremely sensitive surfaces, to obtain permanent accurate pictures of celestial objects which are so faint as to be completely invisible to the eye, even when aided by the most powerful telescopes. In the last quarter of the 19th century spectroscopy and photography together worked a revolution in the science of observational astronomy, and in the utilization of both Huggins acted as pioneer. Besides these new methods, many results of great importance are associated with his name. Thus in 1864 the spectroscope yielded him evidence that the planetary nebula in Draco consists of luminous gas—a conclusion confirming the nebular hypothesis and supporting the belief that such nebulæ are surviving relics of the mass of glowing gas from which Laplace supposed the solar system to have been formed by condensation. Four years afterwards the same instrument enabled Huggins to prove the existence of carbon in comets; and about the same time he showed how by the application of Doppler's principle it can be used not only to detect the motion of stars moving in the line of vision, but even to measure its amount with more or less accuracy. Such data, which the astronomer can scarcely gain in any other way, are obviously indispensable to any adequate conception of the arrangement of the stars in space. In solar physics Huggins suggested a spectroscopic method by which the red prominences of the sun may be viewed at any time, even when it is not eclipsed, and one of his experiments went far towards settling a much-disputed question regarding the solar distribution of calcium. In the general solar spectrum

this element is represented by a large number of lines, but in the spectrum of the prominences and chromosphere only one pair of these can be detected. This circumstance has seemed so anomalous to some astronomers that they have doubted whether the pair of lines in question is due to calcium at all, but Sir William and Lady Huggins (who, after their marriage in 1875, actively assisted her husband in his scientific work) dispelled this doubt by demonstrating in the laboratory that calcium vapour, if at a sufficiently low pressure, gives under the influence of the electric discharge precisely these lines and no others. Sir William Huggins, who was made K.C.B. in 1897, has received many honours, academic and other. He presided over the meeting of the British Association in 1891, and in 1900 was chosen president of the Royal Society, from which he has at different times received a Royal, a Copley, and a Rumford medal. He is the author of many scientific papers and (with Lady Huggins) of a magnificent *Atlas of Representative Stellar Spectra*, published in 1900, which gained the Actonian prize of the Royal Institution.

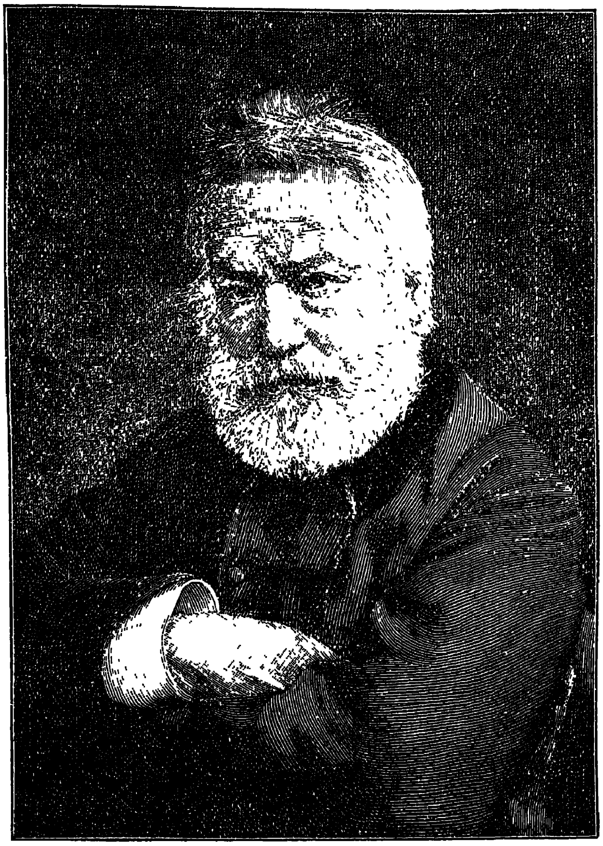
Hughes, David Edward (1831–1900), Anglo-American electrician, was born on 16th May 1831 in London, but the earlier part of his life was spent in America, whither his parents emigrated when he was about seven years old. In 1850 he became professor of music at the college of Bardstown, Kentucky, and soon afterwards his attainments in physical science procured his appointment as professor of natural philosophy at the same place. His professorial career, however, was brief, for in 1854 he removed to Louisville to supervise the manufacture of the type-printing telegraph instrument which he had been thinking out for some time, and which was destined to make both his name and his fortune. The patent for this machine was taken out in the United States in 1855, and its success was immediate. (For a description, see *Ency. Brit.* vol. xxiii. p. 121.) About the period when it was invented the Morse system, under the control of the American Telegraph Company, held the field in the United States, and the new instrument was promptly taken up as a means to fight what were regarded as the excessive rates charged by that company. After seeing it well established on one side of the Atlantic, Hughes in 1857 brought it over to his native country, where, however, the telegraph companies did not receive it with any favour. Two or three years afterwards he introduced it to the notice of the French Government, who, after submitting it to severe tests, ultimately adopted it, and in the succeeding ten years it came into extensive use all over Europe, gaining for its inventor numerous honours and prizes. In the development of telephony also Hughes had an important share, and the telephone has attained its present perfection largely as a result of his investigations. The carbon transmitters which in various forms are in almost universal use are modifications of a simple device which he called a microphone, and which consists essentially of two pieces of carbon, one resting lightly on the other. The arrangement constitutes a variable electrical resistance of the most delicate character; if it is included in an electric circuit with a battery and subjected to the influence of sonorous vibrations, its resistance varies in such a way as to produce an undulatory current which affords an exact representation of the sound waves as to height, length, and form. These results were published in 1878, but Hughes did much more work on the properties of such microphonic joints, of which he said nothing till many years afterwards. When towards the end of 1879 he found that they were also sensitive to "sudden electric impulses, whether given out to the atmosphere through the extra current from a coil or from a frictional machine," he in fact discovered the phenomena on which depends the action of the so-called "coherers" that form an indispensable adjunct to wireless telegraphy. But he went further and practised wireless telegraphy himself, surmising, moreover, that the agency he was employing consisted of true electric waves. Setting some source of the "sudden electric impulses" referred to above into operation in his house, he walked along the street carrying a telephone in circuit with a small battery and one of these microphonic joints, and found that the sounds remained audible in the telephone until he had traversed a distance of 500 yards. This experiment he showed to several English men of science, among others to Sir G. G. Stokes, to whom he broached the theory that the results were due to electric waves. That physicist, however, was not disposed to accept this explanation, considering that a sufficient one could be found in well-known electromagnetic induction effects, and Hughes was so discouraged at that high authority taking this view of the matter that he resolved to publish no account of his inquiry until further experiments had enabled him to prove the correctness of his own theory. These experiments were still in progress when Hertz settled the question by his researches on electric waves in 1887–89. Hughes, who is also known for his invention of the induction balance and for his contributions to the theory of magnetism, died in London on 22nd January 1900. As an investigator he was remarkable for the extraordinary simplicity of the apparatus which served his purposes, domestic articles like jam-pots, pins, &c., forming a large part of the equipment of his laboratory. His manner of life, too, was simple and frugal in the extreme. At his death he was possessed of property worth not much less than half a million sterling, and the whole of this immense sum, with the exception of some bequests to the Royal Society, the Paris Academy of Sciences, the Institution of Electrical Engineers, and the Paris Société Internationale des Électriciens, for the establishment of scholarships and prizes in physical science, was left to four London hospitals, subject only to the payment of life annuities to certain of his relatives. (H. M. R.)

Hughes, Thomas (1822–1896), English lawyer and author, second son of John Hughes of Donnington Priory, editor of *The Boscobel Tracts* (1830), was born at Uffington, Berks, on 20th October 1822. In February 1834 he went to Rugby School, to be under Dr Arnold, a contemporary of his father at Oriel. He rose steadily to the sixth form, where he came into contact with the headmaster whom he afterwards idealized; but he excelled rather in sports than in scholarship, and his school career culminated in a cricket match at Lord's. In 1842 he proceeded to Oriel, Oxford, and graduated B.A. in 1845. He was called to the bar in 1858, became Q.C. in 1869, a bencher in 1870, and was appointed to a county court judgeship in the Chester district in July 1882. While at Lincoln's Inn he came under the dominating influence of his life, that of Frederick Denison Maurice. In 1848 he joined the Christian Socialists, under Maurice's banner, among his closest allies being Charles Kingsley. In January 1854 he was one of the original promoters of the Working Men's College in Great Ormond Street, and whether he was speaking on sanitation, sparring, or singing his favourite ditty of "Little Billee," his work there continued one of his chief interests to the end of his life. After Maurice's death he held the principalship of the college. His *Manliness of Christ* (1879) grew out of a Bible-class which he held there. Hughes had been influenced mentally by Arnold, Carlyle, Thackeray, Lowell,

and Maurice, and had developed into a liberal churchman, extremely religious, with strong socialistic leanings; but the substratum was still and ever the manly country squire of old-fashioned, sport-loving England. In Parliament, where he sat for Lambeth (1865–68), and for Frome (1868–74), he reproduced some of the traits of Colonel Newcome. Thrice he visited America and received a warm welcome, less as a propagandist of social reform than as a friend of Lowell and of the North, and an author. In 1879, in a sanguine humour worthy of Mark Tapley, he planned a co-operative settlement, "Rugby," in Tennessee, over which he lost money. In 1848 Hughes had married Frances, niece of Richard Ford, of Spanish *Handbook* fame. They settled in 1853 at Wimbledon, and there was written his famous story, *Tom Brown's School Days*, "by an Old Boy" (dedicated to Mrs Arnold of Fox Howe), which came out in April 1857. It is probably impossible to depict the schoolboy in his natural state and in a realistic manner; it is extremely difficult to portray him at all in such a way as to interest the adult. Yet this last has certainly been achieved twice in English literature—by Dickens in *Nicholas Nickleby*, and by Hughes in *Tom Brown*. In both cases interest is concentrated upon the master, in the first a demon, in the second a demigod. *Tom Brown* did a great deal to fix the English concept of what a public school should be. Hughes also wrote *The Scouring of the White Horse* (1859), *Tom Brown at Oxford* (1861), *Religio Laici* (1868), and the *Memoir of a Brother*. The brother was George Hughes, who was in the main the original "Tom Brown," just as Dean Stanley was in the main the original of "Arthur." Hughes died at Brighton, on 22nd March 1896. He was English of the English, full of "muscular Christianity," straightforward and unsuspicious to a fault, yet attaching a somewhat exorbitant value to "earnestness"—a favourite expression of Doctor Arnold. (T. SE.)

Hugo, Victor Marie (1802–1885), the great French poet, dramatist, and romance-writer, was born at Besançon on the 26th of February 1802. The all but still-born child was only kept alive and reared by the indefatigable devotion of his mother, a royalist of La Vendée married to a general in the service of Napoleon. Educated first in Spain and afterwards in France, the boy whose infancy had followed the fortunes of the imperial camp grew up a royalist and a Catholic. His first work in poetry and in fiction was devoted to the passionate proclamation of his faith in these principles. The precocious eloquence and ardour of these early works made him famous before his time. The odes which he published at the age of twenty, admirable for their spontaneous fervour and fluency, might have been merely the work of a marvellous boy; the ballads which followed them two years later revealed him as a great poet, a natural master of lyric and creative song. In 1823, at the age of twenty-one, he married his cousin Adèle Foucher. In the same year his first romance, *Han d'Islande*, was given to the press; his second, *Bug-Jargal*, appeared three years later. In 1827 he published the great dramatic poem of *Cromwell*, a masterpiece at all points except that of fitness for the modern stage. Two years afterwards he published *Les Orientales*, a volume of poems so various in style, so noble in spirit, so perfect in workmanship, in music, and in form, that they might alone suffice for the foundation of an immortal fame. In the course of nine years, from 1831 to 1840, he published *Les Feuilles d'Automne*, *Les Chants du Crépuscule*, *Les Voix Intérieures*, and *Les Rayons et les Ombres*. That their author was one of the greatest elegiac and lyric poets ever born into the world, any one of these volumes would amply suffice to prove. That he was the greatest tragic and dramatic poet born since the age of Shakespeare, the appearance of *Hernani* in 1830 made evident for ever to all but the meanest and most perverse of dunces and malignants. The earlier and even greater tragedy of *Marion de Lorme* had been proscribed on the ground that it was impossible for royalty to tolerate the appearance of a play in which a king was represented as the puppet of a minister. In all the noble and glorious life of the greatest poet of his time there is nothing on record more chivalrous and characteristic than the fact that Victor Hugo refused to allow the play which had been prohibited by the Government of Charles X. to be instantly produced under the Government of his supersessor. *Le Roi s'amuse*, the next play which Hugo gave to the stage, was prohibited by order of Louis Philippe after a tumultuous first night—to reappear again fifty years later on the same day of the same month, under the eyes of its author, with atoning acclamation from a wider audience than the first. Terror and pity had never found word or expression on the stage which so exactly realized the ideal aim of tragic poetry among the countrymen of Æschylus and Sophocles since the time or since the passing of Shakespeare, of Marlowe, and of Webster. The tragedy of *Lucrèce Borgia*, coequal in beauty and power with its three precursors, followed them next year in the humbler garb of prose; but the prose of Victor Hugo stands higher on the record of poetry than the verse of any lesser dramatist or poet. *Marie Tudor*, his next play, was hardly more daring in its Shakespearean defiance of historic fact, and hardly more triumphant in its Shakespearean loyalty to the everlasting truth of human character and passion. *Angelo, Tyran de Padoue*, the last of the tragic triad to which their creator denied the transfiguration of tragic verse, is inferior to neither in power of imagination and of style, in skill of invention and construction, and in mastery over all natural and noble sources of pity and of terror. *La Esmeralda*, the libretto of an opera founded on his great tragic romance of *Notre-Dame de Paris*, is a miracle of lyric melody and of skilful adaptation. *Ruy Blas*, his next play, was written in verse, and in such verse as none but he could write. In command and in expression of passion and of pathos, of noble and of evil nature, it equals any other work of this great dramatic poet; in the lifelike fusion of high comedy with deep tragedy it excels them all. *Les Burgraves*, a tragic poem of transcendent beauty in execution and imaginative audacity in conception, found so little favour on the stage that the author refused to submit his subsequent plays to the verdict of a public audience. His first mature work in prose fiction, *Le Dernier Jour d'un Condamné*, had appeared thirteen years earlier. As a tragic monodrama it is incomparable for sustained power and terrible beauty. The story of *Claude Gueux*, published five years later, another fervent protest against the infliction of capital punishment, was followed by many other eloquent and passionate appeals to the same effect, written or spoken on various occasions which excited the pity or the indignation of the orator or the poet. In 1831 appeared the greatest of all tragic or historic or romantic poems in the form of prose narrative, *Notre-Dame de Paris*. Three years afterwards the author published, under the title of *Littérature et Philosophie mêlées*, a compilation or selection of notes and essays ranging and varying in date and in style from his earliest effusions of religious royalism to the magnificent essay on Mirabeau which represents at once the historical opinion and the critical capacity of Victor Hugo at the age of thirty-two. Next year he published *Le Rhin*, a series of letters from Germany, brilliant and vivid beyond all comparison, containing one of the most splendid stories for children ever written, and

followed by a political supplement rather pathetically unprophetic in its predictions. At the age of thirty-eight he honoured the French Academy by taking his place among its members; the speech delivered on the occasion was characteristically generous in its tribute to an undeserving memory, and significantly enthusiastic in its glorification of Napoleon. Idolatry of his father's hero and leader had now superseded the earlier superstition inculcated by his mother. In 1846 his first speech in the chamber of peers —Louis Philippe's House of Lords—was delivered on behalf of Poland; his second, on the subject of coast defence, is memorable for the evidence it bears of careful research and practical suggestion. His pleading on behalf of the exiled family of Bonaparte induced Louis Philippe to cancel the sentence which excluded its members from France. After the fall and flight of the house of Orleans, his parliamentary eloquence was never less generous in aim and always as fervent in its constancy to patriotic and progressive principle. When the conspiring forces of clerical venality and political prostitution had placed a putative Bonaparte in power attained by perjury after perjury, and supported by massacre after massacre, Victor Hugo, in common with all honourable men who had ever taken part in political or public life under the government superseded by force of treason and murder, was driven from his country into an exile of well-nigh twenty years. Next year he published *Napoléon le Petit;* twenty-five years afterwards, *Histoire d'un Crime.* In these two books his experience and his opinion of the tactics which founded the second French empire stand registered for all time. In the deathless volume of *Châtiments,* which appeared in 1853, his indignation, his genius, and his faith found such utterance and such expression as must recall to the student alternately the lyric inspiration of Coleridge and Shelley, the prophetic inspiration of Dante and Isaiah, the satiric inspiration of Juvenal and Dryden. Three years after *Les Châtiments,* a book written in lightning, appeared *Les Contemplations,* a book written in sunlight and starlight. Of the six parts into which it is divided, the first translates into many-sided music the joys and sorrows, the thoughts and fancies, the studies and ardours and speculations of youth; the second, as full of light and colour, grows gradually deeper in tone of thought and music; the third is yet riper and more various in form of melody and in fervour of meditation; the fourth is the noblest of all tributes ever paid by song to sorrow — a series of poems consecrated to the memory of the poet's eldest daughter, who was drowned together with her husband by the upsetting of a boat off the coast of Normandy, a few months after their wedding-day, in 1843; the fifth and the sixth books, written during his first four years of exile (all but one noble poem which bears date nine years earlier than its epilogue or postscript), contain more than a few poems unsurpassed and unsurpassable for depth and clarity and trenchancy of thought, for sublimity of inspiration, for intensity of faith, for loyalty in translation from nature, and for tenderness in devotion to truth; crowned and glorified and completed by their matchless dedication to the dead. Three years later again, in 1859, Victor Hugo gave to the world the first instalment of the greatest book published in the 19th century, *La Légende des Siècles.* Opening with a vision of Eve in Paradise which eclipses Milton's in beauty no less than in sublimity—a dream of the mother of mankind at the hour when she knew the first sense of dawning motherhood, it closes with a vision of the trumpet to be sounded on the day of judgment which transcends the imagination of Dante by right of a realized idea which was utterly impossible of conception to a believer in Dante's creed: the idea of real and final equity; the concept of absolute and abstract righteousness. Between this opening and this close the pageant of history and of legend, marshalled and vivified by the will and the hand of the poet, ranges through an infinite variety of action and passion, of light and darkness, of terror and pity, of lyric rapture and of tragic triumph. After yet another three years' space the author of *La Légende des Siècles* reappeared as the author of *Les Misérables,* the greatest epic and dramatic work of fiction ever created or conceived: the epic of a soul transfigured and redeemed, purified by heroism and glorified through suffering; the tragedy and the comedy of life at its darkest and its brightest, of humanity at its best and at its worst. Two years afterwards the greatest man born since the death of Shakespeare paid homage to the greatest of his predecessors in a volume of magnificent and discursive eloquence which bore the title of *William Shakespeare,* and might, as its author admitted and suggested, more properly have been entitled *À propos de Shakespeare.* It was undertaken with the simple design of furnishing a preface to his younger son's translation of Shakespeare; a monument of perfect scholarship, of indefatigable devotion, and of literary genius, which eclipses even Urquhart's Rabelais—its only possible competitor; and to which the translator's father prefixed a brief and admirable note of introduction in the year after the publication of the volume which had grown under his hand into the bulk and the magnificence of an epic poem in prose. In the same year *Les Chansons des Rues et des Bois* gave evidence of new power and fresh variety in the exercise and display of an unequalled skill and a subtle simplicity of metre and of style employed on the everlasting theme of lyric and idyllic fancy, and touched now and then with a fire more sublime than that of youth and love. Next year the exile of Guernsey published his third great romance, *Les Travailleurs de la*



VICTOR HUGO.
(*From a photograph by P. Nadar, Paris*)

Mer, a work unsurpassed even among the works of its author for splendour of imagination and of style, for pathos and sublimity of truth. Three years afterwards the same theme was rehandled with no less magnificent mastery in *L'Homme qui Rit;* the theme of human heroism confronted with the superhuman tyranny of blind and unimaginable chance, overpowered and unbroken, defeated and invincible. Between the dates of these two great books appeared *La Voix de Guernesey*, a noble and terrible poem on the massacre of Mentana which branded and commemorated for ever the papal and imperial infamy of the colleagues in that crime. In 1872 Victor Hugo published in imperishable verse his record of the year which followed the collapse of the empire, *L'Année Terrible.* All the poet and all the man spoke out and stood evident in the perfervid patriotism, the filial devotion, the fatherly tenderness, the indignation and the pity, which here find alternate expression in passionate and familiar and majestic song. In 1874 he published his last great romance, the tragic and historic poem in prose called *Quatrevingt-treize;* a work as rich in thought, in tenderness, in wisdom and in humour and in pathos, as ever was cast into the mould of poetry or of fiction. The introduction to his first volume of *Actes et Paroles*, ranging in date from 1841 to 1851, is dated in June 1875; it is one of his most earnest and most eloquent appeals to the conscience and intelligence of the student. The second volume contains the record of his deeds and words during the years of his exile; like the first and the third, it is headed by a memorable preface, as well worth the reverent study of those who may dissent from some of the writer's views as of those who may assent to all. The third and fourth volumes preserve the register of his deeds and words from 1870 to 1885; they contain, among other things memorable, the nobly reticent and pathetic tribute to the memory of the two sons he had lost since their common return from exile. In 1877 appeared the second series of *La Légende des Siècles;* and in the same year the author of that colossal work, treating no less of superhuman than of human things, gave us the loveliest and most various book of song on the loveliest and simplest of subjects ever given to man, *L'Art d'être Grandpère.* Next year he published *Le Pape*, a vision of the spirit of Christ in appeal against the spirit of Christianity, His ideal follower confronted and contrasted with His nominal vicar; next year again *La Pitié Suprême*, a plea for charity towards tyrants who know not what they do, perverted by omnipotence and degraded by adoration; two years later *Religions et Religion*, a poem which is at once a cry of faith and a protest against the creeds which deform and distort and leave it misshapen and envenomed and defiled; and in the same year *L'Âne*, a pæan of satiric invective against the past follies of learned ignorance, and lyric rapture of confidence in the future wisdom and the final conscience of the world. These four great poems, one in sublimity of spirit and in supremacy of style, were succeeded next year by a fourfold gift of even greater price, *Les Quatre Vents de l'Esprit:* the first book, that of satire, is as full of fiery truth and radiant reason as any of his previous work in that passionate and awful kind; the second or dramatic book is as full of fresh life and living nature, of tragic humour and of mortal pathos, as any other work of the one great modern dramatist's; the third or lyric book would suffice to reveal its author as incomparably and immeasurably the greatest poet of his age, and one great among the greatest of all time; the fourth or epic book is the sublimest and most terrible of historic poems—a visionary pageant of French history from the reign and the revelries of Henry IV. to the reign and the execution of Louis XVI. Next year the great tragic poem of *Torquemada* came forth to bear witness that the hand which wrote *Ruy Blas* had lost nothing of its godlike power and its matchless cunning, if the author of *Le Roi s'amuse* had ceased to care much about coherence of construction from the theatrical point of view as compared with the perfection of a tragedy designed for the devotion of students not unworthy or incapable of the study; that his command of pity and terror, his powers of intuition and invention, had never been more absolute and more sublime; and that his infinite and illimitable charity of imagination could transfigure even the most monstrous historic representative of Christian or Catholic diabolatry into the likeness of a terribly benevolent and a tragically magnificent monomaniac. Two years later Victor Hugo published the third and concluding series of *La Légende des Siècles.* On the 22nd of May 1885 he died. The first volume published of his posthumous works was the exquisite and splendid *Théâtre en Liberté*, a sequence if not a symphony of seven poems in dramatic form, tragic or comic or fanciful eclogues, incomparable with the work of any other man but the author of *The Tempest* and *The Winter's Tale* in combination and alternation of gayer and of graver harmonies. The unfinished poems, *Dieu* and *La Fin de Satan*, are full to overflowing of such magnificent work, such wise simplicity of noble thought, such heroic and pathetic imagination, such reverent and daring faith, as no other poet has ever cast into deathless words and set to deathless music. *Les Jumeaux*, an unfinished tragedy, would possibly have been the very greatest of his works if it had been completed on the same scale and on the same lines as it was begun and carried forward to the point at which it was cut short for ever. His reminiscences of "Things Seen" in the course of a strangely varied experience, and his notes of travel among the Alps and Pyrenees, in the north of France and in Belgium, in the south of France and in Burgundy, are all recorded by such a pen and registered by such a memory as no other man ever had at the service of his impressions or his thoughts. *Toute la Lyre*, his latest legacy to the world, would be enough, though no other evidence were left, to show that the author was one of the very greatest among poets and among men; unsurpassed in sublimity of spirit, in spontaneity of utterance, in variety of power, and in perfection of workmanship; infinite and profound beyond all reach of praise at once in thought and in sympathy, in perception and in passion; master of all the simplest as of all the subtlest melodies or symphonies of song that ever found expression in a Border ballad or a Pythian ode. (A. C. S.)

Hulke, John Whitaker (1830–1895), British surgeon and geologist, was born 6th November 1830, being the son of a well-known medical practitioner at Deal. He was educated at King's College School and Hospital (M.R.C.S. 1852, F.R.C.S. 1857). After the death of the duke of Wellington in 1854, young Hulke, who had attended with his father on the occasion, wrote the official description for the newspapers. In the Crimean War he volunteered, and was appointed assistant-surgeon at Smyrna, and subsequently at Sebastopol. On returning home he became medical tutor at his old hospital, and afterwards assistant-surgeon. Hulke was an excellent general surgeon, but made his special mark as an ophthalmologist, and as a geologist he had a European reputation. He was president of both the Geological and Pathological Societies in 1883, and president of the Royal College of Surgeons from 1893 until his death on 19th February 1895.

Hull, or Kingston-upon-Hull, a municipal borough (extended 1882 and 1897), city, county, and parliamentary

borough and seaport of Yorkshire, England, a county in itself, at the influx of the Hull into the estuary of the Humber, 174½ miles by rail north of London. The corporation consists of a mayor, 16 aldermen, and 48 councillors. There are also a high steward, a recorder, and a sheriff. In 1885 the parliamentary representation was increased from 2 to 3 members, and the municipal and the parliamentary boroughs were made co-extensive. In 1888 Hull became a county borough, and in 1891 the seat of a bishop-suffragan to the archdiocese of York. There are over 20 parish and district, and 4 Roman Catholic churches, and numerous Nonconformist chapels. Erections since 1881 include the pier (reconstructed), the new river wall, a promenade pier, a technical school, a municipal crematorium, 4 public libraries, a market hall, a dispensary, a sanatorium, a smallpox hospital, municipal almshouses, 2 theatres, Hymer's College, comprising classical, modern, and junior departments, and a grammar school. Among the many board schools are 3 of higher grade, one of them accommodating 600 boys and 520 girls. The West Park was opened in 1885, the East Park in 1887. There are 3 daily newspapers. In 1888 the ports of Hull and Goole were administratively combined, the Hull docks measuring about 186 acres, the Goole docks 30 acres. Docks more recently opened are the Alexandra dock (1883), with 53½ acres of water area, 160 acres of quayage, and 2 graving docks; St Andrew's (1883), the fish dock, since extended. The railway to near Barnsley (1885) gives Hull direct communication with the South Yorkshire coal-fields. The registered shipping in 1889 was 835 vessels of 220,923 tons; in 1899, 867 of 228,395 tons. Entrances in 1889 numbered 5414 vessels of 2,439,617 tons; clearances, 5224 vessels of 2,401,391 tons: entrances in 1899 numbered 6246 of 3,115,748 tons; clearances, 6086 vessels of 3,045,991 tons. Imports of foreign and colonial merchandise were valued in 1899 at £28,822,898, against £26,288,229 in 1889. Exports of the produce and manufactures of the United Kingdom were valued in 1899 at £16,648,793, against £16,768,144 in 1889. Area, 8172 acres. Population (1891), 200,472; (1901), 240,618.

Hull, a city (1875) and railway junction of Quebec, Canada, and the capital of Wright county, opposite the city of Ottawa. The Chaudière Falls of the Ottawa furnish magnificent water-power, which is utilized by the extensive saw-mills, pulp, paper, and match manufactories. Hull contains a convent, three churches, a court-house, and a town hall. Population (1881), 6890; (1901), 13,988.

Hullah, John Pyke (1812–1884), English composer and teacher of music, was born at Worcester, 27th June 1812. He was a pupil of William Horsley from 1829, and entered the Royal Academy of Music in 1833. He wrote an opera to words by Dickens, *The Village Coquettes*, produced in 1836; *The Barbers of Bassora* in 1837, and *The Outpost* in 1838, the last two at Covent Garden. From 1839, when he went to Paris to investigate various systems of teaching music to large masses of people, he identified himself with Wilhem's system of the "fixed Do," and his adaptation of that system was taught with enormous success from 1840 to 1860. In 1847 a large building in Long Acre, called St Martin's Hall, was built by subscription and presented to Hullah. It was inaugurated in 1850 and burnt to the ground in 1860, a blow from which Hullah was long in recovering. He had risked his all in the maintenance of the building, and had to begin the world again. A series of lectures was given at the Royal Institution in 1861, and in 1864 he lectured in Edinburgh, but in the following year was unsuccessful in his application for the Reid professorship. He conducted concerts in Edinburgh in 1866 and 1867, and the concerts of the Royal Academy of Music from 1870 to 1873; he had been elected to the committee of management in 1869. In 1872 he was appointed by the Council of Education musical inspector of training schools for the United Kingdom. In 1878 he went abroad to report on the condition of musical education in schools, and wrote a very valuable report, quoted in the memoir of him published by his wife in 1886. He was attacked by paralysis in 1880, and again in 1883. His compositions, which remained popular for some years after his death, consisted mainly of ballads of a fairly artistic order; but his importance in the history of music is owing to his exertions in popularizing musical education, and his persistent opposition to the Tonic Sol-Fa system, which had a success he could not foresee. His objections to it were partly grounded on the character of the music which was in common use among the early teachers of the system. While it cannot be doubted that Hullah would have won more success if he had not opposed the Tonic Sol-Fa movement so strenuously, it must be confessed that his work was of great value, for he kept constantly in view and impressed upon all who followed him or learnt from him the supreme necessity of maintaining the artistic standard of the music taught and studied, and of not allowing trumpery compositions to usurp the place of good music on account of the greater ease with which they could be read. (J. A. F. M.)

Humacao, a small city near the south-east corner of the island of Porto Rico, 31 miles south-east of San Juan. It is the capital of a province of the same name. Population, 4428.

Humbert, Ranieri Carlo Emanuele Giovanni Maria Ferdinando Eugenio, King of Italy (1844–1900), son of Victor Emmanuel II. and of Adelaide, archduchess of Austria, was born at Turin, capital of the kingdom of Sardinia, on 14th March 1844. His education was entrusted to the most eminent men of his time, amongst others to Massimo d'Azeglio and Pasquale Stanislao Mancini. Entering the army on 14th March 1858 with the rank of captain, he was present at the battle of Solferino in 1859, and in 1866 commanded a division at Custozza. Attacked by the Austrian cavalry near Villafranca, he formed his troops into squares and drove the assailants towards Sommacampagna, remaining himself throughout the action in the square most exposed to attack. With Bixio he covered the retreat of the Italian army, receiving the gold medal for valour. On 21st April 1868 he married his cousin, Margherita Teresa Giovanna, princess of Savoy, daughter of the duke of Genoa (born at Turin on 20th November 1851). On 11th November 1869 Margherita gave birth to Victor Emmanuel, prince of Naples, afterwards Victor Emmanuel III. of Italy. Ascending the throne on the death of his father (9th January 1878), Humbert adopted the style "Humbert I. of Italy" instead of Humbert IV., and consented that the remains of his father should be interred at Rome in the Pantheon, and not in the royal mausoleum of Superga. Accompanied by the premier, Cairoli, he began a tour of the provinces of his kingdom, but on entering Naples (17th November 1878), amid the acclamations of an immense crowd, was attacked by a fanatic named Passanante. The king warded off the blow with his sabre, but Cairoli, in attempting to defend him, was severely wounded in the thigh. The would-be assassin was condemned to death, but the sentence was by the king commuted to one of penal servitude for life. The occurrence upset for several years the health of Queen

Margherita. In 1881 King Humbert, again accompanied by Cairoli, resumed his interrupted tour, and visited Sicily and the southern Italian provinces. In 1882 he took a prominent part in the national mourning for Garibaldi, whose tomb at Caprera he repeatedly visited. When, in the autumn of 1882, Verona and Venetia were inundated, he hastened to the spot, directed salvage operations, and provided large sums of money for the destitute. Similarly, on 28th July 1883, he hurried to Ischia, where an earthquake had engulfed some 5000 persons. Countermanding

King Humbert.
(From a photograph by Giacomo Brogi, Florence.)

the order of the minister of public works to cover the ruins with quicklime, the king prosecuted salvage operations for five days longer, and personally saved many victims at the risk of his own life. In 1884 he visited Busca and Naples, where cholera was raging, helping with money and advice the numerous sufferers, and raising the spirit of the population. Compared with the reigns of his grandfather, Charles Albert, and of his father, Victor Emmanuel, the reign of Humbert was tranquil. Scrupulously observant of constitutional principles, he followed, as far as practicable, parliamentary indications in his choice of premiers, only one of whom—Rudinì—was drawn from the Conservative ranks. In foreign policy he approved of the conclusion of the Triple Alliance, and, in repeated visits to Vienna and Berlin, established and consolidated the pact. Towards Great Britain his attitude was invariably cordial, and he considered the Triple Alliance imperfect unless supplemented by an Anglo-Italian naval *entente*. Favourably disposed towards the policy of colonial expansion inaugurated in 1885 by the occupation of Massawa, he was suspected of aspiring to a vast empire in North-east Africa, a suspicion which tended somewhat to diminish his popularity after the disaster of Adowa on 1st March 1896. On the other hand, his popularity was enhanced by the firmness of his attitude towards the Vatican, as exemplified in his telegram declaring Rome "intangible" (20th September 1886), and affirming the permanence of the Italian possession of the Eternal City. Above all King Humbert was a soldier, jealous of the honour and prestige of the army to such a degree that he promoted a duel between his nephew, the count of Turin, and Prince Henry of Orleans (15th of August 1897) on account of the aspersions cast by the latter upon Italian arms. The claims of King Humbert upon popular gratitude and affection were enhanced by his extraordinary munificence, which was not merely displayed on public occasions, but directed to relieve innumerable private wants into which he had made personal inquiry. It has been calculated that at least £100,000 per annum was expended by the king in this way. The regard in which he was universally held was abundantly demonstrated on the occasion of the unsuccessful attempt upon his life made by the anarchist Acciarito near Rome on 22nd April 1897, and still more after his tragic assassination at Monza by the anarchist Bresci on the evening of 29th July 1900. Good-humoured, active, tender-hearted, somewhat fatalistic, but, above all, generous, he was spontaneously called "Humbert the Good." He was buried in the Pantheon in Rome, by the side of Victor Emmanuel II., on 9th August 1900. (H. W. S.)

Hungary (Magyarország), one of the two states constituting the monarchy of Austria-Hungary (*q.v.*). The kingdom includes Hungary proper and the province of Croatia-Slavonia, the latter enjoying to a large extent autonomy, granted by the so-called compromise of 1868, which regulated the legal relation of Croatia-Slavonia-Dalmatia to the mother-country. The town and district of Fiume, though united with Hungary proper in respect of administration, enjoys autonomy to a greater extent than the other cities endowed with municipal rights. In the present article the kingdom will be treated of mainly as a whole, as statistics of many of the subjects dealt with cannot be obtained for the separate divisions. In 1873 part of the "Military Frontier" mentioned in the ninth edition of the *Encyclopædia Britannica* was united with Hungary proper and part with Croatia-Slavonia. As Transylvania is a mere historical expression, it will always be included in the territory of Hungary proper, as will Fiume also.

Climate.—With only a very small strip of coast-line, Hungary has a continental climate—cold in winter, hot in summer. The rainfall is in general low, except in the mountainous districts. The following table gives the mean temperature (centigrade), relative humidity, and rainfall (including snow) at a series of meteorological stations during the years 1896–1900 :—

Stations.	Metres above Sea.	Mean Temperature. Annual.	January.	July.	Relative Humidity.	Rainfall in Millimetres.
Selmeczbánya	621	7·9	–2·3	18·2	79	905
Budapest	153	10·5	–0·7	20·4	76	616
Keszthely	133	11·4	–1·1	21·9	78	684
Zágráb	163	11·3	1·3	21·4	72	880
Fiume	5	13·8	6·4	22·6	75	1805
Debreczen	129	10·1	–1·9	21·1	79	571
Szeged	95	10·9	–0·5	21·7	80	656
Nagyszeben	414	9·4	–3·4	20·6	79	735

Except at Fiume, the temperature at all these stations in the winter is below freezing-point, and the mean rainfall below 900 millimetres. The mountain-stations, Selmeczbánya in the northern and Nagyszeben in the south-eastern Carpathians, enjoy a more humid and, in the summer, a more temperate climate than the large plain called Alföld,

of which Debreczen and Szeged may be regarded as representative towns.

Area and Population.—The area of the kingdom of Hungary is:

	English Square Miles.
Hungary proper	108,982
Croatia-Slavonia	16,420
Total	125,402

For administrative purposes the territories belonging to the Hungarian Crown (St Stephen's Crown) are divided into municipalities (counties) endowed with a certain amount of self-government. Hungary proper is now subdivided into sixty-three rural and—Fiume included—twenty-six urban municipalities, whereas in Croatia-Slavonia there are eight rural and four urban.

The population of the country at the censuses of 1881, 1891, and 1901 was:—

	1881.	1891.	1901.
Hungary proper	13,749,603	15,261,864	16,838,255
Croatia-Slavonia	1,892,499	2,201,927	2,416,304
Total	15,642,102	17,463,791	19,254,559

From 1870 to 1881 there was but little increase of population, owing to the great cholera epidemic of 1872–73, and to many epidemic diseases among children towards the end of the period. More normal conditions having prevailed from 1881 to 1891, the yearly increase rose from 0·13 per cent. to 1·09 per cent., declining in the decade 1891–1901 to 1·03.

If compared with the first general census of the country, decreed by Joseph II. in 1785, the population of the kingdom shows an increase of nearly 108 per cent. during these 116 years. Recent historical research, the results of which have been published by the Central Statistical Office, has ascertained that the country was densely peopled in the 15th century. Estimates, based on a census of the tax-paying peasantry in the years 1494 and 1495, give five millions of inhabitants, a very respectable number, which explains fully the predominant position of Hungary in the east of Europe at that epoch. The disastrous invasion of the Turks, incessant civil wars, and the devastation of the country by foreign armies and pestilence, caused a very heavy loss both of population and of prosperity. Several censuses in different counties of the country attest the enormous depopulation. In 1715 and 1720, when the land was again free from Turkish hordes and peace was restored, the population did not exceed three millions. Then immigration began to fill the deserted plains once more, and by 1785 the population had trebled itself. But as the immigrants were of very different foreign nationalities, the country became a collection of heterogeneous ethnical elements, amid which the ruling Magyar race, which had lost its best elements in the preceding wars, formed only a minority. Owing, however, to the mental gifts and political genius of the Magyars, their supremacy was never seriously disputed by any of the numerous nationalities of the country.

The density of population, according to the census of 1901, was 153·7 inhabitants to the square mile. The great Alföld and the western parts are the most densely populated, whereas the northern and eastern mountainous counties are but sparsely inhabited. But if the acreage of arable land, which yields much greater resources than the other kinds of land, and is capable of sustaining more hands, be taken as a basis of comparison, then it is found that the scanty average population of the northern and eastern mountainous counties is really denser than that of the western and middle counties. The one marked characteristic of all modern civilization—the agglomeration of population in towns—prevails in Hungary also, though there is but one really large city, Budapest, the political capital of the kingdom and the principal manufacturing town in the country. The population of the towns having in 1901 more than 40,000 inhabitants at three censuses is shown in the following table:—

Town.	1881.[1]	1891.	1901.
Budapest	360,531	505,823	732,322
Szeged	73,675	87,410	102,991
Szabadka (Maria-Theresiopel)	61,367	73,526	82,122
Debreczen	51,122	59,552	75,006
Pozsony (Pressburg)	48,006	56,048	65,867
Hódmezö-Vásárhely	52,424	55,626	60,883
Zágráb (Agram)	29,218	41,481	61,002
Kecskemét	44,887	50,600	57,812
Arad	35,556	43,682	56,260
Temesvár	33,694	43,738	53,033
Nagyvárad (Grosswardein)	31,324	70,750	50,177
Kolozsvár (Klausenburg)	30,363	37,957	49,295
Pécs (Fünfkirchen)	28,702	35,449	43,982
Miskolcz	24,319	32,288	43,096
Kassa	26,097	32,165	40,102

The number and aggregate population of all towns and boroughs in Hungary proper having in 1891 more than 10,000 inhabitants was at the censuses of 1881, 1891, and 1901:—

Census.	Towns.	Inhabitants.	Percentage of Total Population.
1881	93	2,191,878	15·94
1891	106	2,700,852	17·81
1901	122	3,525,377	21·58

Thus the relative increase of the population living in urban districts of more than 10,000 inhabitants amounted in 1901 to nearly 4 per cent. of the total population. In Croatia-Slavonia only 5·62 per cent. of the population was concentrated in such towns in 1901.

In the total population the two sexes were divided (1901) thus:—

	Males.	Females.	Females to 1000 Males.
Hungary proper (including Fiume)	8,372,839	8,465,416	1010·8
Croatia-Slavonia	1,209,333	1,206,971	998·0

The excess of females over males, which may be considered as a general feature of European civilization, is great in the western and northern counties of the kingdom, whereas in the eastern parts and in the province of Croatia-Slavonia there is a preponderance of males. Thus Hungary shows the transition from Western to Eastern distribution of sexes.

One of the prominent features of Hungary being the great complexity of the races residing in it, the census returns of 1881, 1891, and 1901, exhibiting the numerical strength of the different nationalities, are of great interest. Classifying the population according to the mother-tongue of each individual, there were, in the civil population of Hungary proper, including Fiume:—

Census.	Hungarians (*Magyars*).	Germans (*Német*).	Slovaks (*Tót*).	Rumanians (*Oláh*).	Ruthenians (*Ruthén*).	Croatians (*Horvát*).	Servians (*Szerb*).	Others.
1881	6,404,070	1,870.772	1,855,451	2,403,041	353,229	639,986		223,054
1891	7,357,936	1,990,084	1,896,665	2,589,079	379,786	194,412	495,133	259,893
1901	8,588,834	1,980,423	1,991,402	2,784,726	423,159	188,552	434,641	329,837
i.e., in percentages of the total population:								
1881	46·58	13·61	13·49	17·48	2·57	4·65		1·62
1891	48·53	13·12	12·51	17·08	2·50	1·28	3·27	1·71
1901	51·38	11·88	11 88	16·62	2·52	1·17	2 60	1·95

The results of the three censuses recorded show a decided tendency of change in favour of the dominating nationality, the Magyar. The relative importance of the other nationalities is decreasing from census to census. Thus the preponderance of the Magyars is growing. They reached an absolute majority in the decade 1891–1901. This is also shown by the data relating to the percentage of members of foreign nationalities speaking this language. This percentage was among the

Census.	Germans.	Slovaks.	Rumanians.	Ruthenians.	Croatians.	Servians.	Others.
1881	20·16	9·52	5·71	5·52	10·26		18·64
1891	25·15	12·00	6·95	7·33	16·51	11·12	21·39
1901	16·8						

No other means being used to diffuse the knowledge of the official language of the Hungarian state than elementary instruction, and

[1] For 1881 only the civil population can be given.

to some extent military service, the growth of the Hungarian-speaking elements shows the slow but steady advancement of general instruction and the effect of the internal migrations, which bring into contact with the Hungarian majority the isolated masses of foreign nationalities inhabiting the mountains in the north and east of the country. In the province of Croatia-Slavonia the language of instruction and administration being exclusively Croatian, the other races are converted to this nationality. The Hungarians form but 3·15 per cent., the Germans 5·37 per cent. of the population, according to the census of 1891.

Movement of the Population.—The following table shows the average number of marriages, births, and deaths in the kingdom per annum between 1881 and 1901:—

Year.	Marriages.	Births (Living).	Deaths.	Natural Increase (Surplus of Births).
HUNGARY PROPER.				
1881–85	142,391	626,488	467,621	158,867
1886–90	131,642	646,764	478,340	168,424
1891–95	139,064	648,300	492,753	155,547
1896	126,956	647,977	455,969	192,008
1897	131,045	651,667	453,715	197,952
1898	134,541	614,255	456,736	157,519
1899	147,912	644,577	448,756	195,821
1900	178,629	655,674	449,742	205,932
1896–1900	137,816	642,830	452,984	189,846
CROATIA-SLAVONIA.				
1881–85	21,960	87,578	61,971	25,607
1886–90	19,194	94,062	64,868	29,193
1891–95	20,893	95,009	75,433	19,576
1896	20,521	94,959	74,399	20,560
1897	20,131	96,397	75,252	21,145
1898	21,667	92,578	67,654	24,924
1899	22,914	98,695	65,528	33,117
1900	21,058	97,044	65,492	31,552
1896–1900	21,257	95,935	69,675	26,259

The marriage-rate per 1000 varied as follows:—

Division.	'81–85.	'86–90.	'91–95.	1896.	1897.	1898.	1899.	1900.	'96–1900.
Hungary proper	20·2	17·8	18·0	16·0	16·2	16·6	18·0	17·8	17·0
Croatia-Slavonia	22·4	18·0	18·8	18·0	17·4	18·6	18·4	17·6	18·2

Corresponding to the high marriage-rate, the average number of births per annum to 1000 living is also high. It was (exclusive of still-born):—

Division.	'81–85.	'86–90.	'91–95.	1896.	1897.	1898.	1899.	1900.	'96–1900.
Hungary proper	44·6	43·7	41·9	40·7	40·5	37·8	39·2	39·4	39·5
Croatia-Slavonia	44·7	44·0	42·7	41·6	41·8	39·8	42·0	40·7	41·2
Average .	44·6	43·7	42·0	40·8	40·6	38·0	39·6	39·6	39·7

The figures for 1898 were quite abnormal, and must be attributed to the complete failure of the crops in 1897 and the consequent low marriage-rate. The figures for 1900 were nearly the same as for 1899. The proportion of still-born children to 100 births was, in the fifteen years from 1881 to 1895, 1·92 per cent. There is an increase in recent years owing to more trustworthy statistics, the proportion reaching 2·20 per cent. in 1896–1900. The percentage of illegitimate births to the total number of living births was:—

1881–85.	1886–90.	1891–95.	1896.	1897.	1898.	1899.	1900.	1896–1900.
7·86	8·16	8·75	8·80	9·28	9·15	9·28	9·72	9·19

The most favourable feature in vital statistics for recent years is the constant decrease of the death-rate, shown by the following figures, for each 1000 of population per annum:—

Division.	'81–85.	'86–90.	'91–95.	1896.	1897.	1898.	1899.	1900.	'96–1900.
Hungary proper	33·3	32·3	31·8	28·6	28·1	28·0	27·3	27·0	27·8
Croatia-Slavonia	31·7	30·6	33·9	32·5	32·6	29·1	27·9	27·5	29·9
Average .	33·1	32·1	32·1	29·1	28·7	28·2	27·4	27·1	28·1

The improvement is most conspicuous in the case of Hungary proper, and is accounted for by the growth of economic prosperity as well as the advancement in sanitary administration. As a net result the natural increase per 1000 in the population was:—

Division.	'81–85.	'86–90.	'91–95.	1896.	1897.	1898.	1899.	1900.	'96–1900.
Hungary proper	11·3	11·4	10·1	12·1	12·4	9·8	11·9	12·4	11·7
Croatia-Slavonia	13·1	13·8	8·8	9·1	9·2	10·7	14·1	13·2	11·3

There is an excess of emigration over immigration. In the decades 1881–1891 and 1891–1901 for the whole kingdom it amounted to 182,000 and 185,000 persons respectively. Croatia-Slavonia alone has a surplus of immigration, owing to Hungarian emigration there. The main stream of emigration flows in the direction of the United States of America. The statistics of that country gave as the number of immigrants from Hungary:—

Yearly Average.					
1881–85.	1886–90.	1891–95.	1896.	1897.	1898.
10,111	17,201	23,827	25,879	13,791	20,920

The data collected at the German and Dutch emigration ports vary somewhat, but the averages for longer periods do not considerably differ. The emigration to America affects principally the mountainous counties of the north, and the majority of emigrants are of Slovak origin. Many of the emigrants return as well-to-do men, and the movement has caused a noteworthy increase of wages in these counties. From the south-eastern (once Transylvanian) counties there is an emigration to Rumania and the Balkan territories of 4000 to 5000 persons yearly.

Religion.—At the censuses of 1881, 1891, and 1901 the civil population in Hungary proper was divided as follows:—

Religion.	1881.	1891.	1901.
Roman Catholics . .	6,503,207	7,267,695	8,198,497
Greek Catholics . .	1,489,849	1,658,308	1,841,272
Greek Orientals . .	1,937,144	2,064,889	2,199,195
Evangelicals—			
Augsburg Confession [1]	1,107,608	1,180,714	1,258,860
Helvetian Confession [2]	2,023,360	2,212,761	2,427,232
Unitarians . . .	55,787	61,618	68,551
Jews	624,826	707,961	831,162
Others . . .	7,822	9,042	13,486

The corresponding percentages are as follows:—

Religion.	1881.	1891.	1901.
Roman Catholics	47·30	47·93	48·69
Greek Catholics	10·83	10·94	10·93
Greek Orientals	14·09	13·62	13·06
Evangelicals of Augsburg Confession	8·06	7·78	7·48
Evangelicals of Helvetian Confession	14·71	14·59	14·41
Unitarians	0·41	0·41	0·41
Jews	4·54	4·67	4·94
Others	0·06	0·06	0·08

The relative decrease in the number of those adhering to Protestant churches is caused by the low birth-rate among them, whereas the Greek Orientals suffer heavy loss by reason of the great mortality. The rapid growth in the number of Jews is owing partly to immigration, partly to economic prosperity, which latter is also manifest in the peculiarly low death-rate of the Jews (generally 18 per 1000).

Education.—Apart from the infant schools for children under six years of age (2570 in 1900), Hungary has a series of elementary schools of various kinds, numbering in 1900 (inclusive of those in Croatia-Slavonia) 18,455; Hungary proper possessed 17,048. Of this latter number 1631 were maintained by the state, 1747 by communes, and 13,357 by the different churches. The language employed in 60·6 per cent. of these schools was exclusively Hungarian, in 19·9 per cent. it was mixed. The number of teachers in the scholastic year 1899–1900, including those in the schools of Croatia-Slavonia, was 31,213; the total number of pupils was 3,255,982. The number of middle-class schools, called *gymnasia* (giving instruction in Latin and Greek), and of *real*-schools (without such courses), as well as the number of teachers and pupils, is shown by the following table for the year 1899–1900:—

Division.	Gymnasia.	Real-schools.	Teachers.	Pupils.
Hungary proper	165	32	3673	61,943
Croatia-Slavonia	19		401	6,575
Total . .	216		7074	68,518

The Hungarian language was exclusively used in 180, *i.e.*, in 91 per cent. of the 197 middle-class schools in Hungary proper. In

[1] Lutherans. [2] Helvetians, or Reformed.

9 instruction was given in the German tongue, in 5 in Rumanian. The mother-tongue of pupils was in 1891 and 1900 :—

Mother-tongue.	1891.		1900.	
	Total.	Per cent.	Total.	Per cent.
Hungarian . .	30,480	72·4	44,130	76·1
German . . .	6,213	14·7	7,066	12·1
Slovak . . .	1,577	3·7	1,853	3·2
Rumanian . .	2,704	6·4	3,482	6·0
Ruthenian . .	92	0·2	89	0·2
Croatian or Servian .	797	1·9	1,185	2·0

The increase in the number of Hungarian pupils is shown very clearly. These schools are maintained partly by the state—in 1900, 59 were so maintained in Hungary proper—and partly by ecclesiastical foundation, with or without a subsidy from the state. There are also a few *gymnasia* and *real*-schools, founded by communes and by private persons. The total expenditure on middle-class schools in 1899–1900 was 16,386,000 crowns (a crown=10d.). There are two universities in Hungary proper, one at Budapest and one at Kolozsvár; in Croatia-Slavonia there is a university at Zágráb. The latter has faculties of theology, law, and philosophy; the two former have in addition a faculty of medicine. The number of professors (ordinary and extraordinary), lecturers, and undergraduates in 1899–1900 is shown by the following table :—

University.	Professors.	Lecturers.	Undergraduates.
Budapest . .	119	182	5546
Kolozsvár . .	51	44	1210
Zágráb . . .	35	31	770

There are 10 high schools of law, called academies, with, in 1899–1900, 80 professors, 40 lecturers, and 1569 pupils. The number of high theological colleges in Hungary is 49—29 Roman Catholic, 5 Greek Catholic, 4 Greek Oriental, 10 Protestant, and 1 Jewish; in 1899–1900 there were 1599 pupils. The polytechnicum at Budapest, with 34 professors and 74 lecturers, had 1772 pupils in that year; the number of art-schools was 45, with 337 teachers and 5139 pupils. The percentage of illiterates (*analphabeta*), which was 59·7 in 1881, had by 1891 decreased to 57·8, and in 1901 to 50·4. The percentage for Hungary proper only is more favourable (in 1891, 55·5, and in 1901, 48·6 per cent.). Omitting children under six years of age, 55 per cent. of the population could read and write. In Croatia-Slavonia only 33·4 per cent. could do so. The average number of periodicals in 1881–85 was 672; in 1900 there were 1396. Of this latter number 938 appeared in Hungarian, and 209 were political papers.

Pauperism.—There is no government system of poor relief in Hungary. Private beneficence and ecclesiastical charity assist the poor, and if these sources fail the commune has to supplement them. Thus the total amount expended on the poor cannot be ascertained. But the XXI. Art. of 1898 assures to the sick gratuitous medical help and total maintenance to deserted children under seven years of age, and for these purposes a special tax, which cannot exceed 3 per cent. of the direct taxes, is levied.

Crime.—The Penal Code of 1878 divides criminal offences into two classes—the more and the less serious; there are also misdemeanours punishable by fines and imprisonment. The total number of convicted persons in each of these three categories was, in Hungary proper :—

Year.	Criminal Offences.		Misdemeanours.
	More Serious.	Less Serious.	
1894	10,198	75,846	299,501
1898	11,169	84,360	368,796
1900	4,035	64,641	335,231

Crimes of the gravest nature, those against life and property, are diminishing, but political misdemeanours increase rapidly, owing to new laws creating new offences. The only important change of a judicial character since 1871 has been the decentralization of the "Királyi itélötáblák" (1891). Their number now amounts, in Hungary proper, to eleven. For most cases they are the highest courts of appeal, but there is a still higher tribunal for cases of the first importance. The new Code of Procedure (XXXIII. Art. of 1896) and the Law on Juries (XXXIII. Art. of 1897) have been in force since 1st January 1900. These laws extended the jurisdiction of juries to the gravest crimes and introduced great reforms, conforming to modern principles of criminal procedure.

Constitution and Government.—There has been only one reform in the composition of parliament since 1867, namely, that regarding the House of Lords (*Förendiház*). Art. VII. of the year 1885 ordered that this House should consist of—(1) all the archdukes who have attained their majority (eighteen years); (2) hereditary peers (that is, princes, counts, and barons) above twenty-four years of age, provided that the title was in the family before 1885, and that the peer is personally charged with a land-tax of 3000 fl. (£250); (3) Hungarian peers obtaining this right by order of his Majesty; (4) other citizens named by the king, up to a maximum number of fifty; (5) members by virtue of office, *i.e.*, thirty-two archbishops and other dignitaries of the Roman Catholic Church, ten dignitaries of the Greek Church, thirteen representatives of the three Protestant confessions, a few state dignitaries, and five high judges; (6) three delegates of the Croatian-Slavonian Parliament. The total number of members in 1900 was 398. The number of electors to the House of Commons (*Képvislöház*) in 1879 was 824,602; in 1887, 847,216; in 1900, 989,009, or 2395 electors for one deputy. The percentage of electors to the total population was 6 per cent. in 1879 and 5·95 per cent. in 1900. A thorough reform of the local administration has been prepared by the Government.

Finance.—The total annual revenue and expenditure of the state—deducting merely transitory items of credit operations and conversions—were, in millions sterling :—

Year.	Revenue.	Expenditure.	Surplus.
1891–95	42·1	39·4	2·7
1896	43·2	43·0	0·2
1897	46·4	45·6	0·7
1898	43·8	43·7	0·2
1899	42·9	42·8	0·1
1900	45·4	45·2	0·2

The total debt at the end of each of the following years was, in millions sterling :—

1891.	1895.	1898.	1899.	1900.
171·9	181·3	184·3	184·6	192·8

The ordinary revenue of the state is derived chiefly from direct and indirect taxation, including monopolies. In 1900 direct taxes amounted to £9,410,000, indirect to £17,048,000. Among the indirect taxes, that on alcoholic drinks yielded £5,201,000, the monopoly of tobacco £4,767,000 (of which £2,565,000 is net revenue). State forests gave £795,000. The growth in the revenue derived from state railways is shown by the following table (amounts in millions sterling) :—

Year.	Total Receipts.	Expenditure.	Net Revenue.
1881	1·5	1·0	0·5
1890	3·5	2·1	1·4
1898	8·4	5·6	2·8
1899	8·5	5·6	2·9
1900	9·1	6·7	2·4

Already the net revenue corresponds to nearly 4 per cent. of the capital invested, and the prospects of increase may be regarded as very favourable.

Production and Industry.—Though the mineral resources of the country are very great, mining and smelting works only employed 70,476 persons in 1900. This, however, shows an increase compared with the average of 1881–85, which was 47,817, and with that of 1886–90, which was 49,178 persons, whereas the average of 1891–95 was 60,456. The principal products of mining are returned as follows :—

Mineral.	Yearly Average Quantities in Cwts.[1]				
	1881–85.	1886–90.	1891–95.	1896–99.	1900.
Gold[2] . .	32	38	42	61	64
Silver . .	325	333	390	438	397
Pig iron .	3,650,118	4,604,073	6,350,837	8,900,560	8,967,673
Coal . .	45,095,866	54,323,382	77,597,963	107,455,631	127,898,942

The growth in the production of iron and coal is shown more clearly if the quantities raised in the first and last years of the period are compared. The following are, then, the figures in English tons (1 metric ton=1000 kg.=0·984 Eng. ton) :—

Mineral.	1881.	1899.	1900.
Pig iron . .	161,376	478,941	462,952
Coal . .	1,929,774	6,098,412	6,602,913

Thus the production of iron, as well as that of coal, was trebled in nineteen years. There are excellent iron ores in the northern and south-eastern counties, but the quality of coal raised

[1] Calculated in this proportion: 1 metric centner equal to 100 kilograms = 220·5 lb av.

[2] Each kilogram having a value of £136·56; a metric centner is worth £13,656.

is rather unsatisfactory, the greater part of it being only brown coal, which cannot be transformed into coke. The number of blast-furnaces, which was 106 in 1881, only amounted to 68 in 1900.

Agriculture.—The pre-eminence of agriculture as the chief economic resource of Hungary is shown by the high percentage which the agricultural class forms of the total population. In 1891 this was 75·1 per cent. in Hungary proper and 85·2 per cent. in Croatia-Slavonia. The agricultural inquiry of 1895 showed an increase in the area of arable land, but a diminution in the area covered by vineyards, which had suffered greatly from the devastations of the phylloxera. The main varieties of land are distributed as follows:—

By Area in Acres.

Country.	Arable Land.	Gardens.	Meadows.	Vineyards.	Pastures.	Forests.	Marshes.
Hungary proper .	29,714,382	928,053	7,075,888	482,801	9,042,267	18,464,396	199,685
Croatia-Slavonia .	3,370,540	136,354	1,099,451	65,475	1,465,930	3,734,094	7,921

By Percentage of the Total Area.

Hungary proper .	42·81	1·34	10·19	0 69	13·03	26 60	0·28
Croatia-Slavonia .	32 26	1·31	10 52	0·63	14·03	35·74	0·08

The remainder, such as barren territory, devastated vineyards, water, and area of buildings, amounts to 5·1 per cent. of the total. The progress of agriculture is shown by the increase of arable land, the diminution of bare fallow land, and the growth of the average production, which may be regarded as a proof of increasing intensity, improvements, and technical progress. The chief agricultural products of Hungary are wheat, rye, barley, oats, and maize, and the annual crops of these for a period of nineteen years are shown in the following tables:—

Area in Acres in Hungary Proper.

Cereal.	Average per Annum.			1896.	1898.	1899.	1900.
	1881-85.	1886-90.	1891-95.				
Wheat .	6,483,876	7,014,891	7,551,584	7,751,566	6,866,390	7,798,000	8,142,303
Rye .	2,475,301	2,727,078	2,510,093	2,725,166	2,468,283	2,596,500	2,546,738
Barley .	2,420,393	2,491,422	2,407,469	2,375,105	2,336,353	2,508,200	2,485,117
Oats .	2,460,080	2,546,582	2,339,297	2,434,805	2,215,672	2,380,500	2,324,992
Maize .	4,567,186	4,681,376	5,222,538	5,098,213	4,909,809	5,257,600	5,469,050

Produce in Millions of Bushels.

Cereal.	Average per Annum.			1896.	1898.	1899.	1900.
	1881–85.	1886–90.	1891–95.				
Wheat	99·8	121·3	144·9	113 6	96·0	136·4	137·3
Rye .	41·8	42·1	46·5	33·6	30·0	44·0	39·2
Barley	46·2	43·7	53·6	36·6	34·4	52·7	49·7
Oats .	53·9	52·3	64·9	29·7	61·6	64·8	63·6
Maize .	92·4	86·4	118·0	91·6	89 1	108·0	121·7

In Croatia-Slavonia no crop statistics were compiled before 1885. Recent returns for maize and wheat show an increase both in the area cultivated and quantity yielded. The former is the principal product of this province. The number of live stock in Hungary proper in two different years is shown in the following table:—

Animal.	1884.	1895.
Horses . .	1,749,302	1,972,930
Cattle . .	4,879,334	5,829,483
Sheep . .	10,594,867	7,526,783
Pigs . .	4,803,777	6,447,134

In Croatia-Slavonia the live stock was numbered in 1895 at: horses, 309,098; cattle, 908,774; sheep, 595,898; pigs, 882,957. But the improved quality of the live stock is more worthy of notice than the growth in numbers. And the increasing area devoted to the cultivation of clover and nutritious grasses, the improvement in the breed of horses and cattle, procured by administrative measures and fiscal protection, the prizes and other encouragements offered, are all features which ensure a still further development in this important branch of production.

Industry.—The number of persons employed in the various manufacturing industries in 1891 was 831,172 in Hungary proper and 81,838 in Croatia-Slavonia. The total number of those dependent on manufacturing industries formed 13 per cent. of the population in Hungary proper and only 8·3 per cent. in Croatia-Slavonia. In 1891 there were in Hungary proper 1134 establishments employing more than twenty hands; in 1898 the number was 1626. Thus in seven years there was an increase of 43·4 per cent. The number of factories with more than 1000 workmen was 11 in 1891 and 27 in 1898. The industry in the highest state of development is that connected with mills. The number of steam-mills was 147 (about) in 1863, 492 in 1873, 910 in 1885, and 1723 in 1895, when the total horse-power of the steam-engines was 68,929. There are 2,952,000 English tons of wheat-flour produced annually. The number of breweries decreased down to 1890, when there were 95 in the whole kingdom. But production on a large scale survived the competition of the Austrian breweries, and the average annual production of beer increased from 11,019,280 gallons in the decade 1881–90 to 34,820,936 gallons in the years 1894–98. There were 99 breweries in 1900, and they produced 31,862,900 gallons of beer. The same tendency to production on a large scale prevails in the alcohol and sugar industries. But whereas in the former production is rather on the decline owing to the heavy taxes on alcohol, the sugar industry is advancing with rapid strides. The more equal rate of taxation, which made possible the competition of Hungarian with Austrian factories, though the latter had better raw material and more capital, increased the production in a few years. The growth is shown by the fact that the average annual weight of beet used increased sixfold from 1880–88 to 1896–98; in the last of these years 3,996,959 cwts. of sugar were produced, 20 large factories sharing in the yield. In the season of 1898–99 the produce increased to 4,857,897 cwts., in 1899–1900 to 4,936,419 cwts. The tobacco industry is a monopoly, and the factories are under the state. The increase in the annual production of cigars, cigarettes, snuff, and other kinds of tobacco ready for consumption is shown by the following table:—

Year .	1881–85.	1886–90.	1891–95.	1896–99.	1900.
Cwt. .	277,158	312,380	389,472	432,594	411,490

Having renewed with Austria treaties of commerce, which now constitute a customs union, Hungary cannot protect industry by duties. To encourage the investment of capital in industrial establishments, several Acts exempt from taxation new branches of manufactures and those factories provided with the best modern machinery. This has led to several factories being established with the aid of national and foreign—including English—capital.

Commerce.—The foreign trade of Hungary, including Croatia-Slavonia, is shown by the following table, in millions sterling:—

Year.	Imports.	Exports.
1886–90	37·3	37·5
1891–95	43·7	44·1
1896	45·6	45·3
1897	46·1	45·0
1898	49·7	46·0
1899	49·7	50·0
1900	46·3	55·3

Of the merchandise entering[1] the country, 75–80 per cent. comes from Austria, and exports go to the same country to the extent of 75 per cent. (in 1900 only 71·6 per cent.). Next comes Germany with about 10 per cent. of the value of total exports and 5 per cent. of that of imports. The neighbouring Balkan states—Rumania and Servia—follow, and the United Kingdom receives somewhat more than 2 per cent. of the exports, while supplying about 1·5 per cent. of the imports. The value of the principal articles of import and export is shown in the following tables, in thousands of pounds sterling:—

Imports.	1897.	1898.	1899.	1900.
Cotton goods . . .	5882	5941	6787	5933
Woollen manufactures .	3797	4200	4520	3730
Apparel, haberdashery, and linen . .	2398	2564	2780	2837
Silk manufactures . .	1832	2186	2437	2024
Leather, raw . . .	1361	1253	1277	1276
Leather manufactures .	1199	1274	1205	1048
Wine in barrels . .	1265	1236	...	1005

Exports.	1897.	1898.	1899.	1900.
Flour	6994	6906	6123	6526
Wheat	3081	2635	2925	3527
Beef	3176	3051	3589	3848
Barley	2602	2144	2544	2363
Pigs	1390	1590	2072	2478
Wine in barrels . .	1419	1265	1103	1347
Horses	1295	1182	1279	1192
Maize	1340	1166	1396	1322

[1] Merchandise passing the boundaries is subject to declaration; the respective values are stated by a special commission of experts residing in Budapest.

The above figures plainly show the prevailing agricultural character of the country, grain, flour, and animals, including dead meat, being the chief articles of export, whereas textile manufactures supply by far the most important item in the imports. But coal, of the value of nearly twenty millions of crowns, tobacco, rice, iron, and especially iron goods, are also imported in large quantities of great value.

Navigation.—The shipping of Fiume, the chief port of Hungary, shows great progress. The following table gives statistics of the vessels with cargoes which entered and cleared:—

Year.	Entered.		Cleared.	
	Vessels.	Tonnage.	Vessels.	Tonnage.
1881–85	2,505	401,714	3010	523,623
1891–95	5,091	721,456	4604	772,433
1896	6,336	912,338	6120	963,117
1897	9,620	1,151,194	9397	1,193,859
1898	9,893	1,283,425	9767	1,289,594
1899	10,006	1,291,531	9930	1,425,533
1900	10,739	1,681,151	10,733	1,684,329

At all ports in 1900 there entered 19,223 vessels of 2,223,302 tons; cleared, 19,218 vessels of 2,226,733 tons. The tonnage of British steamers amounted to somewhat more than 11 per cent. of the total tonnage of steamers entered and cleared.

Railways.—The total length in English miles of the railways open is shown in the following table:—

1875.	1885.	1895.	1896.	1897.	1898.	1899.	1900.
3985	5601	8644	9236	9778	10,161	10,513	10,624

The principal lines, extending to a length of 4756 miles, are owned by the Hungarian state, and important sections of private railway lines are also administered by the state, only 1835 miles being possessed and controlled in 1900 by private railway companies. The total capital invested amounted at the end of 1900 to £136,078,000, the state's share of which was no less than £91,106,000. The number of passengers conveyed yearly is shown in the following table:—

1886–90.	1891–95.	1896.	1897.	1898.	1899.	1900.
17,928,442	45,061,000	57,452,000	56,982,000	60,312,000	61,581,000	64,412,000

The receipts from passengers and from goods traffic amounted to—

Year.	Passengers.	Goods Traffic.	Total (including miscellaneous).
1880	£1,000,000	£3,300,000	£4,300,000
1890	1,600,000	5,400,000	7,100,000
1898	2,600,000	7,400,000	10,600,000
1899	2,700,000	7,600,000	10,800,000
1900	2,799,000	8,216,000	11,471,000

Thus the receipts from passengers nearly trebled during two decades, and those from the goods traffic increased 150 per cent., though the tariffs were much reduced. (See *Finance.*)

Post and Telegraphs.—The number of post-offices at the end of 1900 was 4923. The total number of letters, post-cards, newspapers and other papers delivered was (in millions)—

Average of	Millions.	Year.	Millions.
1886–90	230·4	1896	350·9
		1897	372·7
1891–95	284·5	1898	400·6
		1899	440·8
1896–1900	414·8	1900	508·7

The number of letters and cards only in 1900 was 260 millions; of newspapers only, 116 millions.

The total length of telegraph lines was, in 1900, 22,824 kilometres; of wires, 114,831 kilometres. The number of messages forwarded amounted in the same year to 7,573,200.

Banks.—The total number of joint-stock banks and others in Hungary proper is shown by the following table:—

Year.	1868.	1878.	1888.	1895.	1898.	1899.	1900.
Banks	156	663	1130	1841	2329	2363	2623

In 1900 Croatia-Slavonia had 253 banks. The value of deposits (savings included) in the whole kingdom at the end of 1900 was 2,088,500,000 crowns (24 crowns = £1). In the postal savings department 32,674,000 crowns were deposited.

AUTHORITIES.—The various statistical reports of the Central Statistical Office include all the material available. A summary of them is annually published under the title, *Magyar Statisztikai Évkönyv* (*Statistical Year-book of Hungary*).—MATLEKOVICS. *Magyarország Kozgazdasága és Közmüvelodés Ilapota ezeréves fenállásakor.* Budapest, 1897–98 (9 volumes, German edition 2 vols).—The Hungarian part of the *Az Osztrák-magyar monarchia írásban és képben.*—CHÉLARD. *La Hongrie millénaire.* Paris, 1896. (Z. R.)

RECENT HISTORY.[1]

The occupation in 1878 of Bosnia and Herzegovina by Austria-Hungary in accordance with article 23 of the Treaty of Berlin was from the first unfavourably viewed in the Hungarian kingdom. There were various reasons for this attitude on the part of the Hungarians; they were jealous of Austrian interference south of their own territory, partly out of fear of the encroachments of Pan-Germanism, and partly because of the friendly feelings they entertained for Turkey, which had welcomed their refugees in the revolution year of 1848. Moreover, the Hungarian finances, which at last, after many years of careful management, seemed to be established on a firm basis, would not, it was apprehended, stand the prolonged strain of a military intervention with all the concomitant hazards. In October 1878 the minister of finance, Koloman Szell (b. 1843), resigned, and the whole cabinet with him, but it was almost immediately modified and reconstituted under Tisza (*q.v.*). At the head of the strong Liberal party he succeeded in allaying the popular indignation, which had found vent in revolutionary meetings, and even excesses, and in persuading the chamber to vote the supplies and continue the military establishment for a further period of ten years. In return for these sacrifices Austria allowed Hungary a freer hand in her policy of Magyarization.

During the next few years various reforms were carried through; the municipal administration was reorganized, instruction in the Hungarian language was made obligatory in the popular and intermediate schools, and the reconstitution of the House of Magnates, which had long been a burning question, passed into law in 1885. In the lower house the period for which deputies were elected was extended from three to five years. The general state of unrest culminated in 1883 in anti-Jewish riots; but this was only a passing storm, and the national exhibition held in Budapest in 1885 concentrated the public mind upon the economic possibilities of the country and the potentialities of the capital city. In the ensuing year Tisza enunciated in parliament the Austro-Hungarian Balkan policy, declaring for the Treaty of Berlin and the independence of Bulgaria. His utterances, though welcomed in the sister state and in Europe at large as a weighty and valuable pronouncement and an earnest of peace, gave umbrage in Hungary itself. The increase in the military budget necessitated by the general state of disquietude in Europe, and a new Army Bill, providing for the reconstitution of the Landsturm, introduced in 1889, added to the public indignation, and rioting in Pesth and other large centres was only suppressed by military intervention. Tisza, however, firmly stood his ground, and again, as in 1878, asked the house to vote the Army Bill (*Wehrgesetz*), providing for the continuance of the military establishment at the same strength for a further period of ten years. Certain clauses of the Bill, rather than its general policy, aroused opposition, notably that requiring volunteers of one year's service to pass their examination in German. This clause was bitterly assailed as a retrograde movement and a menace to the Magyarization of the country. Tisza eventually carried his points, but he had to resort to all the devices of constitutional procedure open to him to compass his ends. Thwarted on the Army Bill, the Radical wing

[1] See also AUSTRIA-HUNGARY, *History*.

next turned its attention to the domicile law (*Heimathsgesetz*), demanding its amendment so as to permit of the return of Kossuth (*q.v.*), who by voluntary self-banishment for more than ten years had *ipso facto* ceased to be a Hungarian citizen. The cabinet, with the exception of Tisza, who favoured this step, declined to identify itself with the motion, and Tisza accordingly resigned (1890); yet the ex-minister, after taking this step, retained his seat in parliament, and was still regarded as the head of the party. The fifteen years (1875–90) during which Tisza held undisputed sway mark the creation of modern Hungary, and as long as his counsels were available the nation looked to him to direct its policy.

Count Julius Szapáry (b. 1832) undertook the presidency of a new ministry, and expressly declared that the Government would adhere to the lines of the policy pursued by Tisza, who, in his turn, loyally promised his support. One of the first acts of the new minister was to revive his predecessor's measure of administrative reform. This, the so-called *Verstaatlichung der Verwaltung*, was in effect the withdrawing from the countries of their elective and autonomous administration, and the substitution of a centralized or state administration. Introduced in 1892, the Bill, owing to the sustained obstruction of the Opposition, had to be abandoned. A short measure, accepting the principle of state organization, was substituted and carried, but the main measure remained in abeyance, the old provincial autonomy persisting in full force.

In this year (1892) new currency reforms were introduced, and a Bill establishing a gold standard became law. With the removal of the Calvinist Tisza, whom they regarded as their most dangerous enemy, the militant clerical element considered the opportunity favourable for entering an energetic protest against the measures of ecclesiastical reform which formed the Government programme. The Civil Marriage Bill, which, though a separate measure, formed part of this grand scheme of reform, was specially singled out for attack, and the remonstrances of the clergy culminated in a conference of bishops in the autumn, at which the pope's support of the clerical opposition was made known. Another *quæstio vexata* was that of the baptism of the children of mixed marriages. The law of 1868 provided that of the issue of such marriages the males should be brought up in the religion of the father and the females in that of the mother, and imposed upon the clergy baptizing a child not of their confession the duty of communicating the fact to the clergy of the other confession. This law, it was notorious, had for a long time past been evaded by the Roman Catholic clergy, who had been in the habit of claiming and baptizing all children of mixed marriages. The antagonism between the Government and the Catholic clergy now became so intense that, on the return of the old Liberal majority to power by the elections of the autumn of 1892, Alexander Wekerle (b. 1844), who had succeeded Szapáry as premier, at once laid before the Diet a sweeping scheme of reform, consisting of Bills for the introduction of civil marriage, civil registration, and the education of children of mixed marriages. The House of Magnates at first rejected the Civil Marriage Bill, but eventually all these Bills composing the scheme of ecclesiastical-political reform were carried through the two houses together.

In 1892 the Rumanian party in Transylvania had begun a serious agitation against the inequality with which they alleged they were treated, and they attempted in vain to go behind the Government and obtain personal redress from the king. At a Pan-Rumanian congress at Hermannstad in July 1893, a memorandum of their grievances was formulated, and Wekerle seized the opportunity to prosecute the leaders for treason. Twenty of them were sentenced (May 1894) to imprisonment; but the king was by no means satisfied either with Wekerle's action in this matter or with his encouragement of the popular demonstrations after Kossuth's death in March 1894, and in December 1894 Wekerle's ministry was dismissed. The year 1894 was remarkable for the jubilee of the literary career of Maurus Jókai (*q.v.*), and the celebrations held throughout the length and breadth of the land showed the strength and depth of the Magyar feeling of nationality.

In January 1895 Baron Desider Bánffy (b. 1843) formed a new Government, and began by completing two of Wekerle's measures, that sanctioning the Jewish religion and that establishing freedom of worship. In this he was successful in spite of the bitter opposition of the clericals backed by Mgr. Agliardi, the papal nuncio. The interference of the latter led to a serious disagreement between the premier and Count Kalnoky (the Federal minister for foreign affairs, *q.v.*), with the result that Kalnoky was forced into resignation. Bánffy's first great task was the renewal of the *Ausgleich* (see AUSTRIA-HUNGARY), and to this he addressed himself with vigour. It was owing to his conciliatory policy that the Austrian monarchy was won over to a complete recognition of the equality of Hungary; Hungarian state officials were appointed to the king's court on the monarch being resident in Hungary, and ministers of the imperial house became known by the title "imperial and royal" (*kaiserlich-königlich*). The millennium exhibition held at Budapest in the summer of 1896 was a complete success, being especially favoured by the royal house, which in its turn was loyally received by the Hungarian people and houses of legislature. In view of the enhanced prosperity of the country as evidenced by the exhibition, Austria now demanded that the Hungarian subvention to the common expenses (quota) should be considerably increased; the current saying in Austria being that "Hungary enjoys 70 per cent. of the power in the dual monarchy for 30 per cent. of the cost." But the proposal to raise the quota from 31½ per cent. to 34 per cent. met with much opposition, the Government being unwilling to make even this concession, and at the same time Badeni's endeavours to gain over the Czechs to the *Ausgleich* drove the Germans in the Austrian parliament to opposition, and the further discussion of the measure was accordingly postponed and parliament dissolved.

The new elections resulted in a magnificent triumph for the Government, but as it was impossible, owing to the shortness of the session, to renew the attempt to pass the *Ausgleich*, a provisional arrangement for a year was proposed. But the obstruction of the Germans in the Austrian parliament still continued and prevented the passing of the *Ausgleichs provisorium*, and the whole of the year 1897 was practically taken up with the discussion of this measure and that of the broad lines of the economic policy of the dual monarchy. It was not until January 1898 that the *Ausgleich* with Austria was, at the instance of the Hungarian Government and with the consent of the parliament, prolonged until the following May. The discussions in parliament gave Bánffy an opportunity of declaring his unalterable allegiance to the dual monarchy, and of enunciating the policy of his Government, which was not merely that of preserving the *status quo* with Austria, but of binding that country by still closer ties to the Hungarian kingdom. The emperor-king, grateful for these evidences of loyalty, gave his assent to a new law for the Magyarization of names of places in Transylvania. This gave rise to a vehement protest on the part of the various nationalities in those districts, especially the Saxon element, whose representatives, as a demonstration against this measure, withdrew from the ranks of the Liberal majority. Among other disquieting symptoms of trouble during the summer of

1898 was the spread of agrarian socialism in the country, which was intensified by a bill regulating the relations between landowners and their labourers. Meanwhile the discussion of the *Ausgleich* roused public feeling to a fever pitch. The assassination of the empress-queen in September 1898 had for the moment a sobering effect, and the proposal of the emperor-king to give the site in Ofen, occupied by the Hentzi monument, which had ever been an eyesore to patriotic Hungarians, for the monument to her memory to be erected by public subscription was enthusiastically received. But an order for the re-erection of the Hentzi statue in the barrack-yard of the cadet school gave rise to fresh obstruction, and led to stormy scenes in the chamber; and the mutual recriminations of parliamentarians resulted in a crop of duels, among which that between Bánffy and Horansky, the premier's bitterest assailant, was conspicuous. The new year (1899) brought no cessation of the obstruction, and it soon became evident that nothing less than the resignation of Bánffy would satisfy the obstructionist group, whose tactics threatened to be subversive of constitutional government in Hungary. In February the crisis culminated in the resignation of the Bánffy ministry, Koloman Szell being entrusted with the formation of a new cabinet.

Thus closed for Hungary a most momentous period in her modern political history. With the new premier's accession to power the parliamentary deadlock came to an end, and a compromise having been effected with the three opposite groups, the *Ausgleich*, embodied in a series of bills, was carried through both houses of legislature in July. Between then and the end of 1901, Hungarian politics was only disturbed by the periodical outbursts of anti-Magyar feeling in Austria, where the tension between the two countries as the outcome of commercial jealousy made itself acutely felt at times. Thus, with regard to the Bosnian railway question, the Hungarians, who had a monopoly of railway connexion with Bosnia, were accused of placing impediments in the way of the construction of the short lines intended to connect the Bosnian state railway with Croatia and Austria on the one side, and with the Dalmatian coast at Spalato on the other. Undoubtedly the feelings aroused in Austria were natural enough. As it was the ambition of the Magyars to make of their country a model industrial state, the Government left no stone unturned in its endeavour to attain this end. Austrian competition was successfully combated by a system of bounties to Hungarian manufactures which, while affording the necessary protection, ran counter to the spirit, if not to the letter, of the customs union. The result was that Austrian manufacturers and traders were attracted in large numbers to Hungary, while Austrian industries were dealt a correspondingly heavy blow. But in the distracted state of parliamentary politics in Austria (*q.v.*), no remedy for this was discernible.

The political situation between the years 1870 and 1902 was largely dominated by the conflict between the Catholic and Protestant interests. Beginning in 1867 with Deák, it found its culminating point in the ultra-Calvinist, Koloman Tisza, while in the last years of the century an extraordinary development took place. Tisza, with the Government party, endeavoured to realize Protestant aims, whilst an independent Protestant party became a thorn in the side of the Government. At the beginning of the 'nineties a Catholic reaction set in with Szapáry, but he, after a short term of office, was forced by Desider Szilágyi (*q.v.*), the relentless champion of Calvinism, to resign. His successor, Wekerle, was dismissed largely as a result of Catholic influence in Vienna. In Bánffy, again, is found a Protestant of extreme Calvinistic leanings, who carried on his high-handed policy by uniting the forces of Judaism and Protestantism, and whose questionable methods at the elections of 1897 left a blot upon the escutcheon of Hungarian statesmanship. After his fall, Szell, a Catholic, undertook the formation of a ministry, and this party, victorious in Hungary, occupied in 1902 the position formerly filled by the Protestant party.

Hungarian Literature.

The number of Magyar writers has since 1880 increased to an extent hardly expected by the reading public in Hungary itself. In 1830 there were only 10 Magyar periodical publications; in 1880 we find 368; in 1885 their number rose to 494; in 1890 to 636; and at the beginning of 1895 no less than 806 periodical publications, written in the Hungarian language, appeared in Hungary. Since that time (1895) the number of periodical as well as of non-periodical literary works has been constantly rising, although, as in all countries with a literature of rather recent origin, the periodical publications are, in proportion to the whole of the output, far more numerous than the non-periodical.[1]

This remarkable increase in the quantity of literary work was, on the whole, accompanied by a fair advance in literary quality. It cannot be said that a new literary generation had arisen, since many of the shining lights of the 'sixties and 'seventies still remained in the field in 1901. In lyrical poetry, among the poets who first came to the fore in the 'sixties several were still active between 1880 and 1901, such as Joseph Komócsy (d. 1894), whose *Szerelem Könyve* ("Book of Love") has become a popular classic; Victor Dalmady, who published in the 'nineties his *Hazafias Költemények* (Patriotic Poems); and Ladislas Arany, son of the great John. Among the prominent lyrists whose works, although partly published before 1880, belong largely to the later period, the following deserve special mention:—The poetry of Emil Ábrányi (born 1850) is filled with the ideas and ideals of Victor Hugo. Ábrányi excels also as a translator, more particularly of Byron. Julius Reviczky (1855–1899) also inclined to the Occidental rather than to the specifically Magyar type of poets; his lyrics are highly finished, aristocratic, and pessimistic (*Pán halála*, "The Death of Pan"). Count Géza Zichy (born 1849) published his lyrical poems in 1892. Joseph Kiss (born 1843) is especially felicitous in ballads taken from village and Jewish life, and in love-songs; Alexander Endrődi (born 1850), one of the most gifted modern lyrical poets of Hungary, has the charm of tenderness and delicacy together with that of a peculiar and original style, his *Kurucz nóták* being so far his most successful attempt at romantic lyrics. Louis Bartók (born 1851) is a remarkable satirist and epigrammatist (*Kárpáti emlékek*). Ödön Jakab (born 1850) leans towards the poetic manner of Tompa, with perhaps a greater power of expression than the author of the *Virágregék* ("Flower-fables"); Jakab wrote *Hangok az ifjuságból* ("Sounds of Youth"), *Nyár* ("Summer"), both collections of lyrical poems. Louis Pósa (born 1850) has made a sphere of his own in his charming poems for and about children, *Édes anyám* ("My dear Mother"). In Andor Kozma (born 1860), author of *A tegnap és a ma* ("Yesterday and To-day," 1889), *Versek* (Poems, 1893), &c., there is undoubted power of genuine satire and deep humour. Michael Szabolcska (born 1864), author of *Hangulatok* ("Moods," 1894), showed great promise; Julius Vargha (born 1853) cultivates the *népies* or folk-poetry as represented by Hungary's two greatest poets, Petőfi and Arany; Vargha has also published excellent translations of Schiller and Goethe. Perhaps scarcely less remarkable are the modern Magyar lyrists, such as, of the older set, John Bulla (born 1843), J. D.

[1] This will appear even more striking by a consideration of the number of periodical publications published in Hungary in languages other than Magyar. Thus, while of German periodicals appearing in Hungary there were in 1871 only 85, they increased in 1880 to 114, in 1885 to 141; and they were, at the beginning of 1895, still 128, in spite of the constant spread of that process of Magyarization which has, since 1880, considerably changed the linguistic habits of the people of Hungary.

Temérdek, Gustavus Csengey (born 1842), Paul Koroda (born 1854), E. Julius Kovács (born 1839, *Poems*, 1892), Ladislas Inczédi, Julius Nógrádi Pap, Julius Szávay (born 1860), John Dengi (born 1853); among the juniors, Anton Radó (also an excellent translator), Louis Palágyi (*Magányos úton*, "On Lonely Way," &c.), Géza Gárdonyi (born 1863, *Aprilis*, 1894), Zoltán Pap, Eugen Heltai (*Ignotus*), Julius Rudnyánszky (born 1860, *Szerelem*, "Love"; *Nyár*, "Summer"), Árpád Zemplényi, Julius Szentessy, Emil Makai (born 1870), Cornelius Gáspár, Julius Varsányi (born 1863, *Mulandóság*, "The Unstableness of Things"), Alexander Luby (*Vergődés*, "Striving"), Eugen V. Szászvárosi, Endre Szabó (born 1849), political satirist. In the most recent lyrics of Hungary there is a growing tendency to socialistic poetry, to the "poetry of misery" (*A nyomor költészete*). In epic poetry Josef Kiss's *Jehova* is the most popular work. Amongst rhymed novels—novels in verse form—the best is the *Délibábok hőse* ("The Hero of Mirages"), in which Ladislas Arany tells, in brilliantly humorous and captivating fashion, the story of a young Magyar nobleman who, at first full of great ideals and aspirations, finally ends as a commonplace country squire.

Among Hungarian novels we may distinguish four dominant *genres* or tendencies. The first is represented almost exclusively by Maurus Jókai, who has gratified his countless admirers, both in Hungary and abroad, with numerous new manifestations of his inexhaustible *verve* and genius. The national festivities instituted in Jókai's honour in 1894, culminating in his being made, in 1897, a member of the Hungarian House of Magnates (the House of Lords in Hungary), publicly recognized the obligation under which Jókai's works had laid the Magyar nation. Amongst Jókai's later novels are: *A kik kétszer halnak meg* ("Those who die Twice"); *Szeretve mind a vérpadig* ("Loving to the very Scaffold"); *A lőcsei fehér asszony* ("The White Lady of Locse"); *A Kis Királyok* ("The Little Kings"); *A tengerszemü hölgy* ("The Lady with the Sea-eyes"): *Fráter György* ("Frater George"); *De kár megvénulni* ("What a pity to grow old"); *Életemből* (Memoirs); poems, dramas, &c. To the school so perfectly represented by Jókai belong Árpád Kupa (*A napszámosok*, "The Labourers"; *Képzelt királyok*, "Imaginary Kings"); Robert Tábori (*Nagy játék*, "Great Game"; *A negyvenéves férfiu*, "The Man at Forty"); and Julius Werner (*Kendi Imre házassága*, "The Wedding of Emericus Kendi"; *Olga; Megvirrad még valaha*, "Dawn will come in the End"). The second class of Hungarian modern novelists is led by the well-known Koloman Mikszáth, a poet endowed with originality, a charming *naïveté*, and a freshness of observation from life. A close observer of the multifarious low life of Hungary, Mikszáth has, in his short stories, given a delightful yet instructive picture of all the minor varied phases of the peasant life of the Slavs, the *Palócok*, the Saxons, the town artisan. Amongst his numerous works may be mentioned *A jó palóczok* ("The Good Palóczok," Slav peasants); *Egy választás Magyarországon* ("An Election in Hungary"); *Pipacsok a búzában* ("Wild Poppies in the Wheatfield"); *A tekintetes vármegye* ("The Worshipful County"); *Ne okoskodj Pista* ("Don't reason, Pista"); *Szent Péter esernyője* ("St Peter's Umbrella," translated from the original into English by Miss B. W. Worswick), &c. Mikszáth has had considerable influence upon other writers. Such are Victor Rákosi (*Sipulus tárcái*, "The Essays of Sipulus"; *Rejtett fészkek*, "Hidden Nests"); Stephen Móra (*Atyánkfiai*, "Our Compatriots"); Alexius Benedek, the author of numerous distinctly sympathetic and truly Magyar tales, fables, and novels, one of the most gifted and deserving literary workers of modern Hungary (*Huszár Anna*, "Anna Huszar"; *Egy szalmaözvegy levelei*, "Letters of a grass-widow"; *A sziv könyve*, "The Book of the Heart"; *Katalin*, "Catherine"; *Csendes órák*, "Quiet Hours"; *Testamentum és hat levél*, "Last Will and Six Letters," translated into German by Dr W. Schönwald, &c.); Géza Gárdonyi (several novels containing the adventures, observations, &c., of Mr Gabriel Gőre; *A kékszemü Davidkáné*, "Blue-eyed Mrs Dávidka"; *A Kátsa*, scenes from gypsy life): Charles Murai (*Vig történetek*, "Jolly Stories"; *Bandi*, a collection of short tales): Stephen Bársony (*Csend*, "Silence"; *A Kaméleon-leány*, "The Chamæleon Girl, and other Stories"; *Erdőn-mezőn*, "In Wood and Field"). The third class of Magyar novelists comprises those cosmopolitan writers who take their method of work, their inspiration, and even many of their subjects from foreign authors, chiefly French, German, Russian, and also Norwegian. A people with an intense national sentiment, such as the Hungarians, do not as a rule incline towards permanent admiration of foreign-born or imported literary styles; and accordingly the work of this class of novelists has frequently met with very severe criticism on the part of various Magyar critics. Yet it can scarcely be denied that several of the "foreign" novelists have contributed a wholesome, if not quite Magyar, element of form or thought to literary narrative style in Hungary. Probably the foremost among them is Sigismund Justh, who died prematurely in the midst of his painful attempt at reconciling French "realistic" modes of thought with what he conceived to be Magyar simplicity (*A puszta könyve*, "The Book of the Puszta," prairie of Hungary; *A Pénz legendája*, "The Legend of Money"; *Gányó Julcsa*, "Juliet Gányó"; *Fuimus*). Other novelists belonging to this school are: Desiderius Malonyai (*Az utolsó*, "The Last"; *Judith könyve*, "The Book of Judith"; *Tanulmányfejek*, "Typical Heads"); Julius Pekár (*Dodo főhadnagy problémái*, "Lieutenant Dodo's Problems"; *Az aranykesztyűs kisasszony*, "The Maid with the Golden Gloves"; *A szoborszép asszony*, "The Lady as Beautiful as a Statue"; *Az esztendo legendája*, "The Legend of the Year"); Thomas Kobor (*Aszfalt*, "Asphalt"; *Ő akarta*, "He Wanted It"; *A csillagok felé*, "Towards the Stars"); Stephen Szomaházy (*Huszonnégy óra*, "Twenty-four Hours"; *A Clairette Keringő*, "The Clairette Valse"; *Páratlan szerdák*, "Incomparable Wednesdays"; *Nyári felhők*, "Clouds of Summer"); Zoltán Thury (*Ullrich főhadnagy és egyéb történetek*, "Lieutenant Ullrich and other Tales"; *Urak és parasztok*, "Gentlemen and Peasants"); also Desiderius Szomory, Ödon Gerő, Árpád Abonyi, Koloman Szántó, Edward Sas, Julius Vértesi, Tibor Dénes, Ákos Pintér, the Misses Janka and Stéphanie Wohl, Mrs Sigismund Gyarmathy, and others. In the fourth class may be grouped such of the latest Hungarian novelists as have tried, and on the whole succeeded, in clothing their ideas and characters in a style peculiar to themselves. Besides Stephen Petelei (*Jetti*, a name—"Henrietta"—*Felhők*, "Clouds") and Zoltán Ambrus (*Pókháló Kisasszony*, "Miss Cobweb"; *Gyanu*, "Suspicion"), must be mentioned especially Francis Herczeg, who has published a number of very interesting studies of Hungarian social life (*Simon Zsuzsa*, "Susanna Simon"; *Fenn és lenn*, "Above and Below"; *Egy leány története*, "The History of a Girl"; *Idegenek között*, "Amongst Strangers"); Alexander Bródy, who brings a delicate yet resolute analysis to unfold the mysterious and fascinating inner life of persons suffering from overwrought nerves or overstrung mind (*A kétlelkü asszony*, "The Double-Souled Lady"; *Don Quixote kisasszony*, "Miss Don Quixote"; *Faust orvos*, "Faust the Physician"; *Tündér Ilona*, *Rejtelmek*, "Mysteries"; *Az ezüst kecske*, "The Silver Goat");

and Edward Kabos, whose sombre and powerful genius has already produced works, not popular by any means, but full of great promise. In him we may trace the influence of Nietzsche's philosophy (*Koldusok*, "Beggars"; *Vándorok*, "Wanderers"). To this list we must add the short but incomparable *feuilletons* (*tárczalevelek*) of Dr Adolf Ágai (writing under the *nom de plume* of Porzó), whose influence on the formation of modern Hungarian literary prose is hardly less important than the unique *esprit* and charm of his writings.

Dramatic literature, liberally supported by the king and the government, and aided by magnificent theatres in the capital and also in the provinces (the finest provincial theatre is in Kolozsvár, in Transylvania), has developed remarkably. The Hungarians have the genuine dramatic gift in abundance; they have, moreover, actors and actresses of the first rank. In the modern drama three great and clearly differentiated groups may be distinguished. First the neo-romantic group, whose chief representatives are Eugen Rákosi, Louis Dóczi (born 1845), who, in addition to *Csók* ("The Kiss"), has written *Utolsó szerelem* ("Last Love"), *Széchy Mária* ("Maria Széchy"), *Vegyes Párok* ("Mixed Couples"). In these and other dramatic writings, more remarkable perhaps for poetic than for stage effects, Dóczi still maintains his brilliancy of diction and the delicacy of his poetic touch. To the same school belong Louis Bartók, Anton Váradi, and Alexander Somló. The next group of Hungarian dramatists is dominated by the master spirit of Gregor Csiky (1842–1891), who in his short but very active life furnished his country with a great number of society dramas, some gay, others semi-serious, but nearly all of them eminently dramatic, caustic, presenting real types of character in language incisive and moderate. In addition to his *Proletárok* (perhaps his masterpiece), Csiky wrote: *Czifra nyomorúság* ("Sham Splendour"), *A Stomfay-család* ("The Stomfay Family"), *Mukányi*, *Nora*, *Bozóti Márta*, *Jó Fülöp* ("Good Philip"), *A Kaviár*, *Két szerelem* ("Two Loves"), *Örök törvény* ("Eternal Law"), *Petneházy*, &c. Among Csiky's most promising disciples is Francis Herczeg (already mentioned as a novelist), author of the successful society comedy, *A Gyurkovics leányok* ("The Misses Gyurkovics"), *Három testőr* ("Three Guardsmen"), *Honty háza* ("The House of Honty"). Árpád Berczik's *Nézd meg az anyját* ("Look at her Mother"), *A protekczió* ("Patronizing"), also followed on the lines of Csiky. The third group of dramatic writers take their subjects, surroundings, and diction from the folk-life of the villages (*népszinmu*, "folk-drama"). The greatest of these dramatists has so far been Edward Tóth (*Toloncz*, "The Ousted Pauper"). Amongst his numerous followers, who have, however, sometimes vulgarized their figures and plots, may be mentioned Tihamér Almási (*Milimári*, *A Miniszterelnök bálja*, "The Ball of the Premier") and Alexander Somló.

In philosophy there has been a remarkable increase of activity, partly assimilative or eclectic, and partly original. Peter Bihari and Maurice Kármán have in various writings spread the ideas of Herbart. After the school of Comte, yet to a large extent original, is the *Az ember és világa* ("Man and his World") of Charles Böhm, who in 1881 started a philosophical review (*Magyar Filozofiai Szemle*), subsequently edited by Joseph Bokor, a vigorous thinker. Realism, more particularly of the Wundt type, is represented by Emericus Pauer, *Az ethikai determinismus* ("Ethical Determinism"), and Eugen Posch (*Az időről*, "On Time"). On a Thomistic basis John Kiss edits a philosophical review (*Bölcseleti Folyóirat*); on similar lines have been working Ákos Mihályfi, Répássy, Augustin Lubrich, and others. Neo-Hegelianism is cultivated by Eugen Schmitt, efficiently assisted by Joseph Alexander Simon (*Az egységes és reális természet filozofia alapvonalai*, "Outlines of a Uniform and Realistic Philosophy of Nature"). F. Medveczky (formerly a German author under the name of Fr. von Bärenbach) espouses Neo-Kantism (*Társadalmi elméletek és eszmények*, 1887, "Social Theories and Ideals"). The Hungarian scholar Samuel Brassai published, in 1896, *Az igazi pozitiv filozofia* ("The True Positive Philosophy"). Amongst the ablest and most zealous students of the history of philosophy are Bernhard Alexander, under whose editorship, aided by Joseph Bánoczi, a series of the works of the world's great thinkers has appeared; Andrew Domanovszky, author of an elaborate History of Philosophy; Julius Gyomlai, translator of Plato; Eugen Péterfy, likewise translator of philosophical works, &c.

Juristic literature has been stimulated by the activity in positive legislation. On 1st January 1900 a new criminal code, thoroughly modern in spirit, was put in force; and in 1901 a Civil Code Bill, to replace the old Hungarian customary system, was introduced. Among the newer writers on common and commercial law may be mentioned Wenczal, Zlinsky, Zögöd, Gustave Schwarz, Alexander Plósz, Francis Nagy, and Neumann; on constitutional law, Korbuly, Boncz, Stephen Kiss, Ernest Nagy, Kmety, Arthur Balogh, Ferdinandy, Bela Grünwald, Julius Andrássy, and Emeric Hajnik; on administration, George Fésüs, Kmety, and Csiky; on finance, Mariska, Exner, and László. Among the later writers on statistics, moreover, have been Konek, Keleti, Láng, Földes, Jekelfalussy, Vorgha, Körösy, Ráth, and Vizaknai.

On subjects of politics, amongst the more important works are the various monographs of Gustavus Beksics on the Dualism of Austria-Hungary, on the "New Foundations of Magyar Politics" (*A magyar politika uj alapjai*, 1899), on the Rumanian question, &c.; the writings of Emericus Bálint, Ákos Beöthy, Victor Concha (systematic politics), L. Ecsery, Géza Ferdinandy (historical and systematic politics), Árpád Zigány, Béla Földes (political economy), Julius Mandello (political economy), Alexander Matlekovics (Hungary's administrative service; *Államháztartás*, 3 vols.), J. Pólya (agrarian politics), M. Somogyi (sociology), and the late Augustus Pulszky.

In history there has been great activity. The millennial festivities in 1896 gave rise to the publication of what was then the most extensive history of the Hungarian nation (*A magyar nemzet története*, 1895–1901), ten large and splendidly illustrated volumes, edited by Alexander Szilágyi, with the collaboration of the best specialists of modern Hungary, Robert Fröhlich, B. Kuzsinszky, Géza Nagy, H. Marczali, Anton Pór, Schönherr, V. Fraknói, Árpád Károlyi, David Angyal, Coloman Thaly, Géza Ballagi.

Literary criticism is actively pursued. Among the more authoritative writers Paul Gyulai and Zsolt Beöthy represent the conservative school; younger critics, like Béla Lázár, Alexander Hevesi, H. Lenkei, Zoltan Ferenczy, Aladár Ballagi, Ladislas Négyessy, have shown themselves somewhat too ready to follow the latest Norwegian or Parisian sensation.

AUTHORITIES.—ZSOLT BEÖTHY. *A magy. nemz. irod. tört.*—S. BODNÁR. *A magy. irod. tört.*—BÉLA LÁZÁR. *A tegnap, a ma, és a holnap* (Budapest, 1896–1900).—JOSEPH SZINNYEI. *Magy. irók élete és munkái* (an extensive biographical dictionary of Hungarian authors, in course of publication).—*Irodalom történeti Közlemények* (a periodical edited by ARON SZILÁDY, for the history of literature).—EMIL REICH. *Hungarian Literature* (London, 1898). (E. RE*.)

Hunstanton, a seaside resort of England, on the east shore of the Wash, in Norfolk, 15 miles by rail north by east from King's Lynn. It has a good beach, a golf-course, a fine Decorated 14th-century church, the (Tudor)

hall of the L'Estrange family, a convalescent home (1871), a pier, and a lighthouse, 109 feet high, casting its beams 16 miles. Nine miles to the south is Sandringham, the country seat of King Edward VII. when prince of Wales. Population (1901), 1893.

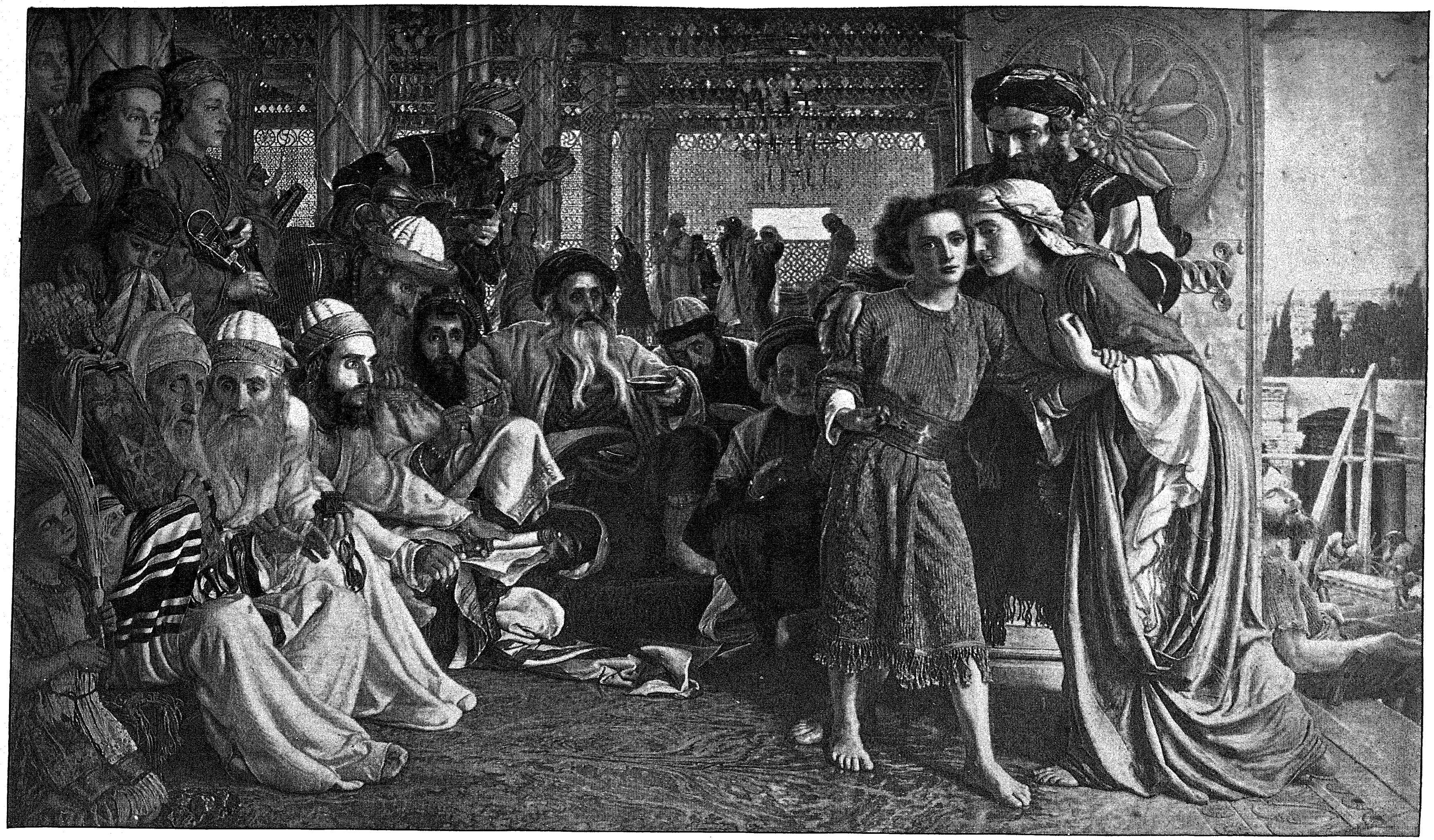
Hunt, Alfred William (1830–1896), English painter, son of Andrew Hunt, a landscape painter, was born at Liverpool in 1830. He began to paint while he was still a boy at the Liverpool Collegiate School; but as the idea of adopting the artist's profession was not favoured by his father, he went in 1848 to Corpus Christi College, Oxford. His career there was distinguished; he won the Newdigate Prize in 1851, and became a Fellow of Corpus in 1858. He did not, however, abandon his artistic practice, for, encouraged by Ruskin, he exhibited at the Royal Academy in 1854, and thenceforward regularly contributed landscapes in oil and water-colour to the London and provincial exhibitions. In 1861 he married, gave up his Fellowship, and was elected an Associate of the Royal Society of Painters in Water-Colours, receiving full membership three years later. His work is distinguished mainly by its exquisite quality and a poetic rendering of atmosphere. Hunt died on 3rd May 1896. Mrs A. W. Hunt (*née* Margaret Raine) is the writer of several works of fiction; and one of her daughters, Miss Violet Hunt, has also won distinction as a novelist.

See FREDERICK WEDMORE. "Alfred Hunt," *Magazine of Art*, 1891; *Exhibition of Drawings in Water Colour by Alfred William Hunt*, Burlington Fine Arts Club (1897).

Hunt, Henry Jackson (1819–1889), American artillerist, was born in Detroit, Mich., on 14th September 1819, graduated at the U.S. Military Academy in 1839, and became an expert in light artillery. When he was promoted to the rank of major, in May 1861, he was made chief of artillery in the Washington defences, and commanded the artillery reserve in the Virginia operations (1862–65), his services at Gettysburg being of the utmost value. He rose to be major-general of volunteers. By writing reports and papers and serving on various boards he was the foremost contributor to the effective use of artillery during the Civil War. He retired in 1883, and served as governor of the Soldiers' Home, Washington, D.C., until his death, on 11th February 1889.

Hunt, Richard Morris (1828–1895), American architect, was born in Brattleboro, Vermont, 28th October 1828. He studied in Europe (1843–1854), mainly in the École des Beaux Arts at Paris. In 1854 he was appointed on the architectural staff of the Louvre, and under Hector Lefuel designed the Pavillon de la Bibliothèque, opposite the Palais Royal. Next year he returned to New York, where he followed his profession until his death. In 1855 he was employed on the extension of the Capitol at Washington. He built the Lenox Library, the Stuyvesant and the *Tribune* buildings in New York. For the Administration Building at the World's Columbian Exposition at Chicago in 1893 he received the gold medal of the Institute of British Architects. Among the most noteworthy of his domestic buildings are the residences of Mr W. K. Vanderbilt and Mr Henry G. Marquand in New York City; Mr George W. Vanderbilt's palatial residence at Biltmore, North Carolina; and Mr Cornelius Vanderbilt's "The Breakers" at Newport, R.I. He was one of three foreign members of the Italian Society of St Luke's, an honorary and corresponding member of the Académie des Beaux Arts and of the Royal Institute of British Architects, and a Chevalier of the Legion of Honour. He was the first to command respect in foreign countries for American architecture, and was the leader of a school that has established in the United States the manner and the traditions of the Beaux Arts. He took a prominent part in the founding of the American Institute of Architects. His talent was eminently practical; and he was almost equally successful in the ornate style of the early Renaissance in France, in the picturesque style of his comfortable villas, and the monumental style of the Lenox Library. He died 31st July 1895.

Hunt, William Holman (1827–——), English artist, was born in London on 2nd April 1827. An ancestor on his father's side bore arms against Charles I., and went over to Holland, where he fought in the Protestant cause. He returned with William III., but the family failed to recover their property. Holman Hunt's father was the manager of a City warehouse, with tastes superior to his position in life. He loved books and pictures, and encouraged his son to pursue art as an amusement, but not as a profession. At the age of twelve and a half young Holman Hunt was placed in a City office, but he employed his leisure in reading, drawing, and painting, and at the age of sixteen began an independent career as an artist. When he was between seventeen and eighteen he entered the Royal Academy schools, where he soon made acquaintance with his lifelong friend John Everett Millais, then a boy of fifteen. In 1846 Holman Hunt sent to the Royal Academy his first picture ("Hark!"), which was followed by "Dr Rochecliffe performing Divine Service in the Cottage of Joceline Joliffe at Woodstock," in 1847, and "The Flight of Madeline and Porphyrio" (from Keats's *Eve of St Agnes*) in 1848. In this year he and Millais, with the co-operation of Dante Gabriel Rossetti and others, initiated the famous Pre-Raphaelite movement in art, which aimed at the exact imitation of nature and perfect sincerity of workmanship. Typical examples of the new creed were furnished in the next year's Academy by Millais's "Isabella" and Holman Hunt's "Rienzi vowing to obtain Justice for the Death of his Young Brother." This last pathetic picture was sold to Mr Gibbons for £105, and was succeeded in 1850 by "A Converted British Family sheltering a Christian Missionary from the Persecution of the Druids" (bought by Mr Combe, of the Clarendon Press, Oxford, for £150), and in 1851 by "Valentine protecting Sylvia from Proteus." This scene from *The Two Gentlemen of Verona* was very warmly praised by Ruskin (in letters to *The Times*), who declared that as studies both of drapery and of every minor detail there had been nothing in art so earnest and complete since the days of Albert Dürer. It gained a prize at Liverpool, and is reckoned as the finest of his earlier works. In 1852 he exhibited "A Hireling Shepherd," a picture of an English "hireling" sporting with a pretty country girl in a sunny meadow while the sheep break into the corn. "Claudio and Isabella," from *Measure for Measure*, and a brilliant study of the Downs near Hastings, called in the catalogue "Our English Coasts, 1852" (since generally known as "Strayed Sheep"), were exhibited in 1853. For three of his works he was awarded prizes of £50 and £60 at Liverpool and Birmingham, but in 1851 he had been so much discouraged by the difficulty of selling his pictures, that he had resolved to give up art and learn farming with a view to emigration. In 1854 he achieved his first great success by the famous picture of "The Light of the World," an allegorical representation of Christ knocking at the door of the human soul. This work produced what was perhaps the greatest effect of any religious painting of the century. "For the first time in England," wrote William Bell Scott, "a picture became



"The Finding of our Saviour in the Temple." By W. Holman Hunt.

(By permission of Corporation of Birmingham.)

a subject of conversation and general interest from one end of the island to the other, and indeed continued so for many years." "The Awakening Conscience," exhibited at the same time, depicted a tragic moment in a life of sin, when a girl, stricken with memories of her innocent childhood, rises suddenly from the knees of her paramour. The inner meaning of both these pictures was explained by Ruskin in letters to *The Times* in May 1854. "The Light of the World" was purchased by Mr Combe, and was given by his wife to Keble College.

In January 1854 Holman Hunt left England for Syria and Palestine with the desire to revivify on canvas the facts of Scripture history "surrounded by the very people and circumstances of the life in Judæa of old days." The first fruit of this idea, which may be said to have dominated the artist's life, was "The Scapegoat," a solitary outcast animal standing alone on the salt-encrusted shores of the Dead Sea, with the mountains of Edom in the distance, seen under a gorgeous effect of purple evening light. It was exhibited at the Royal Academy in 1856, together with three Eastern landscapes. His next picture (1860), one of the most elaborate and most successful of his works, was "The Finding of our Saviour in the Temple" (see Plate). Like all his important pictures, it was the work of years. Many causes contributed to the delay in its completion, including a sentence of what was tantamount to excommunication (afterwards revoked) passed on all Jews acting as models. Thousands crowded to see this picture, which was exhibited in London and in many other of the principal towns of England. It was purchased by a dealer named Gambart for £5500, and was engraved in line by Monsieur Blanchard. It is now in the Art Gallery at Birmingham, the gift of Mr Middlemore, M.P. Holman Hunt's next great religious picture was "The Shadow of Death" (exhibited separately in 1873), an imaginary incident in the life of our Lord, who, lifting His arms with weariness after labour in His workshop, throws a shadow on the wall as of a man crucified, which is perceived by His mother. This work was presented to Manchester by Sir William Agnew. Meanwhile there had appeared at the Royal Academy in 1861 "A Street in Cairo: The Lanternmaker's Courtship," and in 1863 "The King of Hearts," and a portrait of the Right Hon. Stephen Lushington, D.C.L. In 1866 came "Isabella and the Pot of Basil," "London Bridge on the Night of the Marriage of the Prince of Wales," and "The Afterglow," which were exhibited together in a private gallery and drew great attention. In 1867 Holman Hunt sent a charming head of "A Tuscan Girl" to the Grosvenor Gallery and two pictures to the Royal Academy. These were "Il dolce far niente" and a lifelike study of pigeons in rain called "The Festival of St Swithin," now in the Taylor Building, Oxford, with many others of this artist's works. After two years' absence Holman Hunt returned to Jerusalem in 1875, where he was engaged upon his great picture of "The Triumph of the Innocents," which proved to be the most serious labour of his life. The subject is an imaginary episode of the flight into Egypt, in which the Holy Family are attended by a procession of the Holy Innocents, marching along the waters of life and illuminated with unearthly light. Its execution was delayed by an extraordinary chapter of accidents. For months he waited in vain for the arrival of his materials, and at last he unfortunately began on an unsuitable piece of linen procured in despair at Jerusalem. Other troubles supervened, and when he arrived in England he found his picture in such a state that he was compelled to abandon it and begin again. The new version of the work, which is somewhat larger and changed in several points, was not completed till 1885. In the meanwhile the old picture was relined and so skilfully treated that the artist was able to complete it satisfactorily; so that now there are two pictures of "The Triumph of the Innocents," one of which is in the Art Gallery at Liverpool and the other in that at Birmingham. The pictures exhibited between 1875 and 1885 included "The Ship," a realistic picture of the deck of a passenger ship by night (1878), and portraits of his son (1880), Sir Richard Owen (1881), and Dante Gabriel Rossetti (1884). All of these were exhibited at the Grosvenor Gallery, where they were followed by "The Bride of Bethlehem" (1885), "Amaryllis," and a portrait of his son (tracing a drawing on a window) in 1886. In 1880 Holman Hunt delivered a lecture at the Society of Arts on the preparation of artists' materials, and in 1886 a collection of thirty-two of his works was exhibited at the Fine Art Society. His most important later work is "May-Day, Magdalen Tower," a record of the service of song which has been held on the tower of Magdalen, Oxford, at sunrise on May-Day from time immemorial. The subject had

William Holman Hunt.
(From a photograph by Elliott and Fry, London.)

interested the artist for a great many years, and, after "The Triumph of the Innocents" was completed, he worked at it with his usual devotion, climbing up the tower for weeks together in the early morning to study the sunrise from the top. This radiant poem of the simplest and purest devotion was exhibited at the Gainsborough Gallery in Old Bond Street in 1891. He continued to send occasional contributions to the exhibitions of the Royal Water-Colour Society, to the New Gallery, and to the New English Art Club. One of the most remarkable of his later works (New Gallery, 1899) is "The Miracle of Sacred Fire in the Church of the Sepulchre, Jerusalem," which takes place on the morning of the Greek Easter Eve, in a rotunda round the shrine. The picture is crowded with pilgrims, who, wild with religious excitement, improvise scenes from the Passion while waiting for the miraculous burst of flame.

By his strong and constant individuality, no less than by his peculiar methods of work, Mr Holman Hunt holds a somewhat isolated position among artists. He remained entirely unaffected by all the various movements in the art-world after 1850, without budging one iota from his early principles and practice. His ambition was always "to serve as high priest and expounder of the excellence of the works of the Creator." The list of his works is a short

one; he spent too much labour on each work to complete many; but perhaps no painter of the 19th century has produced so great an impression by a few pictures as the painter of "The Light of the World," "The Scapegoat," "The Finding of our Saviour in the Temple," and "The Triumph of the Innocents." In 1856 he executed six designs for the illustrated edition of Tennyson's poems, and has made many illustrations for other works. As a writer Mr Holman Hunt is known by articles in the *Contemporary Review* on "The Pre-Raphaelite Brotherhood," another on "The Proper Mode and Study of Drawing" in the *Magazine of Art*, and one on "Pre-Raphaelitism" in *Chambers's Encyclopædia*. He was engaged in 1901 on a *History of Pre-Raphaelitism*.

See Archdeacon FARRAR and Mrs ALICE MEYNELL. "William Holman Hunt, his Life and Work" (*Art Annual*). London, 1893. —JOHN RUSKIN. *Modern Painters; The Art of England* (Lecture) [consult GORDON CRAUFORD'S *Ruskin's Notes on the Pictures of Mr Holman Hunt*, 1886].—ROBERT DE LA SIZERANNE. *La Peinture Anglaise Contemporaine*. Paris, 1895.—W. B. SCOTT. *Autobiographical Notes.* — W. M. ROSSETTI. *Pre-Raphaelite Diaries and Letters.*—PERCY H. BATE. *The Pre-Raphaelite Painters*, 1899. (C. MO)

Hunter, William Alexander (1844–1898), Scottish jurist and politician, was born in Aberdeen, 8th May 1844, and educated at the local grammar school and university, where he carried off the highest honours and many prizes. He entered the Middle Temple, and was called to the English bar in 1867, but then was occupied mainly with teaching. In 1869 he was appointed Professor of Roman Law at University College, London, and in 1878 Professor of Jurisprudence, resigning that chair in 1882. His name became well known during this period as the author of a standard work on Roman law, together with a smaller introductory volume for students. After 1882, however, Hunter took up politics, in which he held Radical views. He was elected to Parliament for Aberdeen in 1885, and in the House of Commons was a prominent supporter of Charles Bradlaugh. He was the first to advocate old age pensions, and in 1890 carried a proposal to free elementary education in Scotland. In 1895, however, his health broke down; he retired from Parliament in 1896, and died 21st July 1898.

Hunter, Sir William Wilson (1840–1900), British publicist, son of Andrew Galloway Hunter, a Glasgow manufacturer, was born at Glasgow on 15th July 1840. He was educated at Glasgow University (B.A. 1860), Paris, and Bonn, acquiring a knowledge of Sanscrit, and passing first in the competition for the Indian Civil Service in 1861. Posted in the remote district of Birthum, in the lower provinces of Bengal, he began collecting local traditions and records, which formed the materials for his novel and suggestive publication, entitled *The Annals of Rural Bengal*, a book which did much to stimulate public interest in the details of Indian administration. He also compiled *A Comparative Dictionary of the Non-Aryan Languages of India*, a glossary of dialects based mainly upon the collections of Brian Houghton Hodgson, which testifies to the industry of the writer but contains much immature philological speculation. In 1872 he brought out two attractive volumes on the province of Orissa and its far-famed temple of Jagannath. In 1869 Lord Mayo asked Hunter to submit a scheme for a comprehensive statistical survey of the Indian empire. The work involved the compilation of a number of local gazetteers, in various stages of progress, and their consolidation in a condensed form upon a single and uniform plan. The conception was worthy of the gigantic projects formed by Arthur Young and Sir John Sinclair at the close of the 18th century, and the fact that it was successfully carried through between 1869 and 1881 was owing mainly to the energy and determination of Hunter. The early period of his undertaking was devoted by Hunter to a series of tours which took him into every corner of the peninsula and put him into direct communication with the local officials. He himself undertook the supervision of the statistical accounts of Bengal (20 vols. 1875–77) and of Assam (2 vols. 1879). The various statistical accounts, when completed, comprised no fewer than 128 volumes. The immense task of condensing this mass of material proceeded concurrently with their compilation, an administrative feat which enabled *The Imperial Gazetteer of India* to appear in 9 volumes in 1881 (second edition in 14 volumes, 1885–87). Hunter adopted a transliteration of vernacular place-names, by which means the correct pronunciation is ordinarily indicated; but hardly sufficient allowance was made for old spellings consecrated by history and long usage. Hunter's own article on India was published in 1880 as *A Brief History of the Indian Peoples*, and has been widely translated and utilized in Indian schools. A revised form was reissued in 1895, under the title of *The Indian Empire: its People, History, and Products.* In 1882 Hunter, as a member of the Governor-General's council, presided over the Commission on Indian Education; in 1886 he was elected Vice-Chancellor of the University of Calcutta. In 1887 he retired from the service, was created K.C.S.I., and settled at Oaken Holt, near Oxford. He arranged with the Clarendon Press to publish a series of *Rulers of India*, to which he himself contributed volumes on Dalhousie (1890) and Mayo (1892). He had previously, in 1875, written an official *Life of Lord Mayo*, in two volumes. He also wrote a weekly article on Indian affairs for *The Times*. But the great task to which he applied himself on his settlement in England was a history upon a large scale of the *British Dominion in India*, two volumes of which only had appeared when he died, carrying the reader barely down to 1700. He was much hindered by the confused state of his materials, a portion of which he arranged and published in 1894 as *Bengal Manuscript Records*, in three volumes. A delightful story, *The Old Missionary* (1895), and *The Thackerays in India* (1897), a gossipy volume which appeals to all readers of *The Newcomes*, may be regarded as the relaxations of an Anglo-Indian amid the stress of severer studies. In the winter of 1898–99, in consequence of the fatigue incurred in a journey to the Caspian and back, on a visit to the sick-bed of one of his two sons, Hunter was stricken down by a severe attack of influenza, which affected his heart. He died at Oaken Holt on 6th February 1900. (T. SE.)

Hunting.—When railways were first started in England, dismal prophecies were made that the end of hunting would speedily be brought about. The result on the whole has been the reverse. In some counties, of course, the sport has suffered. On the other hand, townsmen who formerly would have been too far from a meet can now secure transport for themselves and their horses in all directions; and as a consequence, meets of certain packs are not advertised because of the number of strangers who would be induced to attend. The sport has never been so vigorously pursued as it is at the beginning of the 20th century, 19 packs of staghounds being kept in England and 4 in Ireland, 162 packs of foxhounds in England, 10 in Scotland, and 23 in Ireland, with packs of harriers and beagles too numerous to be counted. The chase of the wild stag is now carried on in the west country by the Devon and Somerset hounds, which hunt three or four days a week from kennels at Dunster; by Sir J. Amory, Bart.; by the Quantock; and by a fourth pack started in 1902. The other staghound packs

Packs.

are devoted to the capture of the carted deer, a business which is more or less of a parody on the genuine sport, but is popular for the reason that whereas with foxhounds men may have a blank day, they are practically sure of a gallop when a deer is taken out in a cart to be enlarged before the hounds are laid on. Complaints are often raised about the cruelty of what is called tame stag hunting, and it was a special subject of criticism that a pack should be kept at the Royal kennels at Ascot (abolished in 1901) and hunted by the Master of the Buckhounds; but it is the constant endeavour of all masters and hunt servants to prevent the infliction of any injury on the deer. Their efforts in this direction are seldom unsuccessful; and it appears to be a fact that stags which are hunted season after season come to understand that they are in no grave danger. Packs of foxhounds vary, from large establishments in the "Shires," the meets of which are attended by hundreds of horsemen, some of whom keep large stables of hunters in constant work—for though a man at Melton, for instance, may see a great deal of sport with half-a-dozen well-seasoned animals, the number is not sufficient if he is anxious to be at all times well mounted—to small kennels in the north of England, where the field follow on foot. The "Shires" is a recognized term, but is nevertheless somewhat vague. The three counties included in the expression are Leicestershire, Rutlandshire, and Northamptonshire. Several packs which hunt within these limits are not supposed, however, to belong to the "Shires," whereas a district of the Belvoir country is in Lincolnshire, and to hunt with the Belvoir is certainly understood to be hunting in the "Shires." The Shire hounds include the Belvoir, the Cottesmore, the Quorn, and the Pytchleys; for besides the Pytchley proper, there is a pack distinguished as the Woodland. It is generally considered that the cream of the sport lies here, but with many of the packs which are generally described as "Provincial" equally good hunting may be obtained. Round about London a man who is bent on the pursuit of fox or stag may gratify his desire in many directions. The Essex and the Essex Union, the Surrey and the Surrey Union, the Old Berkeley, the West Kent, the Burstow, the Hertfordshire, the Crawley and Horsham, the Puckeridge, as regards foxhounds; the Berkhampstead, the Enfield Chase, Lord Rothschild's, the Surrey, the West Surrey, and the Warnham, as regards staghounds, as well as the Bucks and Berks, which was substituted for the Royal Buckhounds, under the mastership of Sir R. Wilmot, Bart., are within easy reach of town.

Modern horses and hounds.

Questions are constantly raised as to whether horse and hounds have improved or deteriorated of recent years. It is probable that the introduction of scientific agriculture has brought about an increase of pace. Hounds hunt as well as ever they did, are probably faster on the whole, and in the principal hunts more thoroughbred horses are employed. For pace and endurance no hunter approaches the English thoroughbred; and for a bold man who "means going," a steeplechase horse is often the best animal that could be obtained, for when he has become too slow to win races "between the flags," he can always gallop much faster, and usually lasts much longer, than animals which have not his advantage of blood. The quondam "'chaser" is, however, usually apt to be somewhat impetuous at his fences. But it must by no means be supposed that every man who goes out hunting desires to gallop at a great pace and to jump formidable obstacles, or indeed any obstacles at all. A large proportion of men who follow hounds are quite content to do so passively through gates and gaps, with a canter along the road whenever one is available. A few of the principal packs hunt five days a week, and sometimes even six, and for such an establishment not fewer than seventy-five couples of hounds are requisite. A pack which hunts four days a week will be well supplied with anything between fifty and sixty couples, and for two days a week from twenty-five to thirty will suffice. The young hound begins cub-hunting when he is some eighteen months old, and as a rule is found to improve until his third or fourth season, though some last longer than this. Often, however, when a hound is five or six years old he begins to lack speed. Exceptional animals naturally do exceptional things, and a famous hound called Potentate is recorded by the eighth Duke of Beaufort to have done notable service in the hunting field for eleven seasons.

Hunt servants.

Servants necessary for a pack include the huntsman, the duties of whose office a master sometimes fulfils himself; two whippers-in, an earth-stopper, and often a kennel huntsman is also employed, though Lord Willoughby de Broke, an unimpeachable authority, lays it down that "the man who hunts the hounds should always feed them." In all but the largest establishments the kennel huntsman is generally called the "feeder." It is his business to look after the pack which is not hunting, to walk them out, to prepare the food for the hunting pack so that it is ready when they return, and in the spring to attend to the wants of the matrons and whelps. A kennel huntsman proper may be described as the man who does duty when the master hunts his own hounds, undertaking all the responsibilities of the huntsman except actually hunting the pack. It may be said that the first duty of a huntsman is to obtain the confidence of his hounds, to understand them and to make himself understood; and the intelligence of hounds is remarkable. If, for example, it is the habit of the huntsman to give a single note on his horn when hounds are drawing a covert, and a double note when a fox is found, the pack speedily understand the significance. The mysteries of scent are certainly no better comprehended now than they were more than a hundred years ago when Peter Beckford wrote his admirable book, *Thoughts on Hunting*, a work from which a student of the sport may still learn practically all that is to be learnt. The subject of scent is full of mysteries. The great authority already quoted, the eighth Duke of Beaufort, noted as a very extraordinary but well-known fact, for example, "that in nine cases out of ten if a fox is coursed by a dog during a run all scent ceases afterwards, even when you get your hounds to the line of the fox beyond where the dog has been." This is one of many phenomena which have always remained inexplicable. The duties of the whipper-in are to a great extent explained by his title. Whilst the huntsman is drawing the cover the whipper-in is stationed at the spot from which he can best see what is going on, in order to view the fox away, and it is his business to keep the hounds together when they have found and got away after the fox. There are many ways in which a whipper-in who is not intelligent and alert may spoil sport; indeed, the Duke of Beaufort actually went so far as to declare that "in his experience, with very few exceptions, nine days out of ten that the whipper-in goes out hunting, he does more harm than good." In woodland countries, however, a good whipper-in is really of almost as much importance as the huntsman himself; if he is not alert the hounds are likely to divide, as when running a little wide they are apt to put up a fresh fox. The earth-stopper "stops out" and "puts to"—the first expression signifying blocking, during the night, earths and drains to which foxes resort, the second performing the same duties in the morning so as to prevent the fox from getting to ground when he has

been found. In the interests of humanity care should be taken that the earth-stopper always has with him a small terrier, as it is often necessary to "stop-out" permanently; and unless a dog is run through the drain some unfortunate creature in it, a fox, cat, or rabbit, may be imprisoned and starved to death. This business is frequently performed by a gamekeeper, a *douceur* being paid him for any litter of cubs or fox found on his beat.

Cost of hunting.

With regard to the expenses of hunting, it is calculated that a master of hounds should be prepared to spend at the rate of £500 a year for every day in the week that his hounds are supposed to hunt. Taking one thing with another, this is probably rather under than over the mark, and the cost of hunting three days a week, if the thing be really properly done, will most likely be nearer £2000 than £1500. The expenses to the individual naturally vary so much that no figures can be given. As long ago as 1826 twenty-seven hunters and hacks were sold for 7500 guineas, an average of over £290; and when Lord Stamford ceased to hunt the Quorn in 1853, seventy-three of his horses fetched at auction an average of close on £200. Early in the 19th century, when on the whole horses were much cheaper than they are at present, 700 and 800 guineas are prices recorded as having been occasionally paid for hunters of special repute. A man may see some sport on an animal that cost him £40; others may consider it necessary to keep an expensive establishment at Melton Mowbray or elsewhere in the Shires, with a dozen or more 500-guinea hunters, some covert-hacks, and a corresponding staff of servants. Few people realize what enormous sums of money are annually distributed in connexion with hunting. Horses must be fed; the wages of grooms and helpers be paid; saddlery, clothing, shoeing, &c., are items; farmers, innkeepers, railway companies, fly-men, and others benefit more or less directly. (A. E. T. W.)

Huntingdon, a municipal borough and market town of England, capital of the county of Huntingdon, on the Ouse, and on the Great Northern, Great Eastern, and Midland Railways, 59 miles north from London. The recent buildings include the Montagu Institute (1897), in which are held the county council technical education classes, and which also shelters a working men's club. A new red-brick building, in the Elizabethan style, was erected in 1890 to accommodate the Archdeaconry Library (founded in 1716). The town and county hospital was enlarged in 1897, and an isolation hospital built in 1898. The large Early Decorated Trinity Union church (1868) serves both Baptists and Congregationalists. There are also a Wesleyan chapel (1878) and Salvation Army barracks. Amongst the industries should be mentioned the manufacture of carriages and perforated bricks. The town is governed by a mayor, 4 aldermen, and 12 councillors. Population (1901), 4261.

Huntingdon, capital of Huntingdon county, Pennsylvania, U.S.A., on the Juniata river, the Pennsylvania canal, and the Pennsylvania and the Huntingdon and Broad Top Mountain Railways, at an altitude of 621 feet. It contains car works and varied manufactures. Population (1880), 4125; (1890), 5729; (1900), 6053, of whom 225 were foreign-born and 122 were negroes.

Huntingdonshire, one of the south midland counties of England, bounded on the N. by Northampton, on the W. by Northampton and Bedford, and on the remaining sides by Cambridge.

Area and Population.—In 1891 the area of the ancient (geographical) county was 234,218 acres, and the population 57,761, of whom 28,419 were males and 29,342 females, showing a decrease of 1730, or at the rate of 2·9 per cent., since 1881 (59,491), as compared with a decrease at the rate of 6·6 per cent. in the ten years 1871–81; and in 1901, 57,773, or an increase of 12 since 1891. The returns of 1891 give 0·25 persons to an acre and 4·05 acres to a person. In 1891 the area of the registration county was 207,569 acres, and the population 50,289, of whom 24,750 were males and 25,539 females.

Particulars of the birth-rate, death-rate, and illegitimacy-rate, and the number of persons married per 1000 inhabitants are given in the subjoined table:—

	1871-80.	1881-90.	1889-98.	1899.
Birth-rate	31·6	27·9	26·0	25·4
Death-rate	18·5	16·4	16·0	16·6
Illegitimacy-rate (per 1000 births)	52	50	52	61
Marriage-rate	13·3	12·6	13·1	14·2

In 1891 the county contained 129 persons of Scottish birth, 140 of Irish birth, and 48 foreigners. At the same date there were 45 blind, 19 deaf and dumb, and 68 insane.

Administration, &c.—For parliamentary purposes the ancient county is divided into two divisions (Southern or Huntingdon and Northern or Ramsey), each returning one member, and part of the parliamentary borough of Peterborough (Northamptonshire). The administrative county includes the three municipal boroughs of Godmanchester, Huntingdon, and St Ives. There are one court of quarter sessions and five petty sessional divisions. The administrative county contains 99 entire civil parishes and parts of 8 others. The ancient county contains 79 ecclesiastical parishes or districts and parts of 8 others, most of them in the diocese of Ely. It is also traversed by the London and North-Western Railway.

Education.—The number of elementary schools in the county on 31st August 1900 was 88, of which 24 were board schools and 64 voluntary schools, these latter embracing 60 national Church of England schools, 1 Wesleyan school, and 3 British and other schools. The total school board receipts for the year ending 29th September 1900 amounted to £6262, inclusive of £548 income under the Agricultural Rates Act.

Agriculture.—There has been a large decrease in the areas of corn crops and of fallow since 1880, and an increase in both the permanent grass and the meadow land. The area of orchards was nearly doubled between 1885 and 1900, and the area of market gardens more than trebled between 1885 and 1895. In 1889 168,575 acres were farmed by tenants and 41,966 acres by the owners; the corresponding figures for 1895 being 177,238 and 33,412 acres, and for 1900, 179,890 and 28,461 acres respectively. Good drinking water is deficient in many parts of the county. Willows are the commonest trees.

The following table shows the areas under the different kinds of crops at the periods named:—

Year.	Area in Cultivation.	Area under Corn Crops.	Area under Green Crops.	Area of Bare Fallow.	Area under Permanent Grass.
1880	209,262	95,806	20,223	15,757	
1885	210,628	88,503	21,326	15,689	65,462
1890	210,821	81,946	19,905	13,535	76,562
1895	210,650	71,413	20,173	11,863	86,043
1900	208,351	74,359	20,410	8,902	84,151

The next table shows the number of live stock at the periods named:—

Year.	Cows and Heifers.	Other Cattle.	Total Cattle.	Horses.	Sheep.	Pigs.
1880	7499	20,814	28,313	10,969	155,059	17,475
1885	7268	22,817	30,085	10,139	131,128	19,816
1890	7895	24,056	31,951	11,004	118,208	20,997
1895	7124	20,862	27,986	11,393	101,110	21,728
1900	7642	23,104	30,746	11,027	96,459	17,443

Authorities.—S. H. Miller and S. B. J. Skertchly. *The Fenland.* Wisbech, 1878.—A. Kingston. *East Anglia and the Great Civil War.* London, 1897.—*Catalogue of Huntingdonshire Books* collected by H. E. Norris (1610–1895). privately printed, 1895. (J. T. Be.)

Huntington, capital of Huntington county, Indiana, U.S.A., on the Little river, on the Wabash and Erie canal, and on the Wabash and the Erie Railways, at an altitude of 743 feet. It has water-works, natural gas, the car works of the Erie Railway, and manufactures of

wooden ware. Population (1880), 3863; (1890), 7328; (1900), 9491, of whom 621 were foreign-born.

Huntington, capital of Cabell county, West Virginia, U.S.A., on the south bank of the Ohio river, just below the mouth of the Guyandot, on the Chesapeake and Ohio and the Ohio River Railways, at an altitude of 567 feet. It possesses a level site and a regular plan. It is the division headquarters of the Chesapeake and Ohio Railway, has car and machine works, and a large trade in coal, iron ore, and lumber. Population (1880), 3174; (1890), 10,108; (1900), 11,983, of whom 242 were foreign-born and 1212 were negroes.

Huntington, Daniel (1816- ——), American artist, was born in New York, 14th October 1816. In 1835 he studied with S. F. B. Morse, and produced "A Bar-Room Politician" and "A Toper Asleep." Subsequently he painted some landscapes on the river Hudson, and in 1839 went to Rome. On his return to America he painted portraits and began the illustration of *The Pilgrim's Progress*, but his eyesight failed, and in 1844 he went back to Rome. Returning to New York in 1846, he devoted his time chiefly to portrait-painting, although he has painted many *genre*, religious, and historical subjects. He was president of the National Academy from 1862 to 1869, and was re-elected in 1877. Among his principal works are: "The Florentine Girl," "Early Christian Prisoners," "The Shepherd Boy of the Campagna," "The Roman Penitents," "Christiana and Her Children," "Queen Mary signing the Death-Warrant of Lady Jane Grey," and "Feckenham in the Tower" (1850), "Chocura" (1860), "Republican Court in the Time of Washington," containing sixty-four careful portraits (1861), "Sowing the Word" (1869), "St Jerome," "Juliet on the Balcony" (1870), "The Narrows, Lake George" (1871), "Titian," "Clement VII. and Charles V. at Bologna," "Philosophy and Christian Art" (1878), "Goldsmith's Daughter" (1884). His principal portraits are: President Lincoln, in Union League Club, New York; Chancellor Ferris of New York University; Sir Charles Eastlake and the Earl of Carlyle, the property of the New York Historical Society; President Van Buren, in the State Library at Albany; James Lenox, in the Lenox Library; Louis Agassiz (1856–57), William Cullen Bryant (1866), John A. Dix (1880), and John Sherman (1881).

Huntly, a police burgh and burgh of barony of Aberdeenshire, Scotland, at the confluence of the rivers Deveron and Bogie. It is a market town and the centre of a large agricultural district, 40¾ miles north-west of Aberdeen by rail. Its industries are agricultural implement-making, hosiery weaving, weaving of woollen cloth, and the manufacture of lamps and of boots. There are an ancient castle, a public hall, a hospital for aged persons, a public library, and a cottage hospital. The public schools have a secondary department. Population (1881), 3519; (1901), 4136.

Huntsville, capital of Madison county, Alabama, U.S.A., on a plain 10 miles north of the Tennessee river, on the Nashville, Chattanooga, and St Louis, and the Southern Railways, at an altitude of 617 feet. It contains several institutions for higher education, also railway works and cotton mills. Population (1880), 4977; (1890), 7995; (1900), 8068, of whom 143 were foreign-born and 3709 were negroes.

Hunza. See GILGIT.

Hurlford and Crookedholm, a mining town of Ayrshire, Scotland, on the river Irvine, 2 miles east-south-east of Kilmarnock by rail. It has extensive ironworks and fireclay works. There is an institute, with a hall and reading-room. Two public schools had an average attendance of 685 in 1898–99, and a Roman Catholic school, 77. Population (1881), 4385; (1891), 4205; (1901), 5246.

Huşi (*Husch* or *Hushi*), chief town of the district of Falciŭ, Rumania, on the right bank of the river Pruth, about 40 miles south-east of Jassy. It is the seat of a court of first instance, and residence of a bishop. The principal commerce is in wine. A fair is held on the 14th of September. The town is said to have been founded by the Hussites in the 15th century. The cathedral (Biserica Domnesca) was built in 1491 by Stephen the Great. The Treaty of the Pruth between Russia and Turkey was signed at Huşi in 1711. Population, 15,404, of whom about one-fourth are Jews.

Husum, a small seaport town of Prussia, province of Schleswig-Holstein, near the coast of the North Sea, the port for the North Frisian Islands, 99 miles by rail north-north-west of Hamburg. In 1898 a bronze bust of Theodor Storm, who was born in this "grey town by the sea" in 1817 and died in 1888, was unveiled in the park. Husum has large cattle markets, especially for fat cattle. Population (1885), 6267; (1900), 8268.

Hutchinson, Jonathan (1828——), English surgeon and pathologist, was born 23rd July 1828 at Selby, Yorkshire, his parents belonging to the Society of Friends. He entered St Bartholomew's Hospital, and became a member of the Royal College of Surgeons in 1850 (F.R.C.S. 1862), and rapidly came to the front as a skilful operator and a scientific inquirer. He was president of the Hunterian Society in 1869 and 1870, professor of surgery and pathology at the College of Surgeons from 1877 to 1882, president of the Pathological Society, 1879–80, of the Ophthalmological Society, 1883, of the Neurological Society, 1887, of the Medical Society, 1890, and of the Royal Medical and Chirurgical in 1894–96. In 1889 he was president of the Royal College of Surgeons. He was a member of two Royal Commissions, that of 1881 to inquire into the provision for smallpox and fever cases in the London hospitals, and that of 1889–96 on vaccination and leprosy. He also acted as honorary secretary to the Sydenham Society. A progressive and a reformer, his activity in the cause of scientific surgery and in advancing the study of the natural sciences was unwearying. His lectures on neuropathogenesis, gout, leprosy, diseases of the tongue, &c., were full of original observation; but his principal work was connected with the study of syphilis, on which he became the first living authority. He was the founder of the London Polyclinic or Postgraduate School of Medicine; and both in his native town of Selby and at Haslemere, where he acquired a good deal of land and built several houses, he started (about 1890) educational museums for popular instruction in natural history. He has published several volumes on his own subjects, was editor of the quarterly *Archives of Surgery*, and holds the Hon. LL.D. degree of both Glasgow and Cambridge.

Hutchinson, capital of Reno county, Kansas, U.S.A., in the broad bottom-land of the Arkansas river, on the north side, at an altitude of 1533 feet. It is on four railways—the Atchison, Topeka and Santa Fé, the Missouri Pacific, the Chicago, Rock Island and Pacific, and the Hutchinson and Southern. Its site is level, the plan of the city regular, and the water-supply excellent. Near by is a large deposit of rock-salt, and the chief industry is mining and shipping this commodity. Popula-

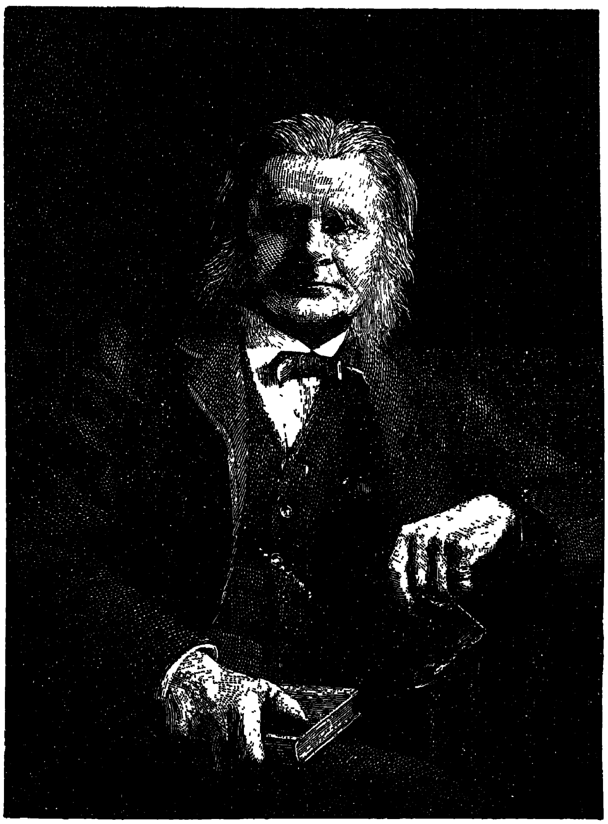
tion (1880), 1540; (1890), 8682; (1900), 9379, of whom 414 were foreign-born and 442 were negroes.

Hutton, Richard Holt (1826–1897), English writer and theologian, son of Joseph Hutton, Unitarian minister at Leeds, was born at Leeds on 2nd June 1826. His family removed to London in 1835, and he was educated at University College School and University College, where he began a life-long friendship with Walter Bagehot, of whose works he afterwards was the editor; he took his degree in 1845, being awarded the gold medal for philosophy. Meanwhile he had also studied for short periods at Heidelberg and Berlin, and in 1847 he entered Manchester New College with the idea of becoming a minister like his father, and studied there under Martineau. He did not, however, succeed in obtaining a "call" to any ministry, and for some little time his future was unsettled. He married in 1851 his cousin, Anne Roscoe, and became joint-editor with J. L. Sanford of the *Inquirer*, the principal Unitarian organ. But his innovations and his unconventional views about stereotyped Unitarian doctrines caused alarm, and in 1853 he resigned. His health had broken down, and he visited the West Indies, where his wife died of yellow fever before he returned. In 1855 Hutton and Bagehot became joint-editors of the *National Review*, a new monthly, and conducted it for ten years. During this time Hutton's theological views, influenced largely by Coleridge, and more directly by F. W. Robertson and F. D. Maurice, gradually approached more and more to those of the Church of England, which he ultimately joined. His interest in theology was profound, and he brought to it a spirituality of outlook and an aptitude for metaphysical inquiry and exposition which added a singular attraction to his writings. In 1861 he joined Mr Meredith Townsend as joint-editor and part proprietor of the *Spectator*, then a well-known Liberal weekly, which, however, was not remunerative from the business point of view. Hutton took charge of the literary side of the paper, and by degrees his own articles became and remained up to the last one of the best-known features of serious and thoughtful English journalism. The *Spectator*, which gradually became a prosperous property, was his pulpit, in which unweariyingly he gave expression to his views, particularly on literary, religious, and philosophical subjects, in opposition to the agnostic and rationalistic opinions then so current in intellectual circles, as popularized by Huxley. A man of fearless honesty, quick and catholic sympathies, broad culture, and many friends in intellectual and religious circles, he became one of the most influential journalists of the day, his fine character and conscience earning universal respect and confidence. He was an original member of the Metaphysical Society (1869). He was an anti-vivisectionist, and a member of the Royal Commission (1875) on that subject. In 1858 he had married again, his second wife, Eliza Roscoe, being a cousin of his first; she died early in 1897, and Hutton's own death followed quickly, on 9th September of the same year. Among his other publications may be mentioned *Essays, Theological and Literary* (1871; revised 1888), and *Criticisms on Contemporary Thought and Thinkers* (1894); and his opinions may be studied compendiously in the selections from his *Spectator* articles published in 1899 under the title of *Aspects of Religious and Scientific Thought*. (H. CH.)

Huxley, Thomas Henry (1825–1895), the most distinguished English biologist (if in a different field we except Charles Darwin) of the 19th century, was born on the 4th of May 1825 at Ealing, where his father, George Huxley, was senior assistant-master in the school of Dr Nicholas. This was an establishment of repute, and is at any rate remarkable for having produced two men with so little in common in after life as Huxley and Cardinal Newman. The cardinal's brother, Francis William, had been "captain" of the school in 1821. Huxley was a seventh child (as his father had also been), and the youngest who survived infancy. Of Huxley's ancestry no more is ascertainable than in the case of most middle-class families. He himself thought it sprang from the Cheshire Huxleys of Huxley Hall. Different branches migrated south, one, now extinct, reaching London, where its members were apparently engaged in commerce. They established themselves for four generations at Wyre Hall, near Edmonton, and one was knighted by Charles II. Huxley describes his paternal race as "mainly Iberian mongrels, with a good dash of Norman and a little Saxon."[1] From his father he thought he derived little except a quick temper and the artistic faculty which proved of great service to him and reappeared in an even more striking degree in his daughter, the Hon. Mrs Collier. "Mentally and physically," he wrote, "I am a piece of my mother." Her maiden name was Rachel Withers. "She came of Wiltshire people," he adds, and describes her as "a typical example of the Iberian variety." He tells us that "her most distinguishing characteristic was rapidity of thought. . . . That peculiarity has been passed on to me in full strength" (*Essays*, i. 4). One of the not least striking facts in Huxley's life is that of education in the formal sense he received none. "I had two years of a pandemonium of a school (between eight and ten), and after that neither help nor sympathy in any intellectual direction till I reached manhood" (*Life*, ii. 145). After the death of Dr Nicholas the Ealing school broke up, and Huxley's father returned about 1835 to his native town, Coventry, where he had obtained a small appointment. Huxley was left to his own devices; few histories of boyhood could offer any parallel. At twelve he was sitting up in bed to read Hutton's *Geology*. His great desire was to be a mechanical engineer; it ended in his devotion to "the mechanical engineering of living machines." His curiosity in this direction was nearly fatal; a *post-mortem* he was taken to between thirteen and fourteen was followed by an illness which seems to have been the starting-point of the ill-health which pursued him all through life. At fifteen he devoured Sir William Hamilton's *Logic*, and thus acquired the taste for metaphysics, which he cultivated to the end. At seventeen he came under the influence of Carlyle's writings. Fifty years later he wrote: "To make things clear and get rid of cant and shows of all sorts. This was the lesson I learnt from Carlyle's books when I was a boy, and it has stuck by me all my life" (*Life*, ii. 268). Incidentally they led him to begin to learn German; he had already acquired French. At seventeen Huxley, with his elder brother James, commenced regular medical studies at Charing Cross Hospital, where they had both obtained scholarships. He studied under Wharton Jones, a physiologist who never seems to have attained the reputation he deserved. Huxley said of him: "I do not know that I ever felt so much respect for a teacher before or since" (*Life*, i. 20). At twenty he passed his first M.B. examination at the University of London, winning the gold medal for anatomy and physiology; Ransom, the well-known Nottingham physician, obtaining the exhibition. In 1845 he published, at the suggestion of Wharton Jones, his first scientific paper, demonstrating the existence of a hitherto unrecognized layer in the inner sheath of hairs, a layer that has been known since as "Huxley's layer."

[1] *Nature*, lxiii. 127.

Something had to be done for a livelihood, and at the suggestion of a fellow-student, Mr (afterwards Sir Joseph) Fayrer, he applied for an appointment in the navy. He passed the necessary examination, and at the same time obtained the qualification of the Royal College of Surgeons. He was "entered on the books of Nelson's old ship, the *Victory*, for duty at Haslar Hospital." Its chief, Sir John Richardson, who was a well-known Arctic explorer and naturalist, recognized Huxley's ability, and procured for him the post of surgeon to H.M.S. *Rattlesnake*, about to start for surveying work in Torres Strait. The commander, Captain Owen Stanley, was a son of the bishop of Norwich and brother of Dean Stanley, and wished for an officer with some scientific knowledge. Besides Huxley the *Rattlesnake* also carried a naturalist by profession, John Macgillivray, who, however, beyond a dull narrative of the expedition, accomplished nothing. Huxley's future life-long friend, Sir Joseph Hooker, might have been his shipmate, but was tied by other plans. The *Rattlesnake* left England on 3rd December 1846, and was ordered home after the lamented death of Captain Stanley at Sydney, to be paid off at Chatham on 9th November 1850. The tropical seas teem with delicate surface-life, and to the study of this Huxley devoted himself with unremitting devotion. At that time no known methods existed by which it could be preserved for study in museums at home. He gathered a magnificent harvest in the almost unreaped field, and the conclusions he drew from it were the beginning of the revolution in zoological science which he lived to see accomplished.



THOMAS HENRY HUXLEY.
(From a photograph by Elliott and Fry, London.)

Cuvier (1769–1832), whose classification still held its ground, had divided the animal kingdom into four great *embranchements*. Each of these corresponded to an independent archetype, of which the "idea" had existed in the mind of the Creator. There was no other connexion between these classes, and the "ideas" which animated them were, as far as one can see, arbitrary. Cuvier's groups, without their theoretical basis, were accepted by Von Baer (1792–1876). The "idea" of the group, or archetype, admitted of endless variation within it; but this was subordinate to essential conformity with the archetype, and hence Cuvier deduced the important principle of the "correlation of parts," of which he made such conspicuous use in palæontological reconstruction. Meanwhile the "natur-philosophen," with Goethe (1749–1832) and Oken (1779–1851), had in effect grasped the underlying principle of correlation, and so far anticipated evolution by asserting the possibility of deriving specialized from simpler structures. Though they were still hampered by idealistic conceptions, they established Morphology. Cuvier's four great groups were Vertebrata, Mollusca, Articulata, and Radiata. It was amongst the members of the last class that Huxley found most material ready to his hand in the seas of the tropics. It included organisms of the most varied kind, with nothing more in common than that their parts were more or less distributed round a centre. Huxley sent home "communication after communication to the Linnean Society," then a somewhat somnolent body, "with the same result as that obtained by Noah when he sent the raven out of the ark" (*Essays*, i. 13). His important paper, *On the Anatomy and the Affinities of the Family of Medusæ*, met with a better fate. It was communicated by the bishop of Norwich to the Royal Society, and printed by it in the *Philosophical Transactions* in 1849. Huxley united, with the Medusæ, the Hydroid and Sertularian polyps, to form a class to which he subsequently gave the name of Hydrozoa. This alone was no inconsiderable feat for a young surgeon who had only had the training of a medical school. But the ground on which it was done has led to far-reaching theoretical developments. Huxley realized that something more than superficial characters were necessary in determining the affinities of animal organisms. He found that all the members of the class consisted of two membranes enclosing a central cavity or stomach. This is characteristic of what are now called the Cœlenterata. All animals higher than these have been termed Cœlemeta; they possess a distinct body-cavity in addition to the stomach. Huxley went farther than this, and the most profound suggestion in his paper is the comparison of the two layers with those which appear in the germ of the higher animals. The consequences which have flowed from this prophetic generalization of the *ectoderm* and *endoderm* are familiar to every student of evolution. The conclusion was the more remarkable as at the time he was not merely free from any evolutionary belief, but actually rejected it. The value of Huxley's work was immediately recognized. On returning to England in 1850 he was elected a Fellow of the Royal Society. In the following year, at the age of 26, he not merely received the Royal medal, but was elected on the council. With absolutely no aid from any one he had placed himself in the front rank of English scientific men. He secured the friendship of Hooker and Tyndall, who remained his life-long friends. The Admiralty retained him as a nominal assistant-surgeon, in order that he might work up the observations he had made during the voyage of the *Rattlesnake*. He was thus enabled to produce various important memoirs, especially those on certain Ascidians, in which he solved the problem of *Appendicularia*—an organism whose place in the animal kingdom Johannes Müller had found himself wholly unable to assign—and on the morphology of the Cephalous Mollusca.

Owen, who was then the leading comparative anatomist in Great Britain, was a disciple of Cuvier, and adopted largely from him the deductive explanation of anatomical

fact from idealistic conceptions. He superadded the evolutionary theories of Oken, which were equally idealistic, but were altogether repugnant to Cuvier. Huxley would have none of either. Imbued with the methods of Von Baer and Johannes Müller, his methods were purely inductive. He would not hazard any statement beyond what the facts revealed. He retained, however, as has been done by his successors, the use of archetypes, though they no longer represented fundamental "ideas" but generalizations of the essential points of structure common to the individuals of each class. He had not wholly freed himself, however, from archetypal trammels. "The doctrine," he says, "that every natural group is organized after a definite archetype . . . seems to me as important for zoology as the doctrine of definite proportions for chemistry." This was in 1853. He further stated:—"There is no progression from a lower to a higher type, but merely a more or less complete evolution of one type" (*Phil. Trans.* 1853, 63). As Chalmers Mitchell points out, this statement is of great historical interest. Huxley definitely uses the word "evolution," and admits its existence *within* the great groups. He had not, however, rid himself of the notion that the archetype was a property inherent in the group. Herbert Spencer, whose acquaintance he made in 1852, was unable to convert him to evolution (*Life*, i. 168). He could not bring himself to acceptance of the theory—owing, no doubt, to his rooted aversion from *à priori* reasoning—without a mechanical conception of its mode of operation. In his first interview with Darwin, which seems to have been about the same time, he expressed his belief "in the sharpness of the lines of demarcation between natural groups," and was received with a humorous smile (*Life*, i. 169).

The naval medical service exists for practical purposes. It is not surprising, therefore, that after his three years' nominal employment Huxley was ordered on active service. Though without private means of any kind, he resigned. The navy, however, retains the credit of having started his scientific career as well as that of Hooker and Darwin. Huxley was now thrown on his own resources, the immediate prospects of which were slender enough. As a matter of fact, he had not to wait many months. His friend Edward Forbes was appointed to the chair of Natural History in Edinburgh, and in July 1854 he succeeded him as lecturer at the School of Mines and as naturalist to the Geological Survey in the following year. The latter post he hesitated at first to accept, as he "did not care for fossils" (*Essays*, i. 15). In 1855 he married Miss H. A. Heathorn, whose acquaintance he had made in Sydney. They were engaged when Huxley could offer nothing but the future promise of his ability. The confidence of his devoted helpmate was not misplaced, and her affection sustained him to the end, after she had seen him the recipient of every honour which English science could bestow. His most important research belonging to this period was the Croonian Lecture delivered before the Royal Society in 1858 on "The Theory of the Vertebrate Skull." In this he completely and finally demolished, by applying as before the inductive method, the idealistic, if in some degree evolutionary, views of its origin which Owen had derived from Goethe and Oken. This finally disposed of the "archetype," and may be said once for all to have liberated the English anatomical school from the deductive method.

In 1859 *The Origin of Species* was published. This was a momentous event in the history of science, and not least for Huxley. Hitherto he hrd turned a deaf ear to evolution. "I took my star," he says, "upon two grounds: firstly, that . . . the evidence in favour of transmutation was wholly insufficient; and secondly, that no suggestion respecting the causes of the transmutation assumed, which had been made, was in any way adequate to explain the phenomena" (*Life*, i. 168). Huxley had studied Lamarck "attentively," but to no purpose. Lyell "was the chief agent in smoothing the road for Darwin. For consistent uniformitarianism postulates evolution as much in the organic as in the inorganic world" (*l.c.*); and Huxley found in Darwin what he had failed to find in Lamarck, an intelligible hypothesis good enough as a working basis. Yet with the transparent candour which was characteristic of him, he never to the end of his life concealed the fact that he thought it wanting in rigorous proof. Darwin, however, was a naturalist; Huxley was not. He says:—"I am afraid there is very little of the genuine naturalist in me. I never collected anything, and species-work was always a burden to me; what I cared for was the architectural and engineering part of the business" (*Essays*, i. 7). But the solution of the problem of organic evolution must work upwards from the initial stages, and it is precisely for the study of these that "species-work" is necessary. Darwin, by observing the peculiarities in the distribution of the plants which he had collected in the Galapagos, was started on the path that led to his theory. Anatomical research had only so far led to transcendental hypothesis, though in Huxley's hands it had cleared the decks of that lumber. He quotes with approval Darwin's remark that "no one has a right to examine the question of species who has not minutely described many" (*Essays*, ii. 283). The rigorous proof which Huxley demanded was the production of species sterile to one another by selective breeding (*Life*, i. 193). But this was a misconception of the question. Sterility is a physiological character, and the specific differences which the theory undertook to account for are morphological; there is no necessary nexus between the two. Huxley, however, felt that he had at last a secure grip of evolution. He warned Darwin:—"I will stop at no point as long as clear reasoning will carry me farther" (*Life*, i. 172). Owen, who had some evolutionary tendencies, was at first favourably disposed to Darwin's theory, and even claimed that he had to some extent anticipated it in his own writings. But Darwin, though he did not thrust it into the foreground, never flinched from recognizing that man could not be excluded from his theory. "Light will be thrown on the origin of man and his history" (*Origin*, ed. i., 488). Owen could not face the wrath of fashionable orthodoxy. In his Rede Lecture he endeavoured to save the position by asserting that man was clearly marked off from all other animals by the anatomical structure of his brain. This was actually inconsistent with known facts, and was effectually refuted by Huxley in various papers and lectures, summed up in 1863 in *Man's Place in Nature*. This "monkey damnification" of mankind was too much even for the "veracity" of Carlyle, who is said to have never forgiven it. Huxley had not the smallest respect for authority as a basis for belief, scientific or otherwise. He held that scientific men were morally bound "to try all things and hold fast to that which is good" (*Life*, ii. 161). Called upon in 1862, in the absence of the president, to deliver the presidential address to the Geological Society, he disposed once for all of one of the principles accepted by geologists, that similar fossils in distinct regions indicated that the strata containing them were contemporary. All that could be concluded, he pointed out, was that the general order of succession was the same. In 1854 Huxley had refused the post of palæontologist to the Geological Survey; but the fossils for which he then said that he "did not care" soon acquired importance in his eyes as supplying evidence for the support of the

evolutionary theory. The thirty-one years during which he occupied the chair of Natural History at the School of Mines were largely occupied with palæontological research. Numerous memoirs on fossil fishes established many far-reaching morphological facts. The study of fossil reptiles led to his demonstrating, in the course of lectures delivered at the College of Surgeons in 1867, on birds, the fundamental affinity of the two groups which he united under the title of Sauropsida. An incidental result of the same course was his proposed rearrangement of the zoological regions into which Sclater had divided the world in 1857. Huxley anticipated, to a large extent, the results at which botanists have since arrived: he proposed as primary divisions, Arctogæa—to include the land areas of the northern hemisphere—and Notogæa for the remainder. Successive waves of life originated in and spread from the northern area, the survivors of the more ancient types finding successively a refuge in the south. Though Huxley had accepted the Darwinian theory as a working hypothesis, he never succeeded in firmly grasping it in detail. He thought "evolution might conceivably have taken place without the development of groups possessing the characters of species" (*Essays*, v. 41). His palæontological researches ultimately led him to dispense with Darwin. In 1892 he wrote:—"The doctrine of evolution is no speculation, but a generalization of certain facts . . . classed by biologists under the heads of Embryology and of Palæontology" (*Essays*, v. 42). Earlier in 1881 he had asserted even more emphatically that if the hypothesis of evolution "had not existed, the palæontologist would have had to invent it" (*Essays*, iv. 44).

From 1870 onwards he was more and more drawn away from scientific research by the claims of public duty. Some men yield the more readily to such demands, as their fulfilment is not unaccompanied by public esteem. But he felt, as he himself said of Priestley, "that he was a man and a citizen before he was a philosopher, and that the duties of the two former positions are at least as imperative as those of the latter" (*Essays*, iii. 13). From 1862 to 1884 he served on no less than ten Royal Commissions, dealing in every case with subjects of great importance, and in many with matters of the gravest moment to the community. He held and filled with invariable dignity and distinction more public positions than have perhaps ever fallen to the lot of a scientific man in England. From 1871 to 1880 he was a secretary of the Royal Society. From 1883 to 1885 he was president. For honours he cared little, though they were within his reach; it is said that he might have received a peerage. He accepted, however, in 1892, a Privy Councillorship, at once the most democratic and the most aristocratic honour accessible to an English citizen. In 1870 Huxley was president of the British Association at Liverpool, and in the same year was elected a member of the newly constituted London School Board. He resigned the latter position in 1872, but in the brief period during which he acted, probably more than any man, he left his mark on the foundations of national elementary education. He made war on the scholastic methods which wearied the mind in merely taxing the memory; the children were to be prepared to take their place worthily in the community. Physical training was the basis; domestic economy, at any rate for girls, was insisted upon, and for all some development of the æsthetic sense by means of drawing and singing. Reading, writing, and arithmetic were the indispensable tools for acquiring knowledge, and intellectual discipline was to be gained through the rudiments of physical science. He insisted on the teaching of the Bible partly as a great literary heritage, partly because he was "seriously perplexed to know by what practical measures the religious feeling, which is the essential basis of conduct, was to be kept up, in the present utterly chaotic state of opinion in these matters, without its use" (*Essays*, iii. 397). In 1872 the School of Mines was moved to South Kensington, and Huxley had, for the first time after eighteen years, those appliances for teaching beyond the lecture room, which to the lasting injury of the interests of the biological science of Great Britain had been withheld from him by the short-sightedness of Government. Huxley had only been able to bring his influence to bear upon his pupils by oral teaching, and had had no opportunity by personal intercourse in the laboratory of forming a school. He was now able to organize a system of instruction for classes of elementary teachers in the general principles of biology, which indirectly affected the teaching of the subject throughout the country.

The first symptoms of physical failure to meet the strain of the scientific and public duties demanded of him made some rest imperative, and he took a long holiday in Egypt. He still continued for some years to occupy himself mainly with vertebrate morphology. But he seemed to find more interest and the necessary mental stimulus to exertion in lectures, public addresses, and more or less controversial writings. His health, which had for a time been fairly restored, completely broke down again in 1885. In 1890 he removed from London to Eastbourne, where after a painful illness he died on 29th June 1895.

The latter years of Huxley's life were mainly occupied with contributions to periodical literature on subjects connected with philosophy and theology. The effect produced by these on popular opinion was profound. This was partly due to his position as a man of science, partly to his obvious earnestness and sincerity, but in the main to his strenuous and attractive method of exposition. Such studies were not wholly new to him, as they had more or less engaged his thoughts from his earliest days. That his views exhibit some process of development and are not wholly consistent was, therefore, to be expected, and for this reason it is not easy to summarize them as a connected body of teaching. They may be found perhaps in their most systematic form in the volume on *Hume* published in 1879.

Huxley's general attitude to the problems of theology and philosophy was technically that of scepticism. "I am," he wrote, "too much of a sceptic to deny the possibility of anything" (*Life*, ii. 127). "Doubt is a beneficent demon" (*Essays*, ix. 56). He was anxious, nevertheless, to avoid the accusation of Pyrrhonism (*Life*, ii. 280), but the Agnosticism which he defined to express his position in 1869 suggests the Pyrrhonist *Aphasia*. The only approach to certainty which he admitted lay in the order of nature. "The conception of the constancy of the order of nature has become the dominant idea of modern thought. . . . Whatever may be man's speculative doctrines, it is quite certain that every intelligent person guides his life and risks his fortune upon the belief that the order of nature is constant, and that the chain of natural causation is never broken." He adds, however, that "it by no means necessarily follows that we are justified in expanding this generalization into the infinite past" (*Essays*, iv. 47, 48). This was little more than a pious reservation, as evolution implies the principle of continuity (*l.c.* p. 55). Later he stated his belief even more absolutely: "If there is anything in the world which I do firmly believe in, it is the universal validity of the law of causation, but that universality cannot be proved by any amount of experience" (*Essays*, ix. 121). The assertion that "There is only one method by which intellectual truth can be reached, whether the subject-matter of investigation belongs to the world of physics or to the world of consciousness" (*Essays*, ix. 126) laid him open to the charge of materialism, which he vigorously repelled. His defence, when he rested it on the imperfection of the physical analysis of matter and force (*l.c.* p. 131), was irrelevant; he was on sounder ground when he contended with Berkeley "that our certain knowledge does not extend beyond our states of consciousness" (*l.c.* p. 130). "Legitimate materialism, that is, the extension of the conceptions and of the methods of physical science to the highest as well as to the lowest phenomena of vitality, is neither more nor less than a sort of shorthand idealism" (*Essays*, i. 194). While "the substance of matter is a metaphysical unknown quality of the existence of which there is no proof . . . the non-existence of a substance of

mind is equally arguable; . . the result . . . is the reduction of the All to co-existences and sequences of phenomena beneath and beyond which there is nothing cognoscible" (*Essays*, ix. 66). Hume had defined a miracle as a "violation of the laws of nature." Huxley refused to accept this. While, on the one hand, he insists that "the whole fabric of practical life is built upon our faith in its continuity" (*Hume*, p. 129), on the other "nobody can presume to say what the order of nature must be"; this "knocks the bottom out of all *à priori* objections either to ordinary 'miracles' or to the efficacy of prayer" (*Essays*, v. 133). "If by the term miracles we mean only extremely wonderful events, there can be no just ground for denying the possibility of their occurrence" (*Hume*, p. 134). Assuming the chemical elements to be aggregates of uniform primitive matter, he saw no more theoretical difficulty in water being turned into alcohol in the miracle at Cana, than in sugar undergoing a similar conversion (*Essays*, v. 81). The credibility of miracles with Huxley is a question of evidence. It may be remarked that a scientific explanation is destructive of the supernatural character of a miracle, and that the demand for evidence may be so framed as to preclude the credibility of any historical event. Throughout his life theology had a strong attraction, not without elements of repulsion, for Huxley. The circumstances of his early training, when Paley was the "most interesting Sunday reading allowed him when a boy" (*Life*, ii. 57), probably had something to do with both. In 1860 his beliefs were apparently theistic: "Science seems to me to teach in the highest and strongest manner the great truth which is embodied in the Christian conception of entire surrender to the will of God" (*Life*, i. 219). In 1885 he formulates "the perfect ideal of religion" in a passage which has become almost famous: "In the 8th century B.C., in the heart of a world of idolatrous polytheists, the Hebrew prophets put forth a conception of religion which appears to be as wonderful an inspiration of genius as the art of Pheidias or the science of Aristotle. 'And what doth the Lord require of thee, but to do justly, and to love mercy, and to walk humbly with thy God'" (*Essays*, iv. 161). Two years later he was writing: "That there is no evidence of the existence of such a being as the God of the theologians is true enough" (*Life*, ii. 162). He insisted, however, that "atheism is on purely philosophical grounds untenable" (*l.c.*). His theism never really advanced beyond the recognition of "the passionless impersonality of the unknown and unknowable, which science shows everywhere underlying the thin veil of phenomena" (*Life*, i. 239). In other respects his personal creed was a kind of scientific Calvinism. There is an interesting passage in an essay written in 1892, "An Apologetic Eirenicon," which has not been republished, which illustrates this: "It is the secret of the superiority of the best theological teachers to the majority of their opponents that they substantially recognize these realities of things, however strange the forms in which they clothe their conceptions. The doctrines of predestination, of original sin, of the innate depravity of man and the evil fate of the greater part of the race, of the primacy of Satan in this world, of the essential vileness of matter, of a malevolent Demiurgus subordinate to a benevolent Almighty, who has only lately revealed himself, faulty as they are, appear to me to be vastly nearer the truth than the 'liberal' popular illusions that babies are all born good, and that the example of a corrupt society is responsible for their failure to remain so; that it is given to everybody to reach the ethical ideal if he will only try; that all partial evil is universal good, and other optimistic figments, such as that which represents 'Providence' under the guise of a paternal philanthropist, and bids us believe that everything will come right (according to our notions) at last." But his "slender definite creed," R. H. Hutton, who was associated with him in the Metaphysical Society, thought—and no doubt rightly—in no respect "represented the cravings of his larger nature."

From 1880 onwards till the very end of his life, Huxley was continuously occupied in a controversial campaign against orthodox beliefs. As Professor Weldon justly says of his earlier polemics:—"They were certainly among the principal agents in winning a larger measure of toleration for the critical examination of fundamental beliefs, and for the free expression of honest reverent doubt." He threw Christianity overboard bodily and with little appreciation of its historic effect as a civilizing agency. He thought that "the exact nature of the teachings and the convictions of Jesus is extremely uncertain" (*Essays*, v. 348). "What we are usually pleased to call religion nowadays is, for the most part, Hellenized Judaism" (*Essays*, iv. 162). His final analysis of what "since the second century, has assumed to itself the title of Orthodox Christianity" is a "varying compound of some of the best and some of the worst elements of Paganism and Judaism, moulded in practice by the innate character of certain people of the Western world" (*Essays*, v. 142). He concludes "That this Christianity is doomed to fall is, to my mind, beyond a doubt; but its fall will neither be sudden nor speedy" (*l.c.*). He did not omit, however, to do justice to "the bright side of Christianity," and was deeply impressed with the life of Catherine of Siena. Failing Christianity, he thought that some other "hypostasis of men's hopes" will arise (*Essays*, v. 254). His latest speculations on ethical problems are perhaps the least satisfactory of his writings. In 1892 he wrote:—"The moral sense is a very complex affair—dependent in part upon associations of pleasure and pain, approbation and disapprobation, formed by education in early youth, but in part also on an innate sense of moral beauty and ugliness (how originated need not be discussed), which is possessed by some people in great strength, while some are totally devoid of it" (*Life*, ii. 305). This is an intuitional theory, and he compares the moral with the æsthetic sense, which he repeatedly declares to be intuitive; thus:—"All the understanding in the world will neither increase nor diminish the force of the intuition that this is beautiful and this is ugly" (*Essays*, ix. 80). In the Romanes Lecture delivered in 1894, in which this passage occurs, he defines "law and morals" to be "restraints upon the struggle for existence between men in society." It follows that "the ethical process is in opposition to the cosmic process," to which the struggle for existence belongs (*Essays*, ix. 31). Apparently he thought that the moral sense in its origin was intuitional and in its development utilitarian. "Morality commenced with society" (*Essays*, v. 52). The "ethical process" is the "gradual strengthening of the social bond" (*Essays*, ix. 35). "The cosmic process has no sort of relation to moral ends" (*l.c.* p. 83); "of moral purpose I see no trace in nature. That is an article of exclusive human manufacture" (*Life*, ii. 268). The cosmic process Huxley identified with evil, and the ethical process with good; the two are in necessary conflict. "The reality at the bottom of the doctrine of original sin" is the "innate tendency to self-assertion" inherited by man from the cosmic order (*Essays*, ix. 27). "The actions we call sinful are part and parcel of the struggle for existence" (*Life*, ii. 282). "The prospect of attaining untroubled happiness" is "an illusion" (*Essays*, ix. 44), and the cosmic process in the long run will get the best of the contest, and "resume its sway" when evolution enters on its downward course (*l.c.* p. 45). This approaches pure pessimism, and though in Huxley's view the "pessimism of Schopenhauer is a nightmare" (*Essays*, ix. 200), his own philosophy of life is not distinguishable, and is often expressed in the same language. The cosmic order is obviously non-moral (*Essays*, ix. 197). That it is, as has been said, immoral is really meaningless. Pain and suffering are affections which imply a complex nervous organization, and we are not justified in projecting them into nature external to ourselves. Darwin and Wallace disagreed with Huxley in seeing rather the joyous than the suffering side of nature. Nor can it be assumed that the descending scale of evolution will reproduce the ascent, or that man will ever be conscious of his doom.

As has been said, Huxley never thoroughly grasped the Darwinian principle. He thought "transmutation may take place without transition" (*Life*, i. 173). In other words, that evolution may be accomplished by leaps and not by the accumulation of small variations. He recognized that the "struggle for existence" had not the gradual adjustment of the organism to its environment which is implied in "natural selection." In highly civilized societies he thought that the former was at an end (*Essays*, ix. 36) and had been replaced by the "struggle for enjoyment" (*l.c.* p. 40). But a consideration of the stationary population of France might have shown him that the effect in the one case may be as restrictive as in the other. So far from natural selection being in abeyance under modern social conditions, "it is," as Professor Karl Pearson points out, "something we run up against at once, almost as soon as we examine a mortality table" (*Biometrika*, i. 76). The inevitable conclusion, whether we like it or not, is that the future evolution of humanity is as much a part of the cosmic process as its past history, and Huxley's attempt to shut the door on it cannot be maintained scientifically.

AUTHORITIES.—*Life and Letters of Thomas Henry Huxley*, by his son LEONARD HUXLEY, 2 vols. 1900.—*Scientific Memoirs of T. H. Huxley*, 4 vols. 1898–1901.—*Collected Essays* by T. H. HUXLEY, 9 vols. 1898.—*Thomas Henry Huxley, a Sketch of his Life and Work*, by P. CHALMERS MITCHELL, M.A. (Oxon.) 1900; a critical study founded on careful research and of great value.

(W. T. T.-D.)

Huy, a town of Belgium, in the province and 21 miles south-west of the town of Liége by rail. It is in the chief vine-growing district of the country, and the town does an important trade in wine and corn. Population (1900), 14,644.

Hwang Ho, or HOANG HO, the second largest river in China. It is known to foreigners as the Yellow river—a name which is a literal translation of the Chinese. It rises on the eastern slopes of the Kuen-lun mountains in Central

Asia, its head-waters being in close proximity to those of the Yangtse. It has a total length of about 2400 miles, and drains an area of approximately 400,000 square miles. The main stream has its source in two lakes named Charing-nor and Oring-nor, in 34° 60′ N. lat. and 98° E. long., and after flowing a south-easterly course it bends sharply to the north-west and north, entering China in the province of Kansu in lat. 36°. After passing Lanchau-fu, the capital of this province, the river takes an immense sweep to the north and north-east, until it encounters the rugged barrier ranges that here run north and south through the provinces of Shansi and Chihli. By these ranges it is bent back on its course and forced due south for 500 miles, forming the boundary between the provinces of Shansi and Shensi, until it finds an outlet eastwards at Tung Kwan—a pass which for centuries has been renowned as the gate of Asia, being indeed the sole commercial passage between central China and the West. At Tung Kwan the river is joined by its only considerable affluent in China proper, the Wei, which drains the whole of the large province of Shensi, and the combined volume of water continues its way nearly due east across the great plain to the sea. The quantity of water discharged varies very greatly at different times of the year. At low water in the winter season the discharge is only about 36,000 cubic feet per second, whereas during the summer flood it reaches 116,000 feet or more. The amount of sediment carried down is very large, though no accurate observations have been made. In the account of Lord Macartney's embassy, which crossed the Yellow river in 1792, it was calculated to be 17,520 million cubic feet a year, but this is considered to be very much over the mark. Two reasons, however, combine to render it probable that the sedimentary matter is very large in proportion to the volume of water: the first being the great fall, and the consequently rapid current over two-thirds of the river's course; the second that the drainage area is nearly all covered with deposits of loess, which, being very friable, readily gives way before the rainfall and is washed down in large quantity. The ubiquity of this loess or yellow earth, as the Chinese call it, has in fact given its name both to the river which carries it in solution and to the sea (the Yellow Sea) into which it is discharged. It is calculated by Dr Guppy (*Journal of China Branch of Royal Asiatic Society*, vol. xvi.) that the sediment brought down by the three northern rivers of China, viz., the Yangtse, the Yellow river, and the Peiho, is 24,000 million cubic feet per annum, and is sufficient to fill up the whole of the Yellow Sea and the Gulf of Pechili in the space of about 36,000 years.

Unlike the Yangtse, the Yellow river is of no practical value for navigation. The silt and sand form banks and bars at the mouth, the water is too shallow in winter and the current is too strong in summer, and, further, the bed of the river itself is continually shifting. It is this last feature which has given the Yellow river the notoriety it has unhappily obtained, and earned for it the name "China's sorrow." As the silt-laden waters debouch from the rocky bed of the upper reaches on to the plains, the current slackens, and the coarser detritus settles on the bottom. By degrees the bed rises, and the people build embankments to prevent the river from overflowing. As the bed rises the embankments must be raised too, until the stream is flowing many feet above the level of the surrounding country. As time goes on the situation becomes more and more dangerous; finally, a breach occurs, and the whole river pours over the country, carrying destruction and ruin in its wake. If the breach cannot be repaired the river leaves its old channel entirely, and finds a new exit to the sea along the line of least resistance. Such in brief has been the story of the Yellow river since the dawn of Chinese history. At various times it has discharged its waters alternately on one side or the other of the great mass of mountains forming the promontory of Shantung, and by mouths as far apart from each other as 500 miles. At each change it has worked havoc and disaster by covering the cultivated fields with two or three feet of sand and mud. Ruthless as it may seem, the river is only completing the geological task which nature has set it to do, viz., building up the great plain by adding a few feet here and there whenever it gets a chance. But the swarming inhabitants, driven from their homes for the time being, set to work to repair the disaster, and confine the giant river in its new course by new embankments. The waters dry up, the fields are again cultivated, until in the next cycle the like causes produce the like results.

The most recent great change in the river's course occurred in 1851, when a breach was made in the north embankment near Kaifungfu in Honan. At this point the river bed was some 25 feet above the plain; the water consequently forsook the old channel entirely and poured over the level country, finally seizing on the bed of a small river called the Tsing, and thereby finding an exit to the sea. Since that time the new channel thus carved out has remained the proper course of the river, the old or southerly channel being left quite dry. It required some fifteen or more years to repair damages from this outbreak, and to confine the stream by new embankments. After that there was for a time comparative immunity from inundations, but in 1882 fresh outbursts again began. The most serious of all took place in 1887, when it appeared probable that there would be again a permanent change in the river's course. By dint of great exertions, however, the Government succeeded in closing the breach, though not till January 1889, and not until there had been immense destruction of life and property. The outbreak on this occasion occurred, as all the more serious outbreaks have done, in Honan, a few miles west of the city of Kaifungfu. The stream poured itself over the level and fertile country to the southwards, sweeping whole villages before it, and converting the plain into one vast lake. The area affected was not less than 50,000 square miles, and the loss of life was computed at over one million. Since 1887 there have been a series of smaller outbreaks mostly at points lower down and in the neighbourhood of Tsinanfu, the capital of Shantung. These perpetually occurring disasters entail a heavy expense on the Government; and from the mere pecuniary point of view it would well repay them to call in the best foreign engineering skill available, an expedient, however, which has not yet recommended itself to the Chinese authorities. (G. J.)

Hybridism.—Professor Romanes represented contemporary opinion well by making his article on HYBRIDISM, in the ninth edition of this Encyclopædia, an annotated summary of Darwin's views. Darwin had shown that there was no foundation in nature for the supposed fixed law that hybrids were infertile. Some mongrels are infertile or sterile; some crosses are quite fertile; there are many curious phenomena connected with the susceptibility of the reproductive functions which make it probable that the common intersterility of species is an accidental result; as domestic animals must often have been chosen on account of a relative stability of their reproductive capacities, it is not surprising that domestic varieties should be fertile so frequently; there is no reason to suppose that natural hybridism has played any considerable part in the evolution of new species. Romanes afterwards developed his theory of *physiological selection*, in which he supposed that the appearance of differential fertility within a species was the starting-point of new species; certain individuals by becoming fertile only *inter se* proceeded along lines of modification diverging from the lines followed by the other members of the species, and thus mutual infertility was the starting-point, not the result, of specific modification. Romanes, however, did not associate his interesting theory with a sufficient number of facts, and it has left little mark in the development of the subject. A. R. Wallace, on the other hand, has argued that sterility between incipient species may have been increased by natural selection in the same fashion as other favourable variations are supposed to have been accumulated. He supposed that some "slight degree of infertility was a not infrequent accompaniment of the external differences which always arise in a state of nature between varieties and incipient species."

There are many new records as to the production of hybrids. Horticulturists have been extremely active and successful in their attempts to produce new flowers

or new varieties of vegetables by seminal or graft-hybrids, and any florist's catalogue or the account of any special plant, such as is to be found in Foster-Melliar's *Book of the Rose*, is in great part a history of successful hybridization. Much special experimental work has been done by botanists, notably by de Vries, to the result of whose experiments we shall recur. Experiments show clearly that the obtaining of hybrids is in many cases merely a matter of taking sufficient trouble, and the successful crossing of genera is not infrequent.

Focke, for instance, cites cases where hybrids were obtained between *Brassica* and *Raphanus*, *Galium* and *Asperula*, *Campanula* and *Phyteuma*, *Verbascum* and *Celsia*. Among animals, new records and new experiments are almost equally numerous. Boveri has crossed *Echinus microtuberculatus* with *Sphærechinus granularis*. Morgan even obtained hybrids between *Asterias*, a Starfish, and *Arbacia*, a Sea-urchin, a cross as remote as would be that between a fish and a mammal. Vernon got many hybrids by fertilizing the eggs of *Strongylocentrotus lividus* with the sperm of *Sphærechinus granularis*. Standfuss has carried on an enormous series of experiments with Lepidopterous insects, and has obtained a very large series of hybrids, of which he has kept careful record. Lepidopterists generally begin to suspect that many curious forms offered by dealers as new species are products got by crossing known species. Apellö has succeeded with Teleostean fish; Gebhardt and others with Amphibia. Elliot and Suchetet have studied carefully the question of hybridization occurring normally among birds, and have got together a very large body of evidence. Among the cases cited by Elliot the most striking are that of the hybrid between *Colaptes cafer* and *C. auratus*, which occurs over a very wide area of North America and is known as *C. hybridus*, and the hybrid between *Euplocamus lineatus* and *E. horsfieldi*, which appears to be common in Assam. Among Mammals the most noteworthy results have been obtained by Professor Cossar Ewart, who has bred nine zebra hybrids by crossing mares of various sizes with a zebra stallion, and who has studied in addition three hybrids out of zebra mares, one sired by a donkey, the others by ponies.

The causes militating against the production of hybrids have also received considerable attention. Delage, discussing the question, states that there is a general proportion between sexual attraction and zoological affinity, and in many cases hybrids are not naturally produced simply from absence of the stimulus to sexual mating, or because of preferential mating within the species or variety. In addition to differences of habit, temperament, time of maturity, and so forth, gross structural differences may make mating impossible. Thus Escherick contends that among insects the peculiar structure of the genital appendages makes cross-impregnation impossible, and there is reason to believe that the specific peculiarities of the modified sexual palps in male spiders have a similar result.

The difficulties, however, may not exist, or may be overcome by experiment, and frequently it is only careful management that is required to produce crossing. Thus it has been found that when the pollen of one species does not succeed in fertilizing the ovules of another species, yet the reciprocal cross may be successful; that is to say, the pollen of the second species may fertilize the ovules of the first. Vernon, working with Sea-urchins, found that the obtaining of hybrids depended on the relative maturity of the sexual products. The difficulties in crossing apparently may extend to the chemiotaxic processes of the actual sexual cells. Thus when the spermatozoa of an Urchin were placed in a drop of sea-water containing ripe eggs of an Urchin and of a Starfish, the former eggs became surrounded by clusters of the male cells, while the latter appeared to exert little attraction for the alien germ-cells. Finally, when the actual impregnation of the egg is possible naturally, or has been secured by artificial means, the development of the hybrid may stop at an early stage. Thus hybrids between the Urchin and the Starfish, animals belonging to different classes, reached only the stage of the pluteus larva. Apellö, experimenting with Teleostean fish, found that very often impregnation and segmentation occurred, but that the development broke down immediately afterwards. Gebhardt, crossing *Rana esculenta* with *R. arvalis*, found that the cleavage of the ovum was normal, but that abnormality began with the gastrula, and that development soon stopped. In a very general fashion there appears to be a parallel between the zoological affinity and the extent to which the incomplete development of the hybrid proceeds.

As to the sterility of hybrids *inter se*, or with either of the parent forms, information is still wanted. Delage, summing up the evidence in a general way, states that mongrels are more fertile and stronger than their parents, while hybrids are at least equally hardy but less fertile. While many of the hybrid products of horticulturists are certainly infertile, others appear to be indefinitely fertile.

Focke, it is true, states that the hybrids between *Primula auricula* and *P. hirsuta* are fertile for many generations, but not indefinitely so; but, while this may be true for the particular case, there seems no reason to doubt that many plant hybrids are quite fertile. In the case of animals the evidence is rather against fertility. Standfuss, who has made experiments lasting over many years, and who has dealt with many genera of Lepidoptera, obtained no fertile hybrid females, although he found that hybrid males paired readily and successfully with pure-bred females of the parent races. Elliot, dealing with birds, concluded that no hybrids were fertile with one another beyond the second generation, but thought that they were fertile with members of the parent races. Wallace, on the other hand, cites from Quatrefages the case of hybrids between the moths *Bombyx cynthia* and *B. arrindia*, which were stated to be fertile *inter se* for eight generations. He also states that hybrids between the sheep and goat have a limited fertility *inter se*. Cornevin and Lesbre state that in 1873 an Arab mule was fertilized in Africa by a stallion, and gave birth to female offspring which she suckled. All three were brought to the Jardin d'Acclimatation in Paris, and there the mule had a second female colt to the same father, and subsequently two male colts in succession to an ass and to a stallion. The female progeny were fertilized, but their offspring were feeble and died at birth. Cossar Ewart gives an account of a recent Indian case in which a female mule gave birth to a male colt. He points out, however, that many mistakes have been made about the breeding of hybrids, and is not altogether inclined to accept this supposed case. Very little has been published with regard to the most important question, as to the actual condition of the sexual organs and cells in hybrids. There does not appear to be gross anatomical defect to account for the infertility of hybrids, but microscopical examination in a large number of cases is wanted. Cossar Ewart, to whom indeed much of the most interesting recent work on hybrids is due, states that in male zebra-hybrids the sexual cells were immature, the tails of the spermatozoa being much shorter than those of the similar cells in stallions and zebras. He adds, however, that the male hybrids he examined were young, and might not have been sexually mature. He examined microscopically the ovary of a female zebra-hybrid and found one large and several small Graafian follicles, in all respects similar to those in a normal mare or female zebra. A careful study of the sexual organs in animal and plant hybrids is very much to be desired, but it may be said that so far as our present knowledge goes there is not to be expected any obvious microscopical cause of the relative infertility of hybrids.

The relative variability of hybrids has received considerable attention from many writers. Horticulturists, as Bateson has written, are "aware of the great and striking variations which occur in so many orders of plants when hybridization is effected." The phrase has been used "breaking the constitution of a plant" to indicate the effect produced in the offspring of a hybrid union, and the device is frequently used by those who are seeking for novelties to introduce on the market. It may be said generally that hybrids are variable, and that the products of hybrids are still more variable. Delage states that in reciprocal crosses there is always a marked tendency for the offspring to resemble the male parents; he quotes from Huxley that the mule, whose male parent is an ass, is more like the ass, and that the hinny, whose male parent is a horse, is more like the horse. Standfuss found among Lepidoptera that males were produced much more often than females, and that these males paired readily. The freshly-hatched larvæ closely resembled the larvæ of the female parent, but in the course of growth the resemblance to the male increased, the extent of the final approximation to the male depending on the relative phylogenetic age of the two parents, the parent of the older species being prepotent. In reciprocal pairing, he found that the male was able to transmit the characters of the parent in a higher degree. Cossar Ewart, in

relation to zebra hybrids, has discussed the matter of resemblance to parents in very great detail, and fuller information must be sought in his writings. He shows that the wild parent is not necessarily prepotent, although many writers have urged that view. He described three hybrids bred out of a zebra mare by different horses, and found in all cases that the resemblance to the male or horse parent was more profound. Similarly, zebra-donkey hybrids out of zebra mares bred in France and in Australia were in characters and disposition far more like the donkey parents. The results which he obtained in the hybrids which he bred from a zebra stallion and different mothers were more variable, but there was rather a balance in favour of zebra disposition and against zebra shape and marking.

"Of the nine zebra-horse hybrids I have bred," he says, "only two in their make and disposition take decidedly after the wild parent. As explained fully below, all the hybrids differ profoundly in the plan of their markings from the zebra, while in their ground colour they take after their respective dams or the ancestors of their dams far more than after the zebra—the hybrid out of the yellow and white Iceland pony, *e.g.*, instead of being light in colour, as I anticipated, is for the most part of a dark dun colour, with but indistinct stripes. The hoofs, mane, and tail of the hybrids are at the most intermediate, but this is perhaps partly owing to reversion towards the ancestors of these respective dams. In their disposition and habits they all undoubtedly agree more with the wild sire."

Ewart's experiments and his discussion of them also throw important light on the general relation of hybrids to their parents. He found that the colouration and pattern of his zebra hybrids resembled far more those of the Somali or Grévy's zebra than those of their sire —a Burchell's zebra. In a general discussion of the stripings of horses, asses, and zebras, he came to the conclusion that the Somali zebra represented the older type, and that therefore his zebra hybrids furnished important evidence of the effect of crossing in producing reversion to ancestral type. The same subject has of course been discussed at length by Darwin, in relation to the cross-breeding of varieties of pigeons.

Other writers, in particular Weismann, Bateson, and de Vries, have discussed the phenomena of hybridism for their bearing on the general questions of inheritance, and of the nature of characters and of variations. Gaertner and Naegeli had declared that the farther apart the parents, the more definite and intermediate the hybrids; the nearer the parents, the more variable the hybrids. Weismann concludes, from examination of a series of plant hybrids, that, from the same cross, hybrids of different character may be obtained, but that the characters are determined at the moment of fertilization; for he found that all the flowers on the same hybrid plant resembled one another in the minutest details of colour and pattern. Bateson approaches the subject chiefly as a means of studying the nature of variations, and has found a series of important pieces of evidence that variations of large magnitude (discontinuous variation) are produced by hybridization. He cites in this connexion the cases of narcissus, begonia, pelargonium, gladiolus, streptocarpus, a great number of orchids, rhododendron, cineraria, and others. Miss Saunders, working in association with him, has found three important cases of discontinuity in hybrid offspring. Bateson urges forcibly the necessity of detailed observation and experiment in this direction, and particularly insists on the necessity of rearing and noting the characters of all the seedlings obtained from hybridization. Horticulturists for the most part have been content to pick out the most striking forms and to keep no record of the others. De Vries has obtained results of very great interest, and has formulated from them what he calls the "Law of disjunction of hybrids." He supposes specific characters to be distinct units (or composed of distinct units), and finds the best mode of studying them in cases where species are distinguished by a single character. Hybrids are described vaguely as mingling the characters of father and mother. What really happens, he thinks, is that they have in a simple form some of the characters of each. When father and mother are distinguished by one character, this cannot happen; such a *monohybrid* never shows the character of one parent (absent in the other) in a reduced form; it possesses it, or it does not possess it. He found on sowing seeds of monohybrids that always about 25 per cent. of the seedlings showed one character (the latent, or recessive character), while 75 showed the other (dominant character). On sowing the seeds of these latter, self-fertilized and kept separate in plots, 25 of them gave the dominant character pure, the others were mixed in the proportion of 37·5 with the dominant to 12·5 with the recessive character. Thus he crossed poppies with a black spot on base of petals (B) with poppies with a white spot (W). On sowing the seeds of these hybrids 75 per cent. were B (dominant) and 25 were W (latent). On sowing the seeds of the 75 B's, 25 gave pure B's, while the others gave mixed results in the proportion of 37·5 B to 12·5 W. The second sowing was needed to distinguish among the 75 B's the 25 which, like the 25 W's, were not hybrids, but had inherited similarly from father and mother. He thinks that all hybrids when studied with reference to single characters will give similar results. The interesting experiments and conclusions of de Vries appear to be strictly derivative from older work published by Gregor Mendel in 1865. The law of the disjunction of unit characters in hybrids, including the distinction between *dominant* and *recessive*, and the numerical distribution of these, must be called Mendel's Law. Much experimental work is required to elaborate it, but it appears to be a fundamental principle of biology, and it is a curious circumstance that such a principle, as striking as the law of combining proportions in chemistry, should have remained unnoticed for so many years after it had been clearly formulated and supported by abundant experimental evidence.

AUTHORITIES.—APELLÖ. "Ueber einige Resultate der Kreuzbefruchtung bei Knochenfischen," *Bergens Mus. Aarbog*, 1894.—BATESON. "Hybridization and Cross-breeding," *Journal of the Royal Horticultural Society*. 1900.—BOVERI. Article "Befruchtung," in *Ergebnisse der Anatomie und Entwickelungeschichte von Merkel und Bonnet*, i. pp. 385–485.—CORNEVIN et LESBRE. "Étude sur un hybride issu d'une mule féconde et d'un cheval," *Rev. Sci.* li. p. 144.—DELAGE. *La Structure du Protoplasma et les théories sur l'Hérédité*. 1895 (with a literature).—DE VRIES. "The Law of Disjunction of Hybrids," *Comptes Rendus*, p. 845, 1900.—ELLIOT. *Hybridism*.—ESCHERICK. "Die biologische Bedeutung der Genitalabhänge der Insecten," *Verh. z. B. Wien*, xlii. p. 225.—EWART. *The Penycuik Experiments*. 1899.—FOCKE. *Die Pflanzen-Mischlinge*. 1881.—FOSTER-MELLIAR. *The Book of the Rose*. 1894.—GEBHARDT. "Ueber die Bastardirung von Rana esculenta mit R. arvalis." *Inaug. Dissert.* Breslau, 1894.—G. MENDEL. "Versuche über Pflanzen-Hybriden." *Verh. Natur. Vereins in Brünn*, 1865, pp. 1–52.—MORGAN. "Experimental Studies," *Anat. Anz.*, 1893, p. 141; *id.*, p. 803.—ROMANES. "Physiological Selection," *Jour. Linn. Soc.* xix. p. 337.—SAUNDERS. *Proc. Roy. Soc.*, 1897, lxii. p. 11.—STANDFUSS. "Études de Zoologie expérimentale," *Arch. Sci. Nat.* vi. p. 495.—SUCHETET. "Les Oiseaux hybrides rencontrés à l'état sauvage," *Mem. Soc. Zool.* v. pp. 253–525, and vi. pp. 26–45.—VERNON. "The Relation between the Hybrid and Parent Forms of Echinoid Larvæ," *Proc. Roy. Soc.* lxv. p. 350.—WALLACE. *Darwinism*. 1889.—WEISMANN. *The Germ-Plasm*. 1893.

(P. C. M.)

Hyde, a municipal borough (1881), railway station, and market town, in the Hyde parliamentary division of Cheshire, England, 4 miles north-east of Stockport. Recent erections include the town-hall (1885), the public baths (1887), new technical school and free library (1899), and new post office (1900). Area, 3072 acres. Population (1881), 28,630; (1901), 32,768.

Hyde Park, a town of Norfolk county, Massachusetts, U.S.A. It lies immediately south-west of Boston, of which it is a residential suburb, on the New England and the New York, New Haven and Hartford Railways. Population (1880), 7088; (1890), 10,193; (1900), 13,244, of whom 3805 were foreign-born and 116 were negroes.

Hydraulic Power. See Power Transmission (*Hydraulic*).

Hydrophobia.—Two new points of interest have arisen in connexion with this rare disease. One is the Pasteur treatment by inoculation with rabic virus, and the other was the attempt of the Government to exterminate rabies in the British Isles by muzzling dogs. The Pasteur treatment was first applied to human beings in 1885 after prolonged investigation and experimental trial on animals. It is based on the fact that a virus, capable of giving rabies by inoculation, can be extracted from the tissues of a rabid animal and then intensified or attenuated at pleasure. It appears that the strength of the rabic virus, as determined by inoculation, is constant in the same species of animal, but is modified by passing through another species. For instance, the natural virus of dogs is always of the same strength, but when inoculated into monkeys it becomes weakened, and the process of attenuation can be carried on by passing the virus through a succession of monkeys, until it loses the power of causing death. If this weakened virus is then passed back through guinea-pigs, dogs, or rabbits, it regains its former strength. Again, if it be passed through a succession of dogs it becomes intensified up to a maximum of strength, which is called the *virus fixe*. Pasteur further discovered that the strength can be modified by temperature and by keeping the dried tissues of a rabid animal containing the virus. Thus, if the spinal cord of a rabid dog be preserved in a dry state, the virus loses strength day by day. The system of treatment consists in making an emulsion of the cord and graduating the strength of the dose by using a succession of cords, which have been kept for a progressively diminishing length of time. Those which have been kept for fourteen days are used as a starting-point, yielding virus of a minimum strength. They are followed by preparations of diminishing age and increasing strength, day by day, up to the maximum, which is three days old. These are successively injected into the circulatory system. The principle is the artificial acquisition by the patient of resistance to the rabic virus, which is presumed to be already in the system, but has not yet become active, by accustoming him gradually to its toxic effect, beginning with a weak form and progressively increasing the dose. It is not exactly treatment of the disease, because it is useless or nearly so when the disease has commenced, nor is it exactly preventive, for the patient has already been bitten. It must be regarded as a kind of anticipatory cure. The cords are cut into sections and preserved dry in sterilized flasks plugged with cotton-wool. Another method of preparing the inoculatory virus, which has been devised by Tizzani and Centanni, consists in subjecting the *virus fixe* to peptic digestion by diluted gastric juice for varying periods of time.

The first patient was treated by Pasteur's system in July 1885. He was successively inoculated with emulsions made from cords that had been kept fourteen and ten days, then eleven and eight days, then eight, seven, six days, and so on. Two forms of treatment are now used—(1) the "simple," in which the course from weak to strong virus is extended over nine days; (2) the "intensive," in which the maximum is reached in seven days. The latter is used in cases of very bad bites and those of some standing, in which it is desirable to lose no time. Two days are compressed into one at the commencement by making injections morning and evening instead of once a day, so that the fifth-day cord is reached in four days instead of six, as in the "simple" treatment. When the maximum—the third-day cord—is reached the injections are continued with fifth-, fourth-, and third-day cords. The whole course is fifteen days in the simple treatment and twenty-one in the intensive. The doses injected range from 1 to 3 cubic centimetres. Injections are made alternately into the right and left flanks. The number treated in each year since 1885, with the mortality, is given in the following table:—

Year.	Patients Treated.	Deaths.	Mortality per cent.
1886	2671	25	·94
1887	1770	14	·79
1888	1622	9	·55
1889	1830	7	·38
1890	1540	5	·32
1891	1559	4	·25
1892	1790	4	·22
1893	1648	6	·36
1894	1387	7	·50
1895	1520	5	·33
1896	1308	4	·30
1897	1521	6	·39
1898	1465	3	·20
1899	1614	4	·25

These figures do not include cases which develop hydrophobia during treatment or within fifteen days after treatment is completed, for it is held that persons who die within that period have their nervous centres invaded by virus before the cure has time to act. The true mortality should therefore be considerably higher. For instance, in 1898 three deaths came within this category, which just doubles the mortality; and in 1899 the additional deaths were six, bringing the mortality up to two and a half times that indicated in the table. When, however, the additional deaths are included the results remain sufficiently striking, if two assumptions are granted—(1) that all the persons treated have been bitten by rabid animals; (2) that a large proportion of persons so bitten usually have hydrophobia. Unfortunately, both these assumptions lack proof, and therefore the evidence of the efficacy of the treatment cannot be said to satisfy a strictly scientific standard. With regard to the first point, the patients are divided into three categories—(1) those bitten by an animal the rabidity of which is proved by the development of rabies in other animals bitten by it or inoculated from its spinal cord; (2) those bitten by an animal pronounced rabid on a veterinary examination; (3) those bitten by an animal suspected of being rabid. The number of patients in each category in 1898 was (1) 141, (2) 855, (3) 469; and in 1899 it was (1) 152, (2) 1099, (3) 363. As might be expected, the vast majority come under the second and third heads, in which the evidence of rabidity is doubtful or altogether lacking. With regard to the second point, the proportion of persons bitten by rabid animals who ordinarily develop hydrophobia has only been "estimated" from very inadequate data; but if the number of rabid dogs be compared with the deaths from hydrophobia in any year or series of years, it can hardly be very high. For instance, in 1895, 668 dogs, besides other animals, were killed and certified to be rabid in England, and the deaths from hydrophobia were twenty. Of course this proves nothing, as the number of persons bitten is not known, but the difference between the amount of rabies and of hydrophobia is suggestively great in view of

the marked propensity of rabid dogs to bite, nor is it accounted for by the fact that some of the persons bitten were treated at the Institut Pasteur. A comparison of the annual mortality from hydrophobia in France before and after the introduction of the treatment would afford decisive evidence as to its efficacy; but unfortunately no such comparison can be made for lack of vital statistics in that country. The experience of the Paris hospitals, however, points to a decided diminution of mortality. On the whole it must be said, in the absence of further data, that while the Pasteur treatment probably diminishes the danger of hydrophobia from the bites of rabid animals, the extent to which it does so is at present uncertain.

Some attempt has been made to argue that the treatment is itself dangerous, and that persons have died from it, not from the bites they had received. Colour was given to the suggestion by the case of a man named O'Leary, who was bitten in the right leg by a dog at Lahore on 22nd August 1898. He was treated at the Institut Pasteur from 12th September to 26th October, and died of hydrophobia in India on 22nd November. The dog could not be traced, but it bit another dog which remained quite well; and the inference was drawn that the first dog was not rabid at all. The facts are not sufficiently explicit to warrant the conclusion that the man died from the effects of the treatment; and even if he did, it is clear, from the very large number of persons treated year by year with good results, that any risk there may be is very small. More recently treatment with an anti-rabic serum has been suggested.

The attempt to stamp out rabies in Great Britain was an experiment undertaken by the Government in the public interest. The principal means adopted were the muzzling of dogs in infected areas, and prolonged quarantine for imported animals. The efficacy of dog-muzzling in checking the spread of rabies and diminishing its prevalence has been repeatedly proved in various countries. It is probable that all carnivorous animals are subject to rabies, and its occurrence in wolves, cats, and foxes is common. Horses, cows, sheep, pigs, and deer have also been known to take it, but in England at least the dog is preëminently the vehicle of contagion and the great source of danger to human beings. There is a difference of opinion on the way in which muzzling acts, though there can be none as to the effect it produces in reducing rabies. Probably it acts rather by securing the destruction of ownerless and stray—which generally includes rabid—dogs than by preventing biting; for though it may prevent snapping, even the wire-cage muzzle does not prevent furious dogs from biting, and it is healthy, not rabid, dogs that wear the muzzle. It has therefore been suggested that a collar would have the same effect, if all collarless dogs were seized; but the evidence goes to show that it has not, perhaps because rabid dogs are more likely to stray from home with their collars, which are constantly worn, than with muzzles which are not, and so escape seizure. Moreover, it is much easier for the police to see whether a dog is wearing a muzzle or not than it is to make sure about the collar. However this may be, the muzzle has proved more efficacious, but it was not applied systematically in England until a late date. Sometimes the regulations were in the hands of the Government, and sometimes they were left to local authorities; in either case they were allowed to lapse as soon as rabies had died down. In April 1897 the Board of Agriculture entered on a systematic attempt to exterminate rabies by the means indicated. The plan was to enforce muzzling over large areas in which the disease existed, and to maintain it for six months after the occurrence of the last case. In spite of much opposition and criticism, this was resolutely carried out, and met with great success. By the spring of 1899—that is, in two years—the disease had disappeared in Great Britain, except for one area in Wales; and with this exception, muzzling was everywhere relaxed in October 1899. It was taken off in Wales also in the following May, no case having occurred since November 1899. Rabies was then pronounced extinct. During the summer of 1900, however, it reappeared in Wales, and several counties were again placed under the order. In December 1901 the United Kingdom was declared free from rabies, and all restrictions, save quarantine for dogs imported from abroad, were removed. According to the Government theory, the disease should never reappear, but the hope is hardly justified by present knowledge. The history of rabies shows that it is endemic in Britain and other populous countries, while in some it is wholly unknown, and that from time to time it assumes epidemic proportions and then dies down again quite independently of muzzling or any such measure. Judging by analogy, we should rather regard it as a disease which is spread by contagion, but does not depend for its existence on contagion, as it may remain latent, becoming active periodically under favourable conditions. The assumption that it exists only in the persons of rabid dogs is highly improbable, and cannot be accepted on the evidence available. We may expect, therefore, that it will reappear from time to time with greater or less diffusive force, but that the measures adopted will be efficacious in checking its spread and keeping it down to insignificant proportions when it does appear. In other words, experience justifies the hope that hydrophobia may be abolished in Great Britain, whether rabies is "stamped out" or not.

See *Annales de l'Institut Pasteur*, 1886–1900; *Journal of the Board of Agriculture*, 1899.—MAKINS, "Hydrophobia," in Treves's *System of Surgery*.—WOODHEAD, "Rabies," in Allbutt's *System of Medicine*.

Hyères, a winter health resort, arrondissement of Toulon, department of Var, France, 11 miles east of Toulon by rail. Numerous villas have been erected in recent years on the beach, about two miles from the town. Port Pothuau, so named in 1881, is the port of the Salins d'Hyères. The salins yield annually about 20,000 tons of salt. Flowers and fruits are extensively cultivated for the London and Paris markets, and cork-cutting is a considerable industry. Strawberries alone are said to be exported to the value of £20,000 annually. In 1899, 209 vessels of 27,741 tons entered and cleared from Port Pothuau, almost entirely engaged in coasting trade. Population (1881), 5918; (1891), 8292; (1901), 17,659.

Hygiene.—The science of practical hygiene aims at "rendering growth more perfect, decay less rapid, life more vigorous, death more remote." The subject involves an acquaintance with such diverse sciences as physics, chemistry, geology, engineering, architecture, meteorology, epidemiology, bacteriology, and statistics. To these may be added the study of the law or those legal enactments which concern the sanitary well-being of the community. In this article it is proposed to refer only to the more important questions in respect to which recent scientific research has led to a better conception of the cause of diseases and methods for their prevention.

The influence of different kinds of soil as a factor in the production of disease requires to be considered, in regard not only to the nature and number of the micro-organisms they contain, but also to the amount of moisture and air in them and their capacity for heat. The moisture in soil is derived from two sources—the rain and the ground water. Above the level of the ground water the soil is kept moist

by capillary attraction and by evaporation of the water below, by rainfall and by movements of the ground water; on the other hand, the upper layers are constantly losing moisture by evaporation from the surface and through vegetation. When the ground water rises it forces air out of the soil; when it falls again it leaves the soil moist and full of air. The nature of the soil will largely influence the amount of moisture which it will take up or retain. In regard to water all soils have two actions, namely, permeability and absorbability. Permeability is practically identical with the speed at which percolation takes place; through clay it is slow, but increases in rapidity through marls, loams, limestones, chalks, coarse gravels, and fine sands, reaching a maximum in soil saturated with moisture. The amount of moisture retained depends mainly upon the absorbability of the soil, and as it depends largely on capillary action, it varies with the coarseness or fineness of the pores of the soil, being greater for soils which consist of fine particles. The results of many analyses show that the capacity of soils for moisture increases with the amount of organic substances present: decomposition appears to be most active when the moisture is about 4 per cent., but can continue when it is as low as 2 per cent., while it appears to be retarded by any excess over 4 per cent. Above the level of the ground water all soils contain air, varying in amount with the degree of looseness of the soil. Some sands contain as much as 50 per cent. of air of nearly the same composition as atmospheric air. The oxygen, however, decreases with the depth, while the carbon dioxide increases.

Soil and disease.

Among the most noteworthy workers at the problems involved in the question of the influence of soil in the production of disease, we find von Foder, Pettenkofer, Levy, Fleck, von Naegeli, Schleesing, Muntz, and Warrington. The study of epidemic and endemic diseases generally has brought to light an array of facts which very strongly suggest that an intimate association exists between the soil and the appearance and propagation of certain diseases; but although experiments and observations allow this view to be looked upon as well established, still the precise *rôle* played by the soil in an ætiological respect is by no means so well understood as to make it possible to separate the factors and dogmatize on their effects. The earliest writers upon cholera emphasized its remarkable preference for particular places; and the history of each successive epidemic implies, besides an importation of the contagion, certain local conditions which may be either general sanitary defects or peculiarities of climate and soil. The general evidence indicates that the specific bacteria of cholera discharges are capable of a much longer existence in the superficial soil layers than has hitherto been supposed; consequently, it is specially necessary to guard against pollution of the soil, and through it against the probable contamination of both water and air. The evidence, however, is not sufficiently strong to warrant a universal conclusion, the diffusion of cholera appearing to be largely dependent upon other factors than soil states. Again, all accounts of diphtheria show a tendency on the part of the disease to recur in the same districts year after year. The questions naturally suggest themselves—Are the reappearances due to a revival of the contagion derived from previous outbreaks in the same place, or to some favouring condition which the place offers for the development of infection derived from some other quarter; and have favouring conditions any dependence upon the character and state of the soil? Greenhow in 1858 stated that diphtheria was especially prevalent on cold, wet soils; and Airy in 1881 describes the localities affected as "for the most part cold, wet clay lands." An analysis of the innumerable outbreaks in various parts of Europe indicates that the geological features of the affected districts play a less important part in the incidence of the disease than soil dampness. In this connexion it is interesting to note the behaviour of the diphtheritic contagion in soil. We have no actual proof that the bacillus is either an ordinary or an occasional resident of the soil, or that it becomes air-borne in sewer-gas or soil emanations. But experiments show that pure cultures, when mixed with garden soil constantly moistened short of saturation, and kept in the dark at a temperature of 14° C., will retain their vitality for more than ten months; from moist soil kept at 26° C. they die out in about two months; from moist soil at 30° C., in seventeen days; and in dry soil at the same temperature, within a week. In the laboratory absolute soil dryness is as distinctly antagonistic to the vitality of the diphtheria bacillus as soil dampness is favourable. Both statistically and experimentally we find that a damp soil favours its life and development, while prolonged submersion and drought kill it. We may consider that, in country districts, constant soil moisture is one of the chief factors; while in the case of urban outbreaks mere soil moisture is subsidiary to other more potent causes.

Again, many facts in the occurrence and diffusion of enteric fever point to an intimate connexion between its origin and certain conditions of locality. Epidemics rarely spread over any considerable tract of country, but are nearly always confined within local limits. Observations made at the most diverse parts of the globe, and the general distribution area of the disease, show that mere questions of elevation or even configuration of the ground have little or no influence. On the other hand, the same observations go to show that the disease is met with oftener on the more recent formations than the older, and this fact, so far as concerns the physical characters of the soil, is identical with the questions of permeability to air and water. Robertson has shown that the typhoid bacillus can grow very easily in certain soils, can persist in soils through the winter months, and when the soil is artificially fed, as may be done by a leaky drain, or by access of filthy water from the surface, the micro-organism will take on a fresh growth in the warm season. The destructive power of sunlight is only exercised on those organisms actually at the surface. Cultures of the typhoid organism planted at a depth of 18 inches were found to have grown to the surface. In the winter months the deeper layers of the soil act as a shelter to the organism, which again grows towards the surface during the summer. The typhoid organism was not found to be taken off from the decomposing masses of semi-liquid filth largely contaminated with a culture of *bacillus typhosus;* but, on the other hand, it was abundantly proved that it could grow over moist surfaces of stones, &c. Certain disease-producing organisms, such as the bacillus of tetanus and malignant œdema, appear to be universally distributed in soil, while others, as the *bacillus typhosus* and *spirillum choleræ*, appear to have only a local distribution. The conditions which favour the vitality, growth, and multiplication of the typhoid bacillus are the following:—The soil should be pervious; it should be permeated with a sufficiency of decaying—preferably animal—organic matters; it should possess a certain amount of moisture, and be subject to a certain temperature. Depriving the organism of any of these essential conditions for its existence in the soil will secure our best weapon for defence. The optimum temperature adapted to its growth and extension is 37° C. = 98°·4 F. Sir Charles Cameron attributes the prevalence of typhoid in certain areas in Dublin to the soil becoming saturated with fæcal matter and specifically infected. The ratio of cases to population living in Dublin on loose porous gravel soil for the ten years 1881–91 was 1 in 94, while that of those living on stiff clay soil was but 1 in 145. "This is as we should expect, since the movements of ground air are much greater in loose porous soils than in stiff clay soils." A foul gravel soil is a most dangerous one on which to build. For warmth, for dryness, for absence of fog, and for facility of walking after rain, just when the air is at its purest and its best, there is nothing equal to gravel; but when gravel has been rendered foul by infiltration with organic matters it may easily become a very hot-bed of disease.

Sewage.

The first practical attempt to purify sewage by a biological process was made by Scott Moncrieff in Great Britain in 1891. The State Board of Health of Massachusetts had previously made a series of experiments upon downward filtration, which showed that the same process that occurred in soils could be carried on in artificial filters. The biological treatment of sewage may be conveniently divided into two stages: (1) the breaking down or liquefying of the organic matter; (2) the nitrifying of the results of the first stage. The changes produced in these stages are effected by means of micro-organisms existing either in the sewage to be treated or in its surroundings. Both aërobic and anaërobic organisms share in the work of breaking down the organic matter, but the former alone are capable of producing nitrification. Scott Moncrieff's system consists of allowing the sewage to enter from below a tank, filled with stones, sufficiently slowly to be acted upon by the anaërobic organisms which form dense colonies in the nidus formed by the stones: the result being that the solid organic matter is liquefied, and a liquid free from suspended matters passes on. The nitrifying chamber is filled with a series of trays containing filtering media, placed one above the other,

with intervening spaces of a few inches between them. The liquid passes slowly downwards through the various trays, meeting under favourable conditions aërobic micro-organisms, and finally passes away to the stream or outfall.

In the "Sutton" system the sewage, after rough straining, is run on to coarse-grain filter beds of burnt ballast, the outlet of each of which is closed in turn and the bed rapidly filled up; the sewage is allowed to remain for about an hour, when it is quickly drawn off and passed on to fine-grain filters as a second or completing stage. The object of the coarse-grain filter bed is to admit the particles of suspended matter contained in the crude sewage into the interior of the bed, where they are subjected to the action of the anaerobic organisms. If the first bed were made of fine material the suspended matter would collect on the surface and have to be dealt with at frequent intervals, and in this case the problem of sludge disposal would again arise. The size of filter material which Dibden has found most suitable is, in the case of a coarse bed, that which will pass through a two-inch ring and be totally rejected by a screen having a half-inch mesh; and, for a fine bed, that which will pass a screen of three-eighths or quarter-inch mesh, and be rejected by one having a mesh of one-sixteenth of an inch.

The "septic tank-system" was devised by Cameron of Exeter in 1896. It consists in providing (1) a closed chamber or tank through which the sewage passes and in which the organic matters in the sewage are brought into solution by anaërobic organisms, and (2) a series of filters worked on the "Sutton" principle, *i.e.*, filling, remaining full, emptying, and resting. The septic tank is constructed to hold about one day's average flow, so that the sewage takes twenty-four hours to pass through it. The flow through the tank is continuous, and the effluent passes off at the same level as the sewage passes in, *i.e.*, to a depth of about 5 feet below the surface. The object is to avoid disturbance of the scum which forms on the surface of the fluid in the tank, and also to prevent the passage of air with the sewage and the reflux of gases from the tank into the sewers. The deposit which forms on the bottom of the tank consists of road grit, together with the insoluble residue from the decomposition of the sewage solids, and is made up of about 8 per cent. of mineral matter, 4 per cent. of organic matter, and 88 per cent. water. The clear water, which forms between the scum on the surface and the deposit at the bottom of the tank, passes out through a cast-iron pipe fifteen inches below the surface of the scum to distributing wells. In these wells valves are placed which control the flow to the distributing channels on the surface of the filters. Each filter is filled to a depth of 4½ feet with crushed furnace clinker resting on 6 inches of coarse gravel. The filters are filled and discharged automatically by means of alternating gear. The bacteriology of the septic-tank process has been investigated by Sims Woodhead, who found that the crude sewage contained the largest number of anaërobic organisms; fluorescing and gas-producing varieties were also numerous. In the septic tank the number of anaërobic organisms did not appear to increase, but the varieties which rapidly liquefied gelatine were found in greater numbers than in crude sewage. In the tank effluent and the filtrate from the beds the number of liquefying anaërobic organisms was found to have fallen considerably. As regards aërobic organisms, the liquefying varieties were in greatest number in the crude sewage and tank contents. Non-liquefying organisms were also present in greater numbers than after the sewage had passed the filters. The organisms in the filter beds are chiefly aërobic, but the anaërobic species which have made their way from the septic tank are undoubtedly present, ready to commence work whenever the conditions become favourable. This system gives excellent results and has already been largely adopted.

At Manchester very successful experiments have been made with an *open septic tank and double filtration* in bacterial filter beds. Raw sewage is allowed to run from the main sewer through a large open tank. "The contents of the tank soon became black, and bubbles of gas began to rise, often accompanied by masses of sludge from the bottom, on still days forming a scum, which gradually completely covered the surface of the liquid." The gas evolved was found to be largely composed of marsh gas, showing that resolution of organic matter was taking place. Nine months after the open tank was placed in operation a flow of 2,500,000 gallons was allowed to pass through in twenty-four hours. About the same time garbage collected from the mechanical screens at the entrance to the works was tipped into the tanks, and a gradual disintegration of the garbage ensued. The effluent from the open septic tank is then treated by double contact on bacteria beds. In every case the effluent from the second filter bed was found non-putrescible.

An important point in connexion with the biological process is that, by the adoption of it, sludge may be looked upon as a practically negligible quantity. The small amount of road grit and other mineral matter mixed up with sewage can easily be eliminated by ordinary grit chambers provided in front of the installation. It may safely be said that the average results by the biological treatment are quite as good as those given by well-managed sewage farms, while the best results are far beyond them.

Water filtration.

Boiling is perhaps the oldest method in practice for the purification of water. The objection to this procedure is that the dissolved gases are driven off, and unless the water is again aërated during the process of cooling it will be found flat and insipid to taste. Special sterilizers have been introduced in order to overcome this difficulty. The best machines are those invented by Desmaroux, Maiche, and Waterhouse-Forbes. In all these machines there is the same principle—an exchange heater by means of which the incoming cold water receives heat from the outgoing hot water, and in this way the fuel required to raise the water to the required temperature is much lessened and the effluent from the machine is almost as cold as the supply.

In Desmaroux's machine the water retains its gases and is quite cool at the exit. The machine is arranged to work at any temperature between 100° C and 120° C. The requisite head to cause the water to pass through the apparatus is obtained by means of a pump, when pressure from a public supply is not available. Maiche's apparatus is also provided with a boiler, exchange heater, and pressure regulators. The water is heated to 109° C. for four minutes, and is delivered from the exchange heater as cool sterile water ready for use. The apparatus delivers about 22 gallons per hour at an expenditure of 6 cubic feet of gas. In the Waterhouse-Forbes sterilizer the water is only boiled for a few seconds, and it is claimed for it that the dissolved gases are not driven off. An apparatus weighing 25 ℔ is capable of delivering 5 gallons of sterilized water per hour. Careful experiments showed that when rich emulsions of *B. coli* or *B. prodigenus* were passed through these machines not a single organism could be detected in the sterilized water.

The addition of bromine to water has been suggested by Dr Pehlumberg. Experiments have proved that 0·06 gramme of bromine per litre, after five minutes' exposure, will render most surface waters safe for drinking purposes. The colour and taste of the bromine are readily removed after the five minutes' treatment by adding 0·095 gramme of sodium hyposulphite and 0·04 gramme of anhydrous sodium carbonate to each litre of water.

Peiftee was the first to show that sand alone could not remove micro-organisms from water. Filters made of sterilized sand were found actually to increase the number of bacteria during the first few days of working, but with the formation of a slimy layer on the surface and in the body of the filter bed the true filtering action commenced. This slimy layer, to which the greatest importance is now attached, consists of zoogloea of bacteria, combined with suspended materials in the water. It is very friable and readily broken up by excessive pressure on the surface or disturbance of the body of the filter beds. Hence the extreme care now taken to fill the filter beds from below, so as to prevent the zoogloea masses from being broken up by the pressure of the air and to control the rate of filtration and limit the pressure of water on the surface. The degree of fineness of the sand grains is also of importance in securing a good filtrate. Hence the work of a filter bed is partly mechanical and partly vital. By the growth of bacteria in the bed, food material is used up and the products of bacterial life are eliminated, so that the growth of bacteria through the filter is arrested. But a sand filter will not arrest all the micro-organisms contained in a water applied to the surface, nor can it give absolute protection against water-borne disease: if the rate of filtration is properly controlled it can give such a protection that in practice we have every reason to be satisfied with it (Koch). Reservoirs to store filtered water should always be covered, so as to avoid contamination with dust, &c.

The sterilization of water by ozone has been proposed by Ohmuller, Suidal, and other workers. In 1898 Marinier and Abraham devised an apparatus for the treatment on a large scale of water supplied to the town of Lille. When the water is treated with ozone, equal to 6 mgms. per litre of air, all pathogenic and saprophytic microbes are destroyed. The ozone treatment increases the aëration of the water and diminishes the organic matter: the nitrates are unaffected. Weyl of Berlin has also reported very favourably on the ozone treatment established at the waterworks at Charlottenburg: the results obtained were the same as those met with when water is purified by careful sand filtration.

The principal methods for effecting the preservation of foods are by (a) drying, (b) smoking, (c) salting, (d) sugar and vinegar, (e) exclusion of air, (f) cold, (g) mineral or organic antiseptics. The preservation of milk is exceedingly difficult, because the liquid is particularly liable to infection by hardy germs. Even when yielded by a healthy cow, the milk on issuing from the udder is already infested with bacteria. When milking is ended, a small quantity of milk is left behind in the lacteal ducts, and in it there settle a number of bacteria, which, making their way from the outside, are favoured by a high temperature and become incorporated with the subsequent flow of milk. In addition to these there are innumerable bacteria originating in the dung and adhering to the udder. The air in the cowhouse is laden with germs, and yields up no small quantities of these to the milk. The germs present in freshly-drawn milk increase very rapidly during transit to the centres of consumption, as also during storage in milk-shops. The reproduction can be moderated by cold, but not arrested, because milk contains several species of bacteria capable of developing at 0° C. Diseased cows yield milk containing pathogenic organisms. Martin shows that 1 in every 13 samples of milk exposed for sale in Paris contained tubercle bacilli, and Dr Schroeder in Washington found that 1 in every 19 samples contained a sufficient number to produce infection. Milk also is often the carrier of the specific organisms of typhoid, cholera, scarlet fever, and foot-and-mouth disease.

Food preservatives.

Milk.—By treating milk to a temperature of 60° C. for one hour, 70° C. for ten minutes, and 95° C. for one minute, tubercle bacilli, if present, will certainly be killed. Cholera and typhoid organisms are less resistant, and are killed more quickly than tubercle bacilli at the above temperatures. Only a single pathogenic species can withstand the short boiling to which milk is ordinarily treated in domestic management, and this is the anthrax bacillus containing spores. The danger from this source is remote, as the microbe does not form spores within the animal body. Even in the worst cases, therefore, only vegetable forms, easily destroyed by boiling, can find their way into the milk from the body of the cow.

The lactic acid bacillus, always present in unboiled milk (to which the souring of milk is due), is easily destroyed by heat; but the *bacillus mesentericus*, often found in it, forms spores, which are not destroyed by ordinary boiling, and germinate when the milk is kept at a moderately warm temperature, producing a brisk fermentation whereby a large volume of gas is liberated. The fundamental idea of Soxhlet's method for sterilizing milk is to boil it for forty minutes in small bottles holding just enough for one meal, and closing the same with an impervious stopper, which is only removed just before use. Milk so treated will keep at the ordinary room temperature, as the spores of the *B. mesentericus* do not develop below 15° C.; but if it be introduced into the alimentary canal of a child the spores will rapidly multiply, and in such cases large quantities of gas, giving rise to flatulency, will be formed, and possibly also poisonous decomposition products of albuminoid matter. To render milk sterile in the strict sense of the word it is necessary to raise it to a temperature of about 120° C. for twenty minutes. Under these conditions the lactose decomposes into dark-brown fission products, the fat loses its emulsified condition and separates out as cream which cannot be made to diffuse again even by shaking, and the albuminoids are converted into a form very difficult of digestion.

In short, there is at the present time the greatest difficulty in freeing milk on a large scale from germs without at the same time seriously prejudicing its flavour and nutritive value. Since, then, the destruction of the hardy germs is so difficult, the greater care should be taken, by washing the udder, hands, and milk vessels, to secure extreme cleanliness in the preparation of milk intended for infant consumption. Sterilization then becomes an easier task, the milk drawn under these conditions being very poor in spore-forming bacteria. It is imperative that cream destined for butter-making should be free from pathogenic organisms. The organisms of cholera, typhoid fever, and tuberculosis present in butter retain their vitality for a long time. As butter is consumed in the raw state, a trustworthy preliminary treatment of the cream is in the highest degree desirable. Schuppan has shown that it is possible to produce good butter from Pasteurized or even sterilized cream, and Weigmann introduced the plan of artificially souring cream by means of pure cultures of *B. acidi lactici.* Boracic acid, salicylic acid, and even benzoic acid have been used as milk preservatives. The influence of small doses of boracic acid is still *sub judice;* it is hardly possible for so much as three or four grains a day to produce any deleterious effect. One objection to allowing boracic acid to be added to milk is that it enables the milkman to palm off stale milk as fresh. It would seem advisable to prohibit chemical preservatives altogether. In condensed milk many of the bacteria present are killed by the preliminary heating and the subsequent concentration at 50° to 60° C. A few survive and are still alive in the finished product, but not in a condition to do any damage, since the high concentration plasmolyses the germs, retarding their development and so preventing decomposition.

Meat.—In the preservation of meat we know that the blood and flesh of healthy animals are entirely free from bacteria, but, on the other hand, the contents of the digestive tract are extremely rich in microbes. If the carcase of a slaughtered animal be left without being disembowelled, these saprophytes will make their way through the capillary vessels of the intestinal wall into the general blood-system, so that the entire carcase quickly begins to undergo decomposition. This can be prevented by the excision of the entire length of the alimentary canal; and if this be practised the remaining flesh will be perfectly free from fungi. Any subsequent danger can only be due to gradual penetration from the surface. Since these sources of bacterial infection cannot be entirely cut off, attempts are made to prevent the increase of these parasites in the flesh. The oldest known remedy is cold, but the temperature must be kept several degrees below zero (C.). The freezing of meat does not kill the germs present, but only hinders their development. If the meat be not stored at low temperatures, but merely put in the ice-chest, whereby it only attains a temperature of 0° C., an increase of germs ensues. These cold-supporting organisms produce the disagreeable taste and smell acquired by edibles remaining in the ice-chest for a few days. Actual putrefaction is not produced by these bacteria. Food-stuffs should not be brought into actual contact with natural ice, since this substance contains not only putrefactive organisms, but also under certain conditions pathogenic organisms. Frozen meat when thawed undergoes rapid decomposition, because the cellular tissue is loosened by freezing, and access to the interior is facilitated for any organisms present on the surface.

In dried and salted meat the development and activity of the organisms can be prevented by depriving them of the water necessary for metabolism. In salting and pickling, it is only the hygroscopic power of the salt which comes into play; the germs are plasmolysed and so their activity is prevented. Tubercle bacilli are not killed by a concentrated solution of salt after two months' and typhoid bacilli after three months' action. Smoking forms a more certain means of preserving meat, the active agents being the vapours of phenol, creosote, &c., present in the smoke. These antiseptics do not penetrate far into the flesh, therefore smoking can only preserve the fresh meat taken from healthy animals.

Disinfection.

Disinfection by means of sulphur dioxide is now looked upon as quite inefficient, even when used in large amount, and has given place to formaldehyde, which is regarded as a powerful germicide. Schlossman states that there are two chief methods of carrying out this disinfection. In Trillat's method an attempt is made to prevent the formation of polymers of formaldehyde by adding calcium chloride, whereas in Schering's apparatus para-formaldehyde is converted into gas, and this is again changed into formaldehyde by means of the water produced by the burning of a certain amount of spirit. The probability is that in both methods the greatest part of the formaldehyde escaping into the air is converted into polymers. In the method introduced by Schlossman and Wallten polymerization is prevented by the use of glycerine.

Lingun has constructed an apparatus consisting of a vessel in which the water is boiled. The steam rises into a reservoir which contains 4 per cent. of formaldehyde and 10 per cent. of glycerine. From the reservoir four pipes pass into the room. A room with a cubic capacity of 2000 cubic feet is filled with vapour in ten minutes. All microbes are destroyed in three hours at the latest. The advantages claimed by Schlossman are: (1) Sterilization is absolute; (2) the closure of all cracks and clefts is not necessary; (3) the procedure requires only three hours; (4) there is no danger of explosions; (5) the method is cheap; (6) the glycoformal vapour is heavier than air, and therefore sinks; (7) the total disinfecting powers of the gas are obtained. The windows are thrown open for half an hour after the disinfection. Liquor ammonia is placed in the room in an amount proportional to the formaldehyde used. The windows are again opened, and thus all smell is got rid of. With Schering's method it has been found that rapid volatilization

is necessary to prevent the polymerization of the greater part of the formaldehyde vapour. Five tablets per 100 cubic feet appear to destroy anthrax cultures containing spores when smeared on linen and exposed in the room: pieces of linen soaked in broth cultures of *B. diphtheriæ* and *B. typhosus* were rendered sterile when five tablets in 100 cubic feet were rapidly converted into formaldehyde vapours by the heat and moisture derived from a large flame of Schering's lamp.

Quarantine. The first suggestion of an international conference on quarantine was made by the French Government in 1838, but so diverse were the views held on the subject, and its enforcement at stations and ports on the Mediterranean was so capricious, that various difficulties arose and the proposals fell through. In 1843 the British Government suggested a further conference; but this again was opposed as premature, since there was no foundation on which to base any regulations which would be acceptable to the Powers. In 1849–50 the wave of cholera which passed over Europe brought the subject again under notice, and a conference assembled in Paris in 1851 to consider the question of quarantine in relation to cholera, yellow fever, and plague, the only diseases for which this means of prevention was to be employed. The results were unsatisfactory; there was little unity of opinion, and no system of international control was possible in the circumstances. It rested with the chief medical officer of the Privy Council (Sir John Simon, K.C.B.) to raise the question of international control, and it was chiefly owing to the strong expression of his opinion that a scientific inquiry began, which ultimately led step by step to the almost total abolition of quarantine not only in Great Britain, but in countries under international control. Writing in 1865, Sir John Simon said, "There are two kinds of precautions which may be used against quarantine: first, if possible, to prevent the entrance of the contagion; secondly, if the contagion be present, to annihilate as far as possible the circumstances which favour its spread. Subject to one qualification, which is not an important one for the present argument, it may, I think, be accepted as certain that quarantine, conducted with extreme rigour and with the precision of a chemical experiment, will keep cholera out of every part of Europe in which the extremely difficult conditions can be absolutely fulfilled; and thus, if I speak to the dry question of medical practice, I have no hesitation in saying that England ought to resist cholera by quarantine. On the other hand, though I cannot pretend to discuss with any kind of authority the non-medical aspects of the question, it would be mere pedantry for me to ignore that facts which are of common notoriety and considerations which are of common sense conflict with that medical conclusion. A quarantine which is ineffective is a mere irrational derangement of commerce, and a quarantine which ensures success is more easily imagined than realized. Only in proportion as a community lives apart from the great highways and emporia of commerce, or is ready and able to treat its commerce as a subordinate political interest, only in such proportion can quarantine be made effectual for preventing it. In proportion as these circumstances are reversed, it becomes impossible to reduce to practice the paper plausibilities of quarantine. The conditions which have to be fulfilled are conditions of natural seclusion, and fulfilment of such conditions by England would involve fundamental changes in the most established habits of the country."

The next international conference was held in Constantinople in 1866. This conference came to the conclusion that cholera had always its origin in India, and that its extension followed the lines of human intercourse. They were of opinion that quarantine was capable of arresting the disease. There should be quarantine of observation and quarantine of rigour. Strict quarantine was to be applied to all ships from an infected port with a foul bill of health, as well as to any vessel which had cases on board during the voyage, although provided with a clean bill of health. The term fixed was ten days from the time of entering any port, to recommence if any case occurred thereafter. Quarantine of observation was to consist of keeping isolated and under observation for an indefinite time—to be fixed by the local authority—a vessel with crew and passengers, with free ventilation but no disinfection. Strict quarantine was defined as isolation for a fixed time of a ship and persons on board, with disinfection of all that might contain the germs of disease. The whole of the cargo was to be landed and the passengers disembarked at a lazaret. In 1873, so far as cholera was concerned, quarantine was officially abandoned by order of the Local Government Board. In 1874 an international sanitary conference was held at Vienna, the object being to arrange among the Powers interested compulsory regulations having for their object to bring about a perfect uniformity in the measures to be adopted against the common danger. This conference was the first which in any form gave sanction to the principle of medical inspection taking the place of quarantine. France was the only one of the Great Powers that still adhered to quarantine. The conference reaffirmed the decision as to the place of origin and transmission of cholera arrived at in Constantinople. Another international conference was held in Rome in 1885. In the matter of disinfection it was for the first time distinctly laid down that it is not necessary to consider articles as infected merely because they came from a country where cholera prevailed; that only persons or articles that have been actually soiled by choleraic discharges, and articles that have been worn by persons suffering from cholera, ought to be subjected to such a process; and that, in the case of individuals, disinfection by means of baths ought alone to be resorted to, fumigation being thus incidentally condemned as useless. But in the conclusions of this conference medical inspection finds no place, except in so far as this term may stand for a formal preliminary (1) to a detention of twenty-four hours in cases where the sea voyage has lasted less than ten days, and (2) to the imposition of quarantine detention varying from three to six days on sick and healthy alike. An international sanitary conference met again at Venice in 1892. It dealt solely with the question of cholera. It was convened to consider the regulations then existing relative to transit in quarantine by the Suez Canal. The delegates were asked to notify what modifications should be introduced into the constitution of the Sanitary Council of Marine and Quarantine of Egypt, and generally the constitution of that council.

There has always been a considerable divergence between the view held by medical authorities and accepted by public opinion in England and in India, and that prevailing on the Continent, as to the efficacy of quarantine against the contagion of cholera and some other infective diseases. The tendency of British opinion throughout this long controversy has been to look to measures of sanitary improvement as the best prophylactic against cholera, and to rely on the application of quarantine for that purpose only to a very small degree, whereas on the Continent the belief in quarantine, though apparently diminishing, retains still much of its actual force. The conclusions of the Venice conference briefly were as follows. Instead of a prescribed five days' detention of *all* passengers, other than those sick of cholera, at Moses Wells, in the case of vessels without a doctor or a disinfecting stove on board, the detention will vary according to a sliding scale from forty-eight hours to five days. In case of a vessel carrying a doctor and a disinfecting stove, it is the doctor on board who is to decide what person or persons are to be landed, on the ground that they are suffering from cholera. Thus there is a guarantee against British subjects suffering from dysentery being landed compulsorily. If any landing of a limited number of such passengers or crew does take place, it will only occur when it is necessary for the purpose of disinfecting a portion of the vessel. Even then there is an alternative of removal to a vessel moored alongside, and any such removal is for a limited number of hours only, after which the persons in the vessel have a right to return to the ship. Thus no compulsory landing of any healthy persons can take place. It will be seen that the Venice conference only dealt with the transmission of cholera *by sea* into Europe.

A conference was held in Dresden in 1893 to complete, so to speak, the work of the previous conference. It was convened to consider (1) the precautions to be adopted *on land* and *sea ports* against cholera, (2) the special conditions affecting the Danube, and (3) the organization of the board of health at Tehran; but these last two points were apparently not raised or discussed. The convention provided a minimum and a maximum precaution. The minimum is obligatory. It corresponds closely with the provisions of the cholera regulations in Great Britain. Practically the only difference is that the medical supervision of persons landing from an "infected" ship is in Great Britain carried out at their own homes, whereas under the convention such persons are to be detained for a period not exceeding five days from the date of the last case on board. By the Dresden convention no ship will be

detained in any port where there is a hospital for the sick, and all other persons are, if possible, to be disembarked. The maximum of precautions laid down by the convention constitutes a limit which no state may exceed. The most important difference between minimum and maximum occurs in the treatment of healthy ships coming from cholera-infected ports. Such ships are always to receive immediate *pratique*. As a minimum of precaution, bilge- and drinking-water must be evacuated, and persons landed from such ships may be subjected to medical supervision at home without any detention. With regard to disinfection also, there is a difference between the minimum and maximum in the case of infected ships, the minimum being that part of the ship actually contaminated shall be disinfected; the maximum, that the whole ship may be disinfected. Under the convention all goods are freed from restrictions, except fresh rags and things believed to be "contaminated," *i.e.*, fouled with cholera matters. The measures to be applied to land frontiers are analogous to those for seaports, with the important exception that only those persons suffering from cholera may be detained on land frontiers. The greater precaution taken in seaports than on land frontiers was due to the opinion that risk of infection on board ship is far greater than in a train. If a case of cholera occurred in a train, the healthy would leave the carriage at the next station, or would even stop the train, and therefore would be exposed to the risk of infection for a very short time only. The conclusions adopted by this conference embody the principle of notification of cholera, and aim at preventing certain unreasonable measures of restriction against countries in which cholera has appeared.

The next international conference was convened under the auspices of the French Government at Paris in 1894, with a view of devising measures for preventing the spread of cholera by way of the Red Sea and the Persian Gulf. At Venice in 1892, and at Dresden in 1893, sanitary conventions were concluded to the effect that precautions must be taken on the accepted basis that cholera is communicated by human agency and on lines of human intercourse. The Paris conference really began where the two previous ones left off. The first point discussed was as to the necessity of requiring a medical inspection of all persons on board a pilgrim ship before embarkation. The conference was assured that this was strictly carried out by Great Britain and British India not only as to cholera, but as to all infectious diseases, and the proposal of the requirement was unanimously accepted. A second proposal related to the disinfection of all articles deemed "contaminées" or "suspect" in accordance with the Venice convention; and, subject to the understanding that the medical officer of health of the port was to be the judge as to what articles came under these definitions, the proposition was carried. A third proposal forbidding the embarkation of any passengers deemed to be infected or suspected of being so was also unanimously agreed to. At a full meeting of the conference the heads were arrived at:—(1) Sanitary police at the ports of departure; (2) Measures to be adopted on board pilgrim ships; (3) Sanitary surveillance over pilgrimages in the Red Sea; (4) Surveillance over the pilgrims going by land to Mecca and Medina. In this, as in all previous conferences, vessels were classified as follows: (*a*) "indemnes"; (*b*) "suspects"; (*c*) "infectés." "Navires indemnes" are those ships in which no case of cholera has existed before starting or during the voyage. These receive immediate *pratique* whatever their bill of health may be. "Navires suspects" are those in which any case of cholera has arisen within seven days. These receive medical visits, and are subjected to disinfection, &c., and there is a recommendation (1) as to maintaining the passengers under observation for five days from the date of leaving the port of departure; and (2) as to preventing the landing of the crew except in case of necessity. "Navires infectés" are those in which any case of cholera has arisen within seven days before arrival. The sick and remainder of the passengers are obliged to disembark and to undergo detention under observation for a period of five days at the outside, to date from the occurrence of the last case of cholera. Disinfection of clothing is also compulsory.

In 1897 an international conference assembled at Venice. This was in connexion with the outbreak of plague in the East, and the conference met to settle on an international basis the steps to be taken to prevent, if possible, its spread into Europe. One of the first points to be dealt with was to settle the incubation period for this disease, and the period to be adopted for administrative purposes. It was admitted that the incubation period was, as a rule, a comparatively short one, namely, of some three or four days. After much discussion ten days was accepted by a very large majority. The principle of notification was unanimously adopted. Each Government is to notify to other Governments the existence of plague within their several jurisdictions, and at the same time state the measures of prevention which are being carried out to prevent its diffusion. The area deemed to be infected is limited to the actual district or village where the disease prevails, and no locality is deemed to be infected merely because of the importation into it of a few cases of plague while there has been no diffusion of the malady. As regards the precautions to be taken on land frontiers, it was decided that during the prevalence of plague every country had the inherent right to close its land frontiers against traffic. As regards the Red Sea, it was decided after discussion that a healthy vessel may pass through the Suez Canal, and continue its voyage in the Mediterranean during the period of incubation of the disease the prevention of which is in question. It was also agreed that vessels passing through the Canal in quarantine might, subject to the use of the electric light, coal in quarantine at Port Said by night as well as by day, and that passengers might embark in quarantine at that port. Infected vessels, if these carry a doctor and are provided with a disinfecting stove, have a right to navigate the Canal in quarantine, subject only to the landing of those who are suffering from plague, and of such persons as have been in actual contact with the sick or with infected articles, together with the disinfection of the infected compartment of the vessel. Passing on to the conclusions dealing with regulations to be imposed "in Europe," the following are the chief points to be noted:—As regards measures to be adopted at ports of arrival, the conclusions of the Dresden convention were as far as practicable adhered to. In the case of healthy vessels, *i.e.*, those on board of which there is no illness, though they have sailed from an infected port, it was decided that they should at once have free *pratique*, but at the option of the local authority certain measures of disinfection of soiled articles may be required. For suspected vessels, viz., those on board of which there has been plague, but no fresh case within twelve days, some limited processes of disinfection, &c., as defined, having been complied with, it is recommended that the crew and passengers should be subject to surveillance for a period of ten days from the date of the arrival of the vessel. In the case of infected vessels, viz., those on which plague is actually present, or on which that disease has occurred ten days before arrival, the sick are to be landed and isolated, and the remainder of those on board are to be subjected, at the discretion of the local authority, to "observation" or "surveillance" for a period not exceeding ten days from the date of the occurrence of the last case of plague. In this convention the terms "observation" and "surveillance" are for the first time clearly defined; the definition as to the latter stating that under that system passengers are not to be isolated, but are to be allowed at once to proceed to their homes, where they can remain under medical supervision so long as may be deemed necessary by the local authority. The results of this conference indicated a great advance on the part of the nationalities represented towards a liberal and truly scientific conception of the means to be adopted by their respective Governments for the prevention and control of infective diseases. (J. L. N.)

Conference of 1897.

Hypnotism.—Under the name of hypnotism a remarkable revival of what used to be called mesmerism or animal magnetism has taken place. It began in France about 1880, and has attracted much scientific and popular interest. It is a common experience that when the attention of persons is for the first time drawn to a thing, they are apt to regard what is new to themselves as altogether new. This has conspicuously happened in regard to hypnotism. Extravagant claims of novelty and utility have been made on its behalf, but

there is really nothing new either in the phenomena or in the hopes founded on them. All that has been added to previous experience is the investigation of certain aspects of the subject in a somewhat more systematic manner and in the light of somewhat fuller knowledge. This has resulted in establishing the reality of the main phenomena on a firm basis of accurate observation, but no substantial advance has been made in the explanation of their nature or in their application to medical practice. Any belief to the contrary is founded on ignorance of what has been done in the past. In order to make clear the precise value of the recent revival, a brief historical retrospect is necessary. (See also MAGNETISM, ANIMAL, *Ency. Brit.* vol. xv.)

In a sense the phenomena of hypnotism have probably been known from time immemorial. They appear to form part of certain traditional practices of great antiquity in the East, and traces of them may be found in classical and mediæval times, but they were first brought forward in a systematic way by Friedrich Anton Mesmer, a Viennese physician who flourished in the latter half of the 18th century. He stumbled across them accidentally in the year 1774, while treating a young woman for hysteria by the application of metal plates. In 1778 he came to Paris, where he soon attracted attention and acquired a vogue which his professional colleagues could not forgive and have not to this day forgiven. No doubt he practised in a highly theatrical and unorthodox manner, and made a great deal of money by doing so, but he did not profess to cure everything, as some modern hypnotists do, and expressly disclaimed any value for his treatment in organic disease. The methods of producing the mesmeric "crisis" were essentially the same as those used to-day for putting persons into the hypnotic state, namely, various ways of fixing the visual and mental attention. "His usual method was to seat himself opposite the patient with knees touching, the patient regarding him fixedly." The effects were also essentially the same—trance, somnambulism, subordination of the will, and impressibility. Mesmer called it animal magnetism, and formulated an elaborate theory on the subject, but most of his propositions are fantastic and unintelligible, though some of his speculations have been curiously confirmed in later years. He had many followers, who carried on the practice after his retirement in 1785, and notably the marquis de Puységur, who anticipated nearly everything that has been done since. After the Revolution, which put a temporary stop to animal magnetism, it was taken up again and flourished widely on the Continent. The Berlin Academy of Science offered a prize for the best essay on the subject. Mesmerism was practised in the hospitals, and minor operations were performed under mesmeric anæsthesia. That was about 1820. In 1831 a commission, appointed by the Académie de Médecine, issued a very favourable report after an inquiry lasting five years. The reality of the phenomena, including somnambulism and its effects, was declared to have been proved, but a second commission in 1837 reversed the decision and threw the whole thing into discredit. The next phase was the re-discovery of what had been discovered before, with the addition of a new name and a new theory. This was the work of James Braid of Manchester, who invented the word Hypnotism, and maintained that the mesmeric phenomena were not caused by a magnetic fluid, but depended on the "physical and psychical condition of the patient, irrespective of any agency proceeding from or excited into action by another." He was led to take up the study in 1841 by witnessing the public performance of a mesmeric entertainer. Neither his methods nor his results differed essentially from those of earlier mesmerists, but he undoubtedly put the thing on a more rational and more scientific basis. He himself suggested that hypnotism might be called "rational" as opposed to "transcendental mesmerism." His success in the therapeutic application of hypnotism was not conspicuously greater than that attained many years before in France. He published his *Neurypnology* in 1843. The word was coined to signify the science of "nervous sleep," but it is not a good one. Natural sleep is "nervous," and hypnotism is not sleep. Braid, in fact, made very much the same mistake as Mesmer in adopting an inadequate or erroneous theory, and viewing all the facts in the light of it. About the same time, but quite independently, a Scots surgeon named Esdaile was practising mesmerism in India, chiefly for producing anæsthesia, which he succeeded in doing with natives to an extent never since approached. He performed upwards of 300 major operations under mesmeric anæsthesia in the Indian hospitals, and otherwise showed a complete mastery of the art. On one occasion he hypnotized a man behind his back and without his knowledge in open court. The affections treated by Braid included various forms of paralysis, neuralgia, nervous headache, hysteria, epilepsy, defects of sight, hearing, smell, and speech, palpitation of the heart, dyspepsia, spinal irritation, club foot, curvature of the spine, some skin diseases, and rheumatism. He disclaimed any wish "to hold it [hypnotism] up as a universal remedy," nor did he profess to understand fully how the effects were produced, but he held that "besides the peculiar impression directly made on the nervous centres, by which the mind is for the time thrown out of gear, and which enables us to localize or concentrate the nervous energy or sensorial power to any particular point or function, we have also an extraordinary power of acting on the capillaries and of increasing and diminishing the force and frequency of the circulation, locally and generally." Experience led him to modify his earlier opinion that the hypnotic state is quite independent of the agency of the operator, and he himself made use of mesmeric "passes." Braid's investigations attracted a good deal of attention, but were not favourably received in scientific and orthodox circles, with some exceptions; and they excited the hostility of the mesmerists, who did not like to see their theory of a magnetic fluid overthrown. Throughout the history of the subject—indeed, from Mesmer down to the Nancy school—exponents and opponents alike have been more given to controversy over theories than to the patient investigation of facts. Braid, however, made some distinguished converts among unprejudiced men to whom the facts appealed, and they seem to have realized the bearing of certain phenomena better than he did himself. Notably they developed the importance of suggestion, and fully anticipated the Nancy school of modern hypnotists. Suggestion was nothing new, having been known to Mesmer, but its significance had been missed by the earlier mesmerists, who believed in a magnetic fluid. Braid appreciated it better, and pointed out that "the sleeper" exhibits "physical manifestations of the suggestion received through words or excited by sensible impressions which thereby direct his current of thought," and also that "definite physical changes could be excited and regulated and controlled at will, according to the suggestion of another person"; but it was more clearly and more fully recognized by Dr Gregory, professor of chemistry at Edinburgh. In a book on mesmerism, published in 1851, he says, "It must be at once obvious to every person acquainted with physiology that the peculiar phenomena now under consideration depend on the principle of suggestion," and further, "it is self-evident that the power of suggestion may be usefully

applied in medicine." Professor Hughes-Bennett, a physician of high standing, said in his lectures about the same time that it was clear "that the effect is produced by operating on the mind of the individual, and through that on his bodily powers. In short, predominating ideas, whether originating spontaneously or suggested by the words and actions of others, seem to be the exciting cause in individuals affected with a peculiar condition of the cerebral functions. The labours of Dr Esdaile in India and Mr Braid of Manchester exhibit a worthy commencement in the rational treatment of disorders by the means alluded to, and there can be little doubt that in no long time its influence, when further studied, will be acknowledged." Hypnotic suggestion was used in medicine in the manner indicated, also for the production of anæsthesia and the treatment of dipsomania; but its value was not generally acknowledged, and it gradually dropped out of sight. Evidently it did not fulfil expectations; it ceased to attract public or scientific attention, and fell into disuse. This fact, after the complete recognition of its nature just quoted, and the sanguine hopes entertained of its utility, is of the greatest significance.

For some thirty years mesmerism or hypnotism was dormant, save for the travelling showman and a few adherents in France, who readily embraced the opportunity of practising the tabooed art under a new name, and even succeeded in smuggling it into the Academie des Sciences. But it excited only a brief spasm of interest, and the subject dropped until the revival initiated by Charcot. In the year 1877 he was nominated to investigate and report on the treatment of nervous diseases with metal discs, introduced by Burq. He found the phenomena genuine, and continued the study in his own wards. Experimenting on cases of hysteria, he soon came across the hypnotic or mesmeric condition, and recognized its reality. In short, by the irony of fate the most distinguished of French physicians, treading exactly in the steps of Mesmer, who also began by experimenting on hysterical patients with metal plates, once more re-discovered the whole thing just a hundred years later. His name soon gave an impetus to the study, and an extensive revival followed. Hypnotism became orthodox, and the few French physicians who had been practising it quietly came out into the light of day. Among them was Dr Liébeault of Nancy, who had been using hypnotism for twenty years. His academic colleagues in that city, who had ignored him hitherto, now sought inspiration from his experience, and he became the father of what was called the Nancy school of hypnotism. Its distinguishing mark was the supreme importance attached to suggestion. According to the most advanced exponents of the Nancy school, there is nothing in hypnotism except suggestion, which is a universal therapeutic agency or "cure all"—if, indeed, all treatment is not a form of suggestion. On the other hand, the "Paris school," following Charcot, regarded hypnotic susceptibility as a morbid condition allied to hysteria. The rise of these rival schools dates from about 1880. At the same time Heidenhain of Breslau embarked independently on the study of mesmerism from a physiological point of view, obtaining his first instruction from a travelling mesmerist, as Braid did. Heidenhain fully established the reality of the phenomena, and formulated a theory that they are due to inhibition of the higher centres in the brain, caused by rhythmical stimulation of the senses. One of his experiments is particularly interesting, because it proves that persons can be hypnotized against their will, and that the condition is not, therefore, purely "subjective." Prussian soldiers were mesmerized and sent to sleep upon parade, though they had the strongest reasons for not committing such a serious breach of discipline. From 1880 onwards the vogue of hypnotism increased rapidly, until it culminated in 1889, when an International Hypnotic Congress was held in Paris. It was attended by representatives from every European nation and from North and South America, and among the honorary presidents were Charcot, Brown-Séquard, Brouardel, Richet, and Lombroso. For two or three years after this hypnotism continued to excite great interest, and sanguine expectations were entertained of its future usefulness in medicine, but the excitement did not last long. Interest once more began to languish, and at present the practice, which never obtained a general hold upon the medical profession, appears to be falling again into neglect.

The foregoing summary will suffice to show that animal magnetism, mesmerism, and hypnotism have a continuous history, and are essentially one and the same thing, which has undergone a series of revivals under different names and in connexion with different theories. The service rendered by the latest revival is not that it has introduced anything new, but that it has established the existence of the hypnotic or mesmeric condition with an authority which must carry conviction to all minds capable of judging evidence. The same phenomena have been re-discovered again and again since Mesmer's time. If they are not real, then it must be supposed that a vast number of persons of all classes and nationalities, including the most ignorant peasants and Orientals, have entered into a conspiracy to deceive for more than a century past, with no real object in view, and often at the cost of great pain to themselves, and have learnt their lesson so well that they all behave in the same way and reproduce the same symptoms so skilfully as to delude hundreds of the most acute and most sceptical observers. This is too large a draft upon the credulity of any one. Scepticism is justified in the case of all exhibitions and paid subjects, who have repeatedly been convicted of trickery, and should never be trusted. But the investigations of medical men and physiologists, carried out upon genuine hospital patients and other subjects of unimpeachable honesty in all classes of life, stand on a different footing. Nor should the phenomena be confounded with the theories invented to explain them. This was the mistake made by the earlier critics of mesmerism; with the exception of the French commission of 1825, and a few other clear-headed observers, they devoted their attention to the supposed magnetic fluid and, ignoring the phenomena, pronounced the whole thing a delusion because the existence of the magnetic fluid was not proved to their satisfaction.

The main facts established may be summarized as follows:—(1) The hypnotic state may be induced in various ways. The most usual are fixation of the gaze on some object; gentle monotonous stimulation of any of the senses; a sudden flash of light or loud noise; passes by the hand; a command or suggestion to go to sleep. Some of these may be combined. Occasionally subjects pass spontaneously into the state. Return to the normal is effected by the command to wake up, which may be assisted by a slight physical stimulus, such as a light tap or blowing in the face. When left to themselves subjects awake spontaneously after a time. Natural susceptibility varies greatly. Some persons are affected at once, and even against their will. Others remain wholly refractory, though willing and even anxious to be hypnotized. Susceptibility is always increased by practice. Some operators are more successful than others. Certain races appear to be far more susceptible than others, the French, for instance, more than the English. In Paris hypnotization has been effected by a revolving instrument resembling that used to attract larks. The

clinique of patients at the Charité Hospital gazing at this object and falling into trances exactly recalls Mesmer's *baquet*. (2) Subjects are very variously affected, but the commonest effects are conditions resembling sleep, trance, or catalepsy, and somnambulism, in which ordinary consciousness is lost, and the subject renders implicit obedience to the operator, remembering nothing on waking up. Certain physiological phenomena have been observed. The muscles contract on being stroked, and the whole body may be rendered rigid; the senses may be enormously heightened, so that sounds can be heard and odours smelt at far greater distances than in the normal state, and print can be read through layers of cotton-wool or a wooden screen; the circulation may be affected by modifying the action of the heart and by causing the blood-vessels, especially the capillaries, to contract or dilate; according to Charcot, it has been ascertained by exact observation with instruments of precision that the blood-vessels undergo regular changes in certain hypnotic states, contracting in some and dilating in others; the respiration may be slowed or quickened; regular changes also take place in the secretions, and the action of various glands may be modified at pleasure; anæsthesia and paralysis may be produced. The psychological phenomena occur in the somnambulistic state, and are mostly manifestations of an extreme susceptibility to suggestions, which may be conveyed by word of mouth, by gestures and signs, or by some other agency acting through one of the senses. The mind and will of the subject are blank, ready to receive and act upon any idea impressed upon them. This phase of hypnotism is the basis of mesmeric exhibitions on the one hand and of its therapeutic application on the other. There seems hardly any limit to the obedience of susceptible subjects in the somnambulistic state, but the fears that it might be used to procure the commission of crime have not been realized. One of the most striking phenomena produced is that of "post-hypnotic suggestion," in which the subject on awaking executes an order previously given during the somnambulistic condition without any recollection or consciousness of the source of the impulse, and it may be after the lapse of a considerable interval of time. The effects of suggestion are greatly heightened in some subjects by a marked increase of intellectual and emotional power, analogous to the exalted capacity of the special senses, which enables them to perform feats of which they are totally incapable in their ordinary condition. A peculiar relation is established between the operator and the subject, who ignores every one else.

Such are the principal phenomena of hypnotism, but it must be understood that some of them are rather rare, and only produced in specially susceptible subjects. The still rarer effects described by the older mesmerists, such as clairvoyance, telepathy, and "presensation," have not been observed by recent investigators, but Charcot describes some very similar phenomena, and it would be highly unscientific to pronounce them impossible merely because they are outside the range of ordinary experience. Theories of hypnotism are legion. Some are discussed elsewhere (see PHYSIOLOGY, *Nerve and Muscle*). They have only an academic or controversial interest. Until the normal working of the brain is better understood, it is futile to speculate on such an abnormal condition as the hypnotic.

There remains the practical application of hypnotism in medicine. Modern experience has not materially enlarged its utility. It has been used for the most part in the same class of cases as during previous flourishing periods — namely, in functional disorders of the nervous system and for the relief of pain. The only distinctively novel application is that attempted by the Nancy practitioners, who professed to find a sovereign remedy in suggestion, and used it in every class of disease, including the specific fevers. The success of this new departure has been less conspicuous than its boldness. Speaking generally, the sanguine hopes of enthusiastic hypnotizers have not been realized, and the attitude of the bulk of the profession in holding aloof from the practice while admitting the reality of the hypnotic phenomena has been fully justified. Charcot himself abandoned the use of hypnotism because he found that it did more harm than good and merely added to the disorder of already disordered nervous systems. Others have followed his example; and though a faithful few may still remain constant to their faith in the virtues of suggestion, it cannot be said that their number or their credit is increasing. This is precisely what might have been expected. History is only repeating itself once more. Had there been any real value in the thing, it would never have fallen into neglect in the 'thirties and again in the 'fifties. Its successive revivals have been due to the reality of the phenomena, which continually reassert themselves with all the indestructible force of truth; its successive periods of decline have been due to inherent weakness and therapeutic inutility. The hypnotic state and its effects are too uncertain, too capricious, and too dangerous for general use in medicine. (A. SL.)

Hythe, a municipal borough of Kent, England, 67 miles south-east of London by rail. Recent erections include a sessions hall and an institute. The sea-wall and parade, belonging to the South-Eastern and Chatham Railway, and the buildings of the Royal School of Musketry, have been extended. There is constant communication with Sandgate by means of a tramway along the front, and an excellent golf-course has been laid out on the downs. Area, 2620 acres. Population (1881), 4173; (1901), 5557.

Ibagué, or SAN BONIFACIO DE IBAGUÉ, chief town in the department of Tolima, in the Republic of Colombia, South America. It is picturesquely situated on a beautiful plain 4300 feet above sea-level, between the rivers Chipalo and Combeimna, affluents of the Cuello, about 18 miles north-west of the Nevada del Tolima. With the Magdalena river it is connected by rail to Girardot, and it is the entrepôt of the valleys of Magdalena and Cauca. There are two thermal springs in the environs, and unexploited mines of sulphur and silver. The chief productions of the district are cacao, tobacco, rice, and sugar-cane. The city dates from 1550. In 1854 it was for a short time the capital of the Republic. Population, about 13,000.

Ibsen, Henrik (1828———), Norwegian dramatic and lyric poet, eldest son of Knud Ibsen, a merchant of the small Norwegian seaport of Skien, and of his wife, Maria Cornelia Altenburg, was born at Skien, in a house on the market-place now destroyed, on the 20th of March 1828. For five generations the family had consisted on the father's side of a blending of Danish, German, and Scottish races, with little intermixture of pure Norwegian; this last element was contributed by the mother. In 1836

Knud Ibsen became insolvent, and the family withdrew, in great poverty, to a cottage in the outskirts of the town. After brief schooling at Skien, Ibsen was sent, towards the close of 1843, to be apprenticed to an apothecary in Grimstad; here he remained through seven dreary years of drudgery, which set their mark upon his spirit. In 1847, in his nineteenth year, he began to write poetry. He made a gloomy and almost sinister impression upon persons who met him at this time, and one of his associates of those days has recorded that Ibsen "walked about Grimstad like a mystery sealed with seven seals." He had continued, by assiduous reading, his self-education, and in 1850 he contrived to leave his narrow conditions and come up as a student to Christiania. In the same year he published his first work, the blank-verse tragedy of *Catilina*, under a pseudonym. A second drama, *The Viking's Grave*, was acted (but not printed) a few months later; he was at this time entirely under the influence of the Danish poet Oehlenschläger. During the next year or two Ibsen made a very precarious livelihood in Christiania as a journalist, but in November 1851 he had the good fortune to be appointed "stage-poet" at the little theatre of Bergen, with a small but regular salary. He was practically manager at this house, and he also received a travelling stipend. In 1852, therefore, he went, to study the stage, to Copenhagen and to Dresden. Among many dramatic experiments which Ibsen made in Bergen, the most considerable and most satisfactory is the saga-drama of *Mistress Inger at Östraat*, which was produced in 1855; here are already perceptible some qualities of his mature character. Much less significant, although at the time more successful, is *The Banquet at Solhaug*, a tragedy produced in Bergen in the first days of 1856; here for a moment Ibsen abandoned his own nascent manner for an imitation of the popular romantic dramatist of Denmark, Henrik Hertz. It is noticeable that Ibsen, by far the most original of modern writers for the stage, was remarkably slow in discovering the true bent of his genius. His next dramatic work was the romantic tragedy of *Olaf Liljekrans*, performed in 1857, but unprinted until 1898. This was the last play Ibsen wrote in Bergen. In the summer of the former year his five years' appointment came to an end, and he returned to Christiania. Almost immediately he began the composition of a work which showed an extraordinary advance on all that he had written before, the beautiful saga-drama of *The Warriors in Helgeland*, in which he threw off completely the influence of the Danish romantic tragedians, and took his material directly from the ancient Icelandic sources. This play marks an epoch in the development of Norwegian literature. It was received by the managers, both in Christiania and Copenhagen, with contemptuous disapproval, and in the autumn of 1857 Ibsen could not contrive to produce it even at the new theatre of which he was now the manager. *The Warriors* was not acted anywhere until 1861. During these years, Ibsen, in constant opposition, suffered many reverses and humiliations, but he persisted, in the face of all, to pursue his own line in art. Some of his finest short poems, and amongst others the admirable seafaring romance of *Terje Vigen*, belong to the year 1860. The annoyances which Ibsen suffered, and the retrograde and ignorant conditions which he felt around him in Norway, developed the ironic qualities in his genius, and he became an acid satirist. The brilliant rhymed drama, *Love's Comedy*, a masterpiece of lyric wit and incisive vivacity, belongs to 1862. This was a protest against the official conventionality which deadens the beauty of all the formal relations between men and women, the pettiness, the publicity, and the prosiness of betrothed and married life among the middle classes in Norway. It showed how society murders the poetry of love. For some time past Ibsen had been meditating another of his saga-dramas in prose, and this appeared in 1864 as *Kongsemnerne* ("The Pretenders"). These works, however, now so universally admired, contained an element of strangeness which was not welcome when they were new. Ibsen's position in Christiania grew more and more disagreeable. He had positive misfortunes which added to his embarrassment. In 1862 his theatre became bankrupt, and he was glad to accept the poorly-paid post of "æsthetic adviser" at the other house. An attempt to obtain a poet's pension (*digtergage*) was unsuccessful; the Storthing, which had just voted one to Björnson, refused to do the same for Ibsen. His cup was full of disillusion and bitterness, and in April 1864 he started, by Berlin and Trieste, ultimately to settle in Rome. His anger and scorn gave point to the satirical arrows which he shot back to his thankless fatherland from Italy in the splendid poem of *Brand*, published in Copenhagen in 1866, a fierce attack on the Laodicean state of religious and moral sentiment in the Norway of that day; the central figure, the stern priest Brand, who attempts to live like Christ and is snubbed and hounded away by all his latitudinarian companions, is one of the finest conceptions of a modern poet. Ibsen had scarcely closed *Brand* before he started a third lyrico-dramatic satire, *Peer Gynt* (1867), which remains, in a technical sense, the most highly finished of all his metrical works. In *Brand* the hero had denounced certain weaknesses which Ibsen saw in the Norwegian character, but these and other faults are personified in the hero of *Peer Gynt;* or rather, in this figure the poet has pictured, in a type, the Norwegian nation in all the egotism, vacillation, and lukewarmness which he believed to be characteristic of it. Ibsen, however, acted better than he preached, and he soon forgot his abstraction in the portrait of Peer Gynt as a human individual. In this magnificent work modern Norwegian literature first rises to a level with the finest

HENRIK IBSEN.
(From a photograph by Nyblin, Christiania.)

European poetry of the century. In 1869 Ibsen wrote the earliest of his prose dramas, the political comedy of *The Young Men's League*, in which for the first time he exercised his extraordinary gift for perfectly natural and yet pregnant dialogue. Ibsen was in Egypt, in October 1869, when his comedy was put on the stage in Christiania, amid violent expressions of hostility; on hearing the news, he wrote his brilliant little poem of defiance, called *At Port Saïd*. By this time, however, in spite of the antagonism of the critics and of certain sections of the public, Ibsen had become a successful author; *Brand* sold largely, and has continued to be the most popular of Ibsen's writings. In 1866, moreover, the Storthing had at last been persuaded to vote him a "poet's pension," and there was now an end of Ibsen's long struggle with poverty. In 1868 he left Rome, and settled in Dresden until 1874, when, after a voluntary exile of ten years, he returned to Norway. But after a short visit he returned to Germany, and lived first at Dresden, afterwards at Munich, and did not finally settle in Christiania until 1891. His shorter lyrical poems were collected in 1871, and in the course of that year his name and certain of his writings were for the first time mentioned to the English public. During these years, however, he was engaged on no new work, but was very carefully revising the old ones, which were now out of print, and which he would not resign again to the reading world until he had subjected them to what in some instances (for example, *Mistress Inger at Östraat*) amounted to practical recomposition. In 1873 he published a huge double drama, each part of which was of unusual bulk, the whole forming the tragedy of *Emperor and Galilean;* this is Ibsen's latest historical play, and has for subject the unsuccessful struggle of Julian the Apostate to hold the world against the rising tide of Christianity. This work is of an experimental kind, and takes its place between the early poetry and the later prose of the author, without properly belonging to either class. Compared with the series of plays which Ibsen was now about to begin, which indeed he had already inaugurated with *The Young Men's League*, *Emperor and Galilean* preserves a colour of idealism and even of mysticism which was for many years to be absent from Ibsen's writings, and to reappear in his old age with *The Master-builder*. There is some foundation for the charge that Ibsen has made his romantic Greek emperor needlessly squalid, and that he has robbed him, at last, too roughly of all that made him a sympathetic exponent of Hellenism. Ibsen was now greatly occupied by the political spectacle of Germany at war in Denmark, then at war in France, and he believed that all things were conspiring to bring the old order of national ideas to a close in Europe, and to start a new epoch of individualism. He was therefore deeply disgusted by the Paris commune, and disappointed by the conservative reaction which succeeded it. This disillusion in political matters had a very direct influence upon Ibsen's literary work. It persuaded him that nothing could be expected in the way of reform from democracies, from large blind masses of men moved capriciously in any direction, but that the sole hope for the future must lie in the study of personality, in the development of individual character. He set himself to diagnose the conditions of society, which he had convinced himself lay sick unto death. Hitherto Ibsen had usually employed rhymed verse for his dramatic compositions, or, in the case of his saga-plays, a studied and artificial prose. In spite of the surprising achievements of his poetry, he determined to abandon versification altogether for the future, and to write only in the language of everyday conversation. In the first drama of this his new period, *The Pillars of Society* (1877), he dealt with the problem of hypocrisy in a small commercial centre of industry, and he drew in the Bernick family a marvellous picture of social egotism in a prosperous seaport town. There was a certain similarity between this piece and *A Doll's House* (1878), although the latter was much the more successful in awakening curiosity. Indeed, no production of Ibsen's has been so widely discussed as this play, which is nevertheless not his most coherently conceived. Here also social hypocrisy, the convention which goes on covering up and patching together the rotten texture of life instead of rending it away, was the object of the playwright's satire, but this time mainly in relation to marriage. In *A Doll's House* Ibsen first developed his views with regard to the individualism of woman. In his previous writings he had depicted woman as the devoted and willing sacrifice to man; here he begins to explain that she has no less a duty to herself, and must keep alive her own conception of honour and of responsibility. The conclusion of *A Doll's House* was violently and continuously discussed through the length and breadth of Europe, and to the situation of Nora Helmer is probably due more than to anything else the long tradition that Ibsen is "immoral." He braved convention still more audaciously in *Ghosts* (1881), which is perhaps the most powerful of the series of plays in which Ibsen is occupied in diagnosing the diseases of modern society. It was received in Norway with a tumult of ill-will, and the author was attacked no less venomously than he had been twenty years before. Ibsen was astonished and indignant at the reception which was given to *Ghosts*, and at the insolent indifferentism of the majority to all ideas of social reform. He wrote, more as a pamphlet than as a play, what is yet one of the most effective of his comedies, *An Enemy of the People* (1882). Dr Stockmann, the hero of that piece, discovers that the drainage system of the bathing-station on which the little town depends is faulty, and the water impure and dangerous. He supposes that the corporation will be grateful to have these deficiencies pointed out; on the contrary, they hound him out of their midst as an "enemy of the people." In this play occurs Ibsen's famous and typical saying, "a minority may be right—a majority is always wrong." This polemical comedy seemed at first to be somewhat weakened by the personal indignation which runs through it, but it has held the stage. Ibsen's next drama, *The Wild Duck* (1884), was written in singular contrast with the zest and fire which had inspired *An Enemy of the People*. Here he is squalid and pessimistic to a degree elsewhere unparalleled in his writings; it is not quite certain that he is not here guilty of a touch of parody of himself. The main figure of the play is an unhealthy, unlucky enthusiast, who goes about making hopeless mischief by exposing weak places in the sordid subterfuges of others. This drama contains a figure, Hjalmar Ekdal, who claims the bad pre-eminence of being the meanest scoundrel in all drama. *The Wild Duck* is the darkest, the least relieved, of Ibsen's studies of social life, and his object in composing it is not quite obvious. With *Rosmersholm* (1885) he rose to the height of his genius again; this is a mournful, but neither a pessimistic nor a cynical play. The fates which hang round the contrasted lives of Rosmer and Rebecca, the weak-willed scrupulous man and the strong-willed unshrinking woman, the old culture and the new, the sickly conscience and the robust one, create a splendid dramatic antithesis. Since that time, Ibsen has written a series of dramas, of a more and more symbolical and poetic character; the earliest of these was the mystical *The Lady from the Sea* (1888). At Christmas 1890 he brought out *Hedda Gabler;* two years later *The Master-*

builder, in which many critics see the highest attainment of his genius; at the close of 1894 *Little Eyolf;* at Christmas 1896 *John Gabriel Borkman;* and in January 1900 *When We Dead Awaken.* On the occasion of his seventieth birthday (20th March 1898), Ibsen was the recipient of the highest honours from his own country and of congratulations and gifts from all parts of the world. A colossal bronze statue of him was erected outside the new National Theatre in September 1899. No recent writer belonging to the smaller countries of Europe has had so widely spread a fame as that of Ibsen, and although the value of his dramatic work is still occasionally contested—at least in England—it has received the compliment of vivacious discussion in every part of the world. There would, perhaps, have been less violence in this discussion if it had been perceived that the author does not pose as a moral teacher, but as an imaginative investigator. He often and with much heat has insisted that he is not called upon as a poet to suggest a remedy for the diseases of society, but to diagnose them. In this he is diametrically opposed to Tolstoi, who admits that he writes his books for the healing of the nations. If the subjects which Ibsen treats, or some of them, are open to controversy, we are at least on firm ground in doing homage to the splendour of his art as a playwright. He has re-introduced into modern dramatic literature something of the velocity and inevitability of Greek tragic intrigue. It is very rarely that any technical fault can be found with the architecture of his plots, and his dialogue is the most lifelike that the modern stage has seen. His long apprenticeship to the theatre in his early days was no doubt of immense service to him in this respect. In every country, though least perhaps in England, the influence of Ibsen has been marked in the theatrical productions of the younger school. Even in England, on the rare occasions when his dramas are acted, they awaken great interest among all intelligent playgoers.

Ica, a coast department of Peru. It has an area of 6295 square miles, and the population in 1896 was 90,962, or 14 to the square mile. It is divided into two provinces, Chindia and Ica. The vine is extensively cultivated, in addition to sugar-cane, tobacco, and rice, and the mineral waters have some repute. There is a railway from Ica, the capital of the province and department (about 12,000), to Pisco.

ICELAND.

Geography and Statistics.

ICELAND has an area of 40,437 square miles. Its length is 298 miles, and breadth 194 miles. The most extensive development of the coast-line is on the north-west, where a peninsula, diversified by a great number of fjords, projects outwards from the main portion of the island. The total length of the coast-line is about 3730 miles, of which approximately one-third belongs to the north-west peninsula. The great bays on the west of the island (Faxaflói and Breiðifjörður), as well as the many bays on the north, which are separated from one another by rocky promontories, appear to owe their origin to subsidences of the surface; whereas the fjords of the north-west peninsula, which make excellent harbours, and those of the east coast, seem to be the result chiefly of erosion.

The Tablelands.—Iceland is a plateau or tableland, built up of volcanic rocks of older and younger formation, and pierced on all sides by fjords and valleys. As compared with the tableland, the lowlands have a relatively small area, namely, one-fourteenth of the whole; but, on the other hand, they are of vastly the greater importance, for the low-lying coasts and valleys are almost the only parts of the island which are inhabited. In consequence of the rigour of its climate, the central tableland is absolutely uninhabitable. At the very outside, not more than one-fourth of the area of Iceland is inhabited; the rest consists of elevated deserts, lava streams, and glaciers. The north-west peninsula is separated from the main mass of the island by the bays Hunaflói and Breiðifjörður, so that there are really two tablelands, a larger and a smaller. The isthmus which connects the two is only 4¼ miles across, but has an altitude of 748 feet above sea-level. The mean elevation of the north-west peninsula is 2000 feet. The numerous fjords and glens which cut into it from all sides are shut in by precipitous walls of basalt, which plainly shows that they have been formed by erosion right through the mass of the plateau. The surface of this tableland is also bare and desolate, being covered with gravel and fragments of rock. There is scarcely a vestige of vegetation; but here and there are large straggling snowfields, the largest being Gláma and Drangajökull, on the culminating points of the plateau. The only districts which are inhabited are the shores of the fjords, where grass grows capable of supporting sheep; but a large proportion of the population gain their livelihood by fishing. The other and larger tableland, which constitutes the substantial part of Iceland, reaches its culminating point in the south-east, in the gigantic snowfield of Vatnajökull, which covers an area of 3300 square miles. The axis of highest elevation of Iceland stretches from north-west to south-east, from the head of Hvammsfjörður to Hornafjörður, and from this water-parting the rivers descend on both sides. The crest of the water-parting is crowned by a chain of snow-capped mountains, separated by broad patches of lower ground. In fact, they are really a chain of minor plateaux, which rise to an altitude of from 4500 to 6250 feet above sea-level and 2000 to 3000 feet above the tableland itself. In the extreme east is Vatnajökull, which is separated from Tungnafellsjökull by Vonarskard (3300 feet). Between Tungnafellsjökull and Hofsjökull lies the broad depression of Sprengisandur (2130 feet). Between Hofsjökull—still going north-west—and the next snow-capped mountain, Langjökull, lies Kjölur (2000 feet); and between Langjökull and Eiriksjökull, Flosaskard (2630 feet). To the north of the *jöklar* last mentioned there are a number of lakes, all well stocked with fish. Numerous valleys or glens penetrate into the tableland, especially on the north and east, and between them long mountain spurs, sections of the tableland which have resisted the action of erosion, thrust themselves out towards the sea. Of these the most considerable is the mass crowned by Mýrdalsjökull, which stretches towards the south. The interior of the tableland consists for the most part of barren, grassless deserts, the surface being covered by gravel, loose fragments of rock, lava, driftsand, volcanic ashes, and glacial detritus.

The *Lowlands* cover, as already mentioned, a relatively small area. With the exception of the lower parts of the larger glens, there are no lowlands on the north and east; they are confined entirely to the south and west. The south coast is flat next the sea; but immediately underneath Vatnajökull there is merely a strip of gravel and sand, brought down and deposited by the glacial streams.

The most extensive low-lying plain of Iceland is that which lies between Mýrdalsjökull and Reykjanes, with an area of about 1550 square miles. In its lowest parts this plain barely keeps above sea-level, but it rises gradually towards the interior, finally terminating in a ramification of valleys. Its maximum altitude is attained in 381 feet, near Geysir. On the west of Hekla this lowland plain connects by a regular slope directly with the tableland, to the great injury of its inhabited districts, which are thus exposed to the clouds of pumice dust and drift-sand that cover large areas of the interior. In this way a considerable portion of this region has been devastated by the north-east storms. Nevertheless the greater part of this lowland plain produces good grass, and is relatively well inhabited. The plain is drained by three rivers—Markarfljót, Thjórsá, and Oelfusá—all of large volume, and numerous smaller streams. Towards the west there exist a number of warm springs. There is another lowland plain around the head of Faxaflói, nearly 400 square miles in extent. This, like the former plain, is encircled by mountains. As a rule the surface of this second plain is very marshy. Several dales or glens penetrate the central tableland; the eastern part of this lowland is called Borgarfjörður, the western part Mýrar.

Glaciers.—An area of no less than 5170 square miles is covered with snowfields and glaciers (*jöklar*). This extraordinary development of ice and snow is due to the raw, moist climate, the large rainfall, and the low summer temperature. The snow-line varies greatly in different parts of the island, its range being from 1300 to 4250 feet. It is highest on the tableland, on the north side of Vatnajökull, and lowest on the north-west peninsula, to the south of North Cape. Without exception the great névés of Iceland belong to the interior tableland. Interiorly they consist of slightly rounded domes or billowy snowfields of vast thickness. In external appearance they bear a closer resemblance to the glaciers of the Polar Regions than to those of the Alps. The largest snowfields are Vatnajökull (3280 square miles), Hofsjökull (520), Langjökull (500), and Mýrdalsjökull (390). The glaciers which stream off from these snowfields are often of vast extent, *e.g.*, the largest glacier of Vatnajökull has an area of 150 to 200 square miles, but the greater number are of course small. Altogether, at the present time more than 124 glaciers are known in Iceland. It is on the south side of Vatnajökull that they descend lowest; the lower end of Breidamerkurjökull was in the year 1894 only 30 feet above sea-level. The glaciers of the north-west peninsula also descend very nearly to sea-level. The great number of streams of large volume is due to the moist climate and the abundance of glaciers, and the milky white or yellowish-brown colour of their waters is due to the glacial clays. The majority of them change their courses very often, as well as vary greatly in volume; frequently they are impetuous torrents, hampered by numerous waterfalls. Iceland also possesses a great number of lakes, the largest being Thingvallavatn and Thorisvatn, each about 27 square miles in area. Mývatn, in the north, is well known from the natural beauty of its surroundings. Above its surface tower a great number of volcanoes and several craters, and its waters are alive with waterfowl, a multitude of ducks of every species breeding on its islands. The lakes of Iceland owe their origin to different causes, some being due to glacial erosion, others to volcanic subsidence. Mývatn fills a depression between lava streams, and has a depth of not more than 8¾ feet. The group of lakes called Fiskivötn (or Veidivötn), which lie in a desolate region to the west of Vatnajökull, consist for the most part of crater lakes. The groups of lakes which lie north-west from Langjökull occupy basins formed between ridges of glacial gravel; and in the valleys numerous lakes are found at the backs of the old moraines.

Geology.—Iceland is built up almost entirely of volcanic rocks, none of them older, however, than the middle of the Tertiary period. The principal varieties are basalt and palagonitic breccias, the former covering two-thirds of the entire area, the latter the remaining one-third. Compared with these two systems, all other formations have but an insignificant development. The palagonitic breccias, which stretch in an irregular belt across the island, are younger than the basalt. In the north-west, north, and east the coasts are formed of basalt, and rise in steep, gloomy walls of rock to altitudes of 3000 feet and more above the level of the sea. Deposits of clay, with remains of plants of the Tertiary period, lignite, and tree-trunks pressed flat, which the Icelanders call *surtarbrandur*, occur in places in the heart of the basalt formation. The region in which these fossiliferous strata are developed in greatest thickness is the north-west peninsula. Indeed, in some few places well-marked impressions of leaves and fruit have been discovered, proving that in Tertiary times Iceland possessed extensive forests, and its annual mean temperature must have been at least 48·2° Fahr., whereas the present mean is 35·6°. The palagonitic breccias, which attain their greatest development in the south of the island and on the tableland, consist of reddish, brown, or yellowish rocks, tuffs and breccias, belonging to several different groups or divisions, the youngest of which seems to be of a date subsequent to the Glacial epoch. All over Iceland, in both the basalt and breccia formations, there occur small intrusive beds and dykes of liparite, and as this rock is of a lighter colour than the basalt, it is consequently visible from a distance. In the south-east of the island, in the parish of Lón, there exist a few mountains of gabbro, a variety of rock which does not occur in any other part of Iceland. In the neighbourhood of Húsavik in the north there have been found marine deposits containing a number of marine shells; they belong to the Red Crag division of the Pliocene. In the middle of Iceland, where the geological foundation is tuff and breccias, large areas are buried under ancient outflows of lava, which bear evidences of glacial scratching. These lava streams, which are of a doleritic character, flowed before the Glacial age, or during its continuance, out of lava cones with gigantic crater openings, such as may be seen in some places even at the present day. During the Glacial epoch the whole of Iceland was covered by a vast sheet of inland ice, except for a few small isolated peaks rising here and there along its outer margins. This ice-cap had on the tableland a thickness of 2300 to 2600 feet. Rocks scored by glacial ice and showing plain indications of striation, together with thousands of erratic blocks, are found scattered all over Iceland. Signs of the coast having receded subsequent to the Glacial epoch are very common all round the island, especially on the north-west peninsula. There we find strikingly developed marine terraces of gravel, shore lines, and surf beaches marked on the solid rock. In several places, too, there are traces of shells; and sometimes skeletal remains of whales and walruses, as well as ancient driftwood, have been discovered at tolerable distances from the present coast. The ancient shore-lines occur at two different altitudes. Along the higher, 230 to 260 feet above the existing sea-level, shells have been found which are characteristic of high Arctic latitudes and no longer exist in Iceland; whereas on the lower shore-line, 100 to 130 feet, the shells belong to species which occur amongst the coast fauna of the present day.

Volcanoes.—Iceland is one of the most volcanic regions

on the face of the earth; volcanic activity has gone on continuously from the first formation of the island in the Tertiary period down to the present time. So far as is known, there have in historic times been eruptions from twenty-five volcanic vents. Altogether 107 volcanoes are known to exist in Iceland, with thousands of craters, great and small. From all these there has issued a vast quantity of lava. The lava-streams which have flowed out since the Glacial epoch now cover an area of 4650 square miles. They are grouped in dense masses around the volcanoes from which they have flowed. The majority of them are the accumulated result of several outflows which have taken place at different periods; but the bulk of the lava dates from outbreaks which occurred in prehistoric times. The largest volume of lava which has issued at one outflow within historic times is the stream which came from the craters of Laki at Skaptá. This belongs to the year 1783, and covers an area of 218 square miles, and amounts to a volume represented by a cube each of whose sides measures 7½ miles. The largest unbroken lava-field in Iceland is Odaðahraun, upon the tableland north from Vatnajökull (2000 to 4000 feet above sea-level). It is the accretion of countless eruptions from over twenty volcanoes, and covers an area of 1300 square miles (or, including all its ramifications and minor detached streams, 1700 square miles), and its volume would fill a cube measuring 134 miles in every direction. As regards their superficies, the lava-streams differ greatly. Sometimes they are very uneven and jagged (*apalhraun*), consisting of blocks of lava loosely flung together in the utmost confusion. The big lava-fields, however, are composed of vast sheets of lava, ruptured and riven in divers ways (*helluhraun*). The smooth surface of the viscous billowy lava is further diversified by long twisted "ropes," curving backwards and forwards up and down the undulations. Moreover, there are gigantic fissures, running for several miles, which have been caused by subsidences of the underlying sections. The best-known fissure of this character is Almannagjá at Thingvellir. On the occasion of outbreaks the fine ashes are scattered over a large portion of the island, and sometimes carried far out across the Atlantic. After the eruption of Katla in 1625 the ashes were blown as far as Bergen in Norway, and when Askja was in eruption in 1875 a rain of ashes fell on the west coast of Norway 11 hours 40 minutes later and at Stockholm 15 hours afterwards. The volcanic ash frequently proves extremely harmful, in that it destroys the pastures, so that the sheep and cattle die of hunger and disease. The outbreak of Laki in 1783 occasioned the loss of 11,500 cattle, 28,000 horses, and 190,500 sheep—that is to say, 53 per cent. of all the cattle there were in the island, 77 per cent. of the horses, and 82 per cent. of the sheep. After that the island was visited by a famine, which destroyed 9500 people, or one-fifth of the total population.

The Icelandic volcanoes may be divided into three classes: (1) cone-shaped, like Vesuvius, built up of alternate layers of ashes, scoriæ, and lava; (2) cupola-shaped, with an easy slope and a vast crater opening at the top—these shield-shaped cupolas are composed entirely of layers of lava, and their inclination is seldom steeper than 7°–8°; (3) long chains of craters running close alongside a fissure in the ground. For the most part the individual craters are low, generally not exceeding 300 and 500 feet. These crater chains are both very common and often very long. The chain of Laki, which was formed in 1783, extends to 20 miles, and embraces about one hundred separate craters of different sizes. Sometimes, however, the lava-streams are vomited straight out of gigantic fissures in the earth without any crater being formed. Many of the Icelandic volcanoes are during their periods of quiescence covered with snow and ice. Then when an outbreak occurs the snow and ice melt, and in that way they sometimes give rise to serious catastrophes (*jökulhlaup*), through large areas of the country being suddenly inundated by great floods of water, which bear masses of ice floating on their surface. Katla caused very serious destruction in this way by converting several cultivated districts into barren wastes. In the same way in the year 1362 Oeræfajökull, the loftiest mountain in Iceland (6424 feet), annihilated two entire parishes by sweeping forty farms, together with their inhabitants and live stock, bodily into the ocean. The best-known of the volcanoes is Hekla, which has been in eruption eighteen times within the historic period, the last in 1845. Katla during the same period has been active thirteen times, the last occasion being in 1860. The largest volcano is Askja, situated in the middle of the lava-field of Odaðahraun. Its crater measures 34 square miles in area, and its latest outburst was in 1875. At Mývatn there are several volcanoes, which were particularly active in the years 1724–30. On several occasions there have been volcanic outbreaks under the sea outside the peninsula of Reykjanes, islands appearing above the waves and afterwards disappearing again. The crater chain of Laki has only been in eruption once in historic times, namely, the violent and disastrous outbreak of 1783. Iceland, however, possesses no constantly active volcano, such as, *e.g.*, Stromboli. There are often long intervals between the successive outbreaks, and the outbreaks are wont to be exceedingly violent. Indeed, many of the volcanoes, and this is especially true of the chains of craters, have only vented themselves in a solitary outburst.

Earthquakes are a phenomenon of frequent occurrence, especially in the districts which are peculiarly volcanic. Historical evidence goes to show that they are closely associated with three naturally defined regions—(1) the region between Skjálfandi and Axarfjörður in the north, where violent earth tremblings are extremely common; (2) at Faxaflói, where minor vibrations are frequent; (3) the southern lowlands, between Reykjanes and Mýrdalsjökull, have frequently been devastated by violent earthquake shocks, with great loss of property and life, *e.g.*, on 14th–16th August 1784, when 92 farmsteads were totally destroyed, and 372 farmsteads and 11 churches were seriously damaged; and again in August and September 1896, when another terrible earthquake visited this region, completely destroying 161 farmsteads and doing injury to 155 others. Hot springs are found in every part of Iceland, both singly and in groups; they are more particularly numerous in the western portion of the southern lowlands, where amongst others is the famous Geysir. Sulphur springs and boiling mud lakes are also general in the volcanic districts; and in places there are carbonic acid springs, these more especially on the peninsula of Snæfellsnes, north of Faxaflói.

Climate.—Considering its high latitude and situation, Iceland has a relatively mild climate. The meteorological conditions vary, however, greatly in different parts of the island. In the south and east the weather is generally changeable, stormy, and moist; whilst on the north the rainfall is less. The climate of the interior tableland approximates to the continental type, the thermometer sometimes falling to the levels of extremely bitter cold. The mean temperature of the year is 37·2° Fahr. in Stykkishólmur on Breiðifjörður, 38·3° at Eyrarbakki in the south of Iceland, 41° at Vestmannaeyjar, 36° at Akureyri in the north, 36·7° on Berufjörður in the east, and 30·6° at Mödrudalur on the central tableland. The range is great not only from year to year, but also from

month to month. For instance, at Stykkishólmur the highest annual mean for March was 39·7°, and the lowest 8°, during a period of thirty-eight years. Iceland lies contiguous to that part of the north Atlantic in which the shifting areas of low pressure prevail, so that storms are frequent and the barometer is seldom firm. The barometric pressure at sea-level in the south-west of Iceland during the period 1878–1900 varied between 30·8 and 27·1 inches. The climate of the coasts, which is closely dependent upon the oceanic currents, is relatively mild in summer, but tolerably cold in winter. The winter means of the north and east coasts average 31·7° and 31·3° Fahr. respectively; the summer means, 42·8° and 44·6°; and the means of the year, 33·1° and 35·6°. On the other hand, the winter means of the south and west coasts average 32° and 31·7° respectively; the summer means, 48·2° and 50°; the annual means, 37·4° and 39·2°. The rainfall on the south and east coasts is considerable, *e.g.*, at Vestmannaeyjar, 49·4 inches in the year; at Berufjörður, 43·6 inches. On the west coast it is less, *e.g.*, 24·3 inches at Stykkishólmur; but least of all on the north coast, being only 14·6 inches on the island of Grímsey, which lies off that coast. Mist is commonly prevalent on the east coast; at Berufjörður there is mist on no less than 212 days in the year. The south and west coasts are washed by the Gulf Stream, and the north coast by an Arctic current, which frequently brings with it a quantity of drift-ice, and thus exercises a considerable effect upon the climate of the island; sometimes it effectually blocks the north coast in the summer months. On the whole, during the 19th century, the north coast has been free from ice on an average of one year in every four or five.

Flora.—The vegetation presents the characteristics of an Arctic-European type, and is tolerably uniform throughout every part of the island, the differences even on the tableland being but slight. At present 435 species of Phanerogams and Vascular Cryptogams are known; the lower Orders have been but little investigated. The grasses are of the greatest importance to the inhabitants, for upon them they are dependent for the summer and winter keep of their live stock. Heather is also extensively prevalent, and plays a prominent part in the feeding of the sheep. The development of forest trees is insignificant. Birch woods still exist in a good many places, especially in the warmer valleys, which penetrate considerable distances inland; but the trees are very short, scarcely attaining to more than 3 to 10 feet in height. In a few places, however, they reach 13 to 20 feet; and the highest birch-tree in Iceland (at Hallormstadaskógur in East Iceland) reaches 28 feet. A few mountain ash or rowan trees (*Sorbus aucuparia*) are found growing singly here and there, and attain to 30 feet in height. Willows are also pretty general, the highest in growth being *Salix phyllicifolia*, 7 to 10 feet.

Fauna.—The Icelandic fauna is of a sub-Arctic type. But while the species are few, the individuals are often numerous. The land mammals are very poorly represented; and it is doubtful whether any species of those that do exist is indigenous. The polar bear is an occasional visitant, being brought to the coast by the Greenland drift-ice. Foxes are common; mice and the brown rat have been introduced, though one mouse variety is possibly indigenous. Reindeer were introduced in 1770. The marine mammalia are very numerous. The walrus is now seldom seen, although in prehistoric times it was very common. There are numerous species of seals; and the seas abound in whales, and a considerable whaling industry thrives on the north-west coast. Of birds there are over 100 species, more than one-half of them being aquatic. In the interior the whistling swan is common, and numerous varieties of ducks are found in the lakes. The eider duck, which breeds on the islands of Breiðifjörður, is a source of livelihood to the inhabitants, as are also the many kinds of sea-fowl which breed on the sea-cliffs. Iceland possesses neither reptiles nor batrachians. The fish fauna is abundant in individuals, some sixty-eight species being found off the coasts. The cod fisheries are amongst the most important in the world. Large quantities of herring, plaice, and halibut are also taken. Many of the rivers abound in salmon, and trout are plentiful in the lakes and streams.

Population and Occupations.—The census of 1890 gave a total population of 70,927, and this number had by the end of 1899 increased to 76,383. The increase during the 19th century was 27,000; to whom must be added at least 15,600 more, who have emigrated to America, chiefly to Manitoba, since 1872. The principal occupation of the Icelanders is breeding of cattle, more particularly the breeding of sheep, although during the last few years the fishing industries have come rapidly to the front. In 1850, 82 per cent. of the population were dependent upon cattle-breeding and 7 per cent. upon fishing; in 1890 the numbers were 64 per cent. and 18 per cent. respectively. Agriculture is, however, not now practised in Iceland; all bread-stuffs are imported. In ancient times barley was grown in some places, but it never paid for the cost of cultivation. The moist insular climate and the coolness of the summers are inimical to the cultivation of crops and the growth of forests. The breeding of cattle has declined in importance. In 1703 there were 35,860 head of cattle; in 1898, 21,982 head. On the other hand, the number of sheep has increased from 278,994 in 1703 to 735,442 in 1898. In the latter year there were 44,134 horses, relatively a large number, but then all travelling is done on horseback, and by the same means all goods are conveyed. Formerly gardening was of no importance, but considerable progress has been made in this branch of late years, especially in the cultivation of potatoes and turnips. In 1895 the harvest amounted to 67,400 bushels of potatoes and 61,750 bushels of turnips. Fruit-trees will not thrive; but black and red currants and rhubarb are grown, the last-named doing excellently well. Iceland possesses four agricultural schools, one agricultural society, and small agricultural associations in nearly every district. The fisheries give employment to about 12,000 people. For the most part the fishing is carried on from open boats, notwithstanding the dangers of so stormy a coast, especially in winter, and many lives are lost every year. But during recent years the fishermen have begun to use larger decked vessels, and these boats are increasing in number every season. In summer the waters are visited by a great number of foreign fishermen, inclusive of about 300 fishing-boats from French ports, manned by about 5000 men, as well as in the last years by fishing-boats from the Faröes and Norway and steam trawlers from England. Excellent profit is made in certain parts of the island from the herring fishery; this is especially the case on the east coast. Marine insurance societies and a school of navigation have been founded at Reykjavik. The export of fish and fish products has greatly increased. For instance, in 1849–55 the annual average exported was 1480 tons; in 1891–94 it was 10,800 tons, valued at £215,000; and in 1899 amounted to 11,339 tons and 68,079 barrels of oil, valued at £276,596.

Commerce.—From the first colonization of the island down to the 14th century the trade was in the hands of native Icelanders and Norsemen; in the 15th century it was chiefly in the hands of the English, in the 16th of

Germans from the Hanse towns. From 1602 to 1786 commerce was a monopoly of the Danish Government; in the latter year it was declared free to all Danish subjects, and in 1854 free to all nations. Since the year 1874, when Iceland obtained her own administration and the arrangement of her own finances, both the general comfort of the people and the commerce have increased considerably. The total value of the imports and exports together amounted in 1849 to not more than £170,000; in the years 1881–85 the annual average value of the imports alone amounted to £340,000, and of the exports to £310,000; whilst in 1891–95 the imports averaged £356,000, and the exports £340,000. In the year 1899 the imports were valued at £458,500, and the exports at £426,900, or a total of £885,400. That is to say, since 1849 the value of the aggregate trade has increased by £715,400, and is now more than five times greater than when free trade was introduced. The principal native products exported are live sheep, horses, salt meat, wool and woollen wares, and hides, to which must be added the fish products—cod, train-oil, herring, and salmon —and eiderdown feathers, &c. The imports consist principally of cereals and flour, coffee, sugar, ale, wines and spirits, tobacco, manufactured wares, iron and metal wares, timber, salt, coal, &c. In the year 1898 there were in Iceland 204 merchants' businesses, of which 156 belonged to Icelanders, and 48 to Danes and foreigners; in addition several co-operative societies buy considerable quantities of goods in England through commission agents. In 1899 the shipping which entered at Icelandic ports was represented by 380 vessels of 70,359 tons (199 steamships of 54,228 tons and 181 sailing vessels of 16,131 tons); of which 82 of 18,357 tons came from Denmark, 179 of 30,000 tons from Great Britain, and 69 of 10,725 tons from Norway. The money, weights, and measures in use are the same as in Denmark. The National Bank in Reykjavik issues bank-notes, though not beyond £41,670 in value.

Communications.—In so sparsely inhabited a country the means of communication have always been primitive. All land journeys are made on horseback, and in the remoter parts all goods have to be transported by the same means. Throughout the greater part of the island there exist no proper roads even in the inhabited districts, only bridle-paths. In the uninhabited districts there are not even bridle-paths. Nevertheless a good deal has been done to improve such paths as there are, and even several miles of driving roads have been made, more particularly in the south. Since 1888 many bridges have been built; previous to that year there were none at all. The larger rivers have been spanned by iron swing bridges, as, for example, Oelfusá and Thjórsá, and Blanda is now crossed by a fixed iron bridge. Great progress has also been made in the steamboat services round the coasts and with foreign countries. Postal connexion is maintained with Denmark by steamboats, which sail from Copenhagen eighteen times a year, and put in at Leith on the way. Besides, steamers go all round the island, touching at nearly every port.

Religion.—The Icelanders are Lutherans. For ecclesiastical purposes the island is divided into 20 deaneries and 142 parishes, and the affairs of each ecclesiastical parish are administered by a parish council, and in each deanery by a district (*hjerað*) council. When a living falls vacant, the governor-general of the island, after consultation with the bishop, selects three candidates, and from these the congregation chooses one, the election being subsequently confirmed by the governor-general. In the case of certain livings, however, the election requires confirmation by the Crown. In 1847 a theological seminary was founded at Reykjavik, and there the majority of the Icelandic ministry are educated; some, however, are graduates of the University of Copenhagen.

The *public health* has shown great improvement; the death-rate of little children has in especial diminished very appreciably. This improvement is due to greater cleanliness, better dwellings, better nourishment, and the increase in the number of doctors and midwives, who are now scattered all over the country, whereas formerly there was scarcely a doctor to be found from one end of the island to another. A new asylum for leprosy has been erected at Laugarnes near Reykjavik. There is a medical school at Reykjavik, opened in 1876. The general sanitary affairs of the island are under the control of a chief surgeon (national physician), who lives in Reykjavik, and also has the superintendence over the doctors and the medical school. There are at the present time twenty permanently appointed district surgeons, besides sixteen assistant surgeons, a state oculist, four small hospitals, and four dispensaries. Midwives are required to attend a course of lectures at the medical school.

Administration and Finances.—There was no change of any importance in the administrative relations during the last twenty-five years of the 19th century. But in 1902 it was arranged that the minister for Iceland should transfer his office from Copenhagen to Reykjavik. Iceland has her own budget, the Althing having, by the constitution of 1874, acquired the right to vote its own supplies. The Althing only meets every other year, and the budget is consequently passed for two years at once. In the financial period 1896–97 the total income was £67,200, the expenditure £67,300. There is a national reserve fund of about £60,000, but no public debt; nor is there any contribution for either military or naval purposes. Iceland has her own customs service, but the only import duties levied are upon spirits, tobacco, coffee, and sugar, and in each case the duties are fairly low. During recent years one-quarter of the national income has been spent upon the means of communication—subventions to the steamboat service round the coasts, and for the building of bridges and the making of roads. In Reykjavik there is a national bank, and there are numerous small savings banks in various parts of the island.

Education.—Notwithstanding that there are still only a few elementary schools in the towns, in the fishing villages, and in certain more densely inhabited parts of the island, education is pretty widespread amongst the people. Very often the children are instructed at home; in some places by peripatetic teachers. It is incumbent upon the clergy to see that all children are taught to read, and write, and "sum." The people are great readers; considering the number of the inhabitants, books and periodicals have a very extensive circulation. At the present time eighteen newspapers are issued (once and twice a week), besides several journals. Iceland has always been distinguished for her native literature. At Reykjavik there are a Latin school, a medical school, and a theological school; at Mödruvellir and Hafnarfjörður, modern high schools (*realschulen*); and in addition to these there are four agricultural schools, a school of navigation, and three girls' schools. The largest collection of books is the national library at Reykjavik, containing some 40,000 volumes and 3000 MSS. At the same place there is also a valuable archæological collection. Amongst the learned societies may be mentioned the Icelandic Literary Society (*Bokmentafjelag*) and the Society of the Friends of the People, as well as the Archæological Society of Reykjavik.

Towns.—There are several small towns scattered along the coasts. The largest is Reykjavik on Faxaflói, with

6700 inhabitants (1900), the capital of the island, and the place of residence of the governor-general and the bishop. There, too, the Icelandic Parliament (Althing) meets; and there, further, are the principal public institutions of the island (library, schools, &c.). The town is adorned by a statue to Thorvaldsen, the famous sculptor, who was of Icelandic descent. The remaining towns embrace Isafjörður (1000) on the north-west peninsula, Akureyri (1000) on the north, and Seydisfjörður (800) in the east. The total urban population was 14,705 inhabitants in 1899. (TH. T.)

LITERATURE.

The literature of Iceland since 1874 has been in a more flourishing state than ever before since the 13th century. Lyrical poetry is by far the largest and the most interesting portion of it. The great influence of Jónas Hallgrímsson (1807–1845) is still felt, and his school was the reigning one up to the end of the 19th century, although then a change seemed to be in sight. The most successful poet of this school is Steingrímr Thorsteinsson (born 1830). He is specially famous for his splendid descriptions of scenery (*The Song of Gilsbakki*), his love-songs, and his sarcastic epigrams. As a translator he has enriched the literature with *The Arabian Nights*, *Sakuntala*, *King Lear*, and several other masterpieces of foreign literature. Equal in fame is Matthías Jochumsson (born 1835), who, following another of Jónas Hallgrímsson's many ways, has successfully revived the old metres of the classical Icelandic poets, whom he resembles in his majestic, but sometimes too gorgeous, language. He is as an artist inferior to Steingrímr Thorsteinsson, but surpasses him in bold flight of imagination. He has successfully treated subjects from Icelandic history (*Grettisljóð*, a series of poems about the famous outlaw Grettir). His chief fault is a certain carelessness in writing; he can never write a bad poem, but rarely a poem absolutely flawless. He has translated Tegnér's *Frithiofs Saga*, several plays of Shakespeare, and some other foreign masterpieces. The great religious poet of Iceland, Hallgrímr Pétursson, has found a worthy successor in Valdimar Briem (born 1848), whose *Songs of the Bible* are deservedly popular. He is like Matthías Jochumsson in the copious flow of his rhetoric; some of his poems are perfect both as regards form and contents, but he sometimes neglects the latter while polishing the former. An interesting position is occupied by Benedict Gröndal (born 1826), whose travesties of the old romantic stories,[1] and his truly Aristophanic drama *Gandreiðin* ("The Magic Ride") about contemporary events, are among the best satirical and humorous productions of Icelandic literature. Most of his works belong, however, to the period before 1874; after that time he is chiefly known as a miscellaneous writer.

Influenced by Jónas Hallgrímsson with regard to language and poetic diction, but keeping unbroken the traditions of Icelandic mediæval poetry maintained by Sigurðr Breiðfjörð (1798–1846), is another school of poets, very unlike the first. In the middle of the 19th century this school was best represented by Hjálmar Jónsson from Bóla (1796–1875), a poor farmer without any education to speak of, but endowed with great poetical talents, and the author of satirical verses not inferior to those of Juvenal both in force and coarseness. In the last decades of the 19th century this school produced two poets of a very high order, both distinctly original and Icelandic, and comparatively free from any foreign influence. One is Páll Olafsson (born 1827). His songs are mostly written in the mediæval quatrains (*ferskeytla*), and are generally of a humorous and satirical character; his convivial songs are known by heart by every modern Icelander; and although some of the poets of the present day are more admired, there is none who is more loved by the people at large. The other is Þorsteinn Erlingsson (born 1858). His exquisite satirical songs, in an easy and elegant, but still manly and splendid language, have raised much discussion. Of his poems may be mentioned *The Oath*, a series of most beautiful ballads, with a tragical love-story of the 17th century as their base, but with many and happy satirical allusions to modern life; *Jörundr*, a long poem about the convict king, the Danish pirate Jörgensen, who nearly succeeded in making himself the master of Iceland, and *The Fate of the Gods* and *The Men of the West* (the Americans), two poems which, with their anti-clerical and half-socialistic tendencies, have caused strong protests from some of the orthodox Lutheran clergy. Near to this school, but still standing apart, is Grímur Thomsen (born 1820).

In the beginning of the 'eighties a new school arose—having its origin in the colony of Icelandic students at the University of Copenhagen. They had all attended the lectures of Georg Brandes, the great reformer of Scandinavian literature, and, influenced by his literary theories, they chose their models in the realistic school, which then gradually was becoming the reigning one in all the Scandinavian countries. This school is very dissimilar from the half-romantic school of Jónas Hallgrímsson; it is nearer the national Icelandic school represented by Páll Olafsson and Þorsteinn Erlingsson, but differs from those writers by introducing foreign elements hitherto unknown in Icelandic literature, and—especially in the case of the prose-writers—by imitating closely the style and manner of some of the great Norwegian novelists. Their influence brought the Icelandic literature into new roads, and it is interesting to see how the tough Icelandic element gradually assimilates the foreign. Of the lyrical poets, Hannes Hafsteinn (born 1861) is by far the most important. In his splendid ballad, *The Death of Skarphedinn*, and in his beautiful series of songs describing a voyage through some of the most picturesque parts of Iceland, he is entirely original; but in his love-songs, beautiful as many of them are, a strong foreign influence can be observed. Among the innovations of this poet we may note a predilection for new metres, sometimes adopted from foreign languages, sometimes invented by himself, a thing practised rarely and generally with small success by the Icelandic poets, who as a rule are extremely conservative in that respect, and generally keep to the metres used by their predecessors.

No Icelandic novelist has as yet equalled Jón Thóroddsen (1819–1868). The influence of the realistic school has of late been predominant. The most distinguished writer of that school has been Gestur Pálsson (1852–1891), whose short stories, with their sharp and biting satire, have produced many imitations in Iceland. The best are *A Home of Love* and *Captain Sigurd*. Jónas Jónasson (born 1856), a clergyman of northern Iceland, has, in a series of novels and short stories, given accurate, but somewhat dry, descriptions of the more gloomy sides of Icelandic country life. His best novel is *Randíðr from Hvassafell*, a historical novel of the Middle Ages. Besides these we may mention Torfhildur Hólm, one of the few ladies who have distinguished themselves in Icelandic literature. Her novels are mostly historical.

The drama is still in its infancy, but the last decade of the 19th century saw the establishment of a permanent theatre at Reykjavík. The poet Matthías Jochumsson has written several dramas, but their chief merits are lyrical. The most successful of Icelandic dramatists as yet is Indriði Einarsson, whose plays, chiefly historical, in spite

[1] *E.g.*, "The Battle of the Plains of Death," a burlesque on the battle of Solferino.

of excessive rhetoric, are very interesting, and possess a true dramatic spirit.

In geography and geology Þorvaldr Thoroddsen has acquired a European fame for his researches and travels in Iceland, especially in the rarely-visited interior. Of his numerous works in Icelandic, Danish, and German, we may mention the *History of Icelandic Geography*, a monumental work. In history Páll Melsteð's (born 1812) chief work, the large *History of the World*, belongs to this period, and its pure style has had a beneficial influence upon modern Icelandic prose.

Of the younger historians we may mention Þorkell Bjarnason (*History of the Reformation in Iceland*). Jón Þorkelsson (born 1822), inspector of the archives of Iceland, has rendered great services to the study of Icelandic history and literature by his editions of the *Diplomatarium Islandicum* and *Obituarium Islandicum*, and by his *Icelandic Poetry in the 15th and 16th Century*, written in Danish, an indispensable work for any student of that period. A leading position among Icelandic lexicographers is occupied by Jón Þorkelsson, formerly head of the Latin school at Reykjavik, whose *Supplement til islandske Ordbøger*, an Icelandic-Danish vocabulary (three separate collections), has hardly been equalled in learning and accuracy. Other distinguished philologists are his successor as head of the Latin school, Björn Magnússon Olsen (*Researches on Sturlunga, Ari the Wise, The Runes in the Old Icelandic Literature*—the last two works in Danish); Finnur Jónsson, professor at the University of Copenhagen (*History of the Old Norwegian and Icelandic Literature*, in Danish, and excellent editions of many old Icelandic classical works); and Valtýr Guðmundsson, lecturer at the University of Copenhagen (several works on the old architecture of Scandinavia) and editor of the influential Icelandic literary and political review, *Eimreiðin* ("The Locomotive").

The English reader can be referred to no authorities on recent Icelandic literature in his own language, but he will find interesting information in the following German works:—J. C. Poestion. *Isländische Dichter der Neuzeit.* Leipzig, 1897.—C. Küchler. *Geschichte der isländischen Dichtung der Neuzeit.* Leipzig, 1896. —Ph. Schweitzer. *Island; Land und Leute.* Leipzig, 1885.— Alexander Baumgartner. *Island und die Faroer.* Freiburg-im-Breisgau, 1889. (S. Bl.)

Ichang, a treaty port in the province of Hupeh, China, on the left bank of the Yangtse, of which it is the present upper limit of steam navigation. It is distant 400 miles from Hankow, and consequently about 1000 miles from Shanghai. All cargo to or from Szechuen is here transhipped from steamer to junk, or *vice versâ*. About 10 miles above Ichang the famed scenery of the Yangtse gorges begins. Through these the great river runs in a series of rapids, which make navigation by vessels of any size extremely difficult and even dangerous. A very large trade, nevertheless, is carried on by this route between Chungking and Ichang. As a local centre of distribution this port is of no great consequence, the transhipment trade with Szechuen being almost its sole business. The population is estimated at 35,000. The number of foreign residents is very small, trade being carried on by Chinese agents. The total trade of the port amounted in 1899 to £4,675,000, and in 1900 to £3,741,500, as compared with £1,025,800 in 1891, the principal import being cotton yarn and the principal export opium.

ICHTHYOLOGY.

The activity that prevailed in the field of ichthyology during the last two decades of the 19th century has not been surpassed in any of the other branches of zoology. In those contributions which were of a systematic or descriptive character so many additions have been made to the list of generic and specific forms that the number of known species of living fishes, which in the year 1870 was stated to have been about 8525, has since then been nearly doubled. Our acquaintance with the fish-faunas of all the geographical regions has made proportionate progress, especially in the case of North America and tropical Africa, while the use of the deep-sea trawl, with its many improvements, as well as of other instruments of capture, partly in previously unexplored oceans, has brought to light an astonishing number of new forms of oceanic fishes. There is scarcely any part of the organization of fishes which has not been made the subject of investigation by the morphologist with the view of clearing up the genetic relations of the various types. Researches into the development of the ova, and of the larval and post-larval stages, particularly of economic and oceanic fishes, have been stimulated by their important bearing upon the interests of the fishing industries. Finally, palæontological inquiries, undertaken with due reference to living forms, have resulted in important discoveries, filling up gaps in the imperfect geological record, and leading towards a better understanding of the line of evolution of certain types. In this supplementary article only some of the most important results can be dealt with, and they will be referred to in the same sequence which was adopted for the article in the earlier volumes (xii.) of the *Ency. Brit.* (ninth edition).

The systematic arrangement under which the class of fishes was presented to the student at the end of the historical sketch in the former article, and which is chiefly based on the anatomical characters demonstrated by Johannes Müller, has met with scanty acceptance from ichthyologists. It ceased to satisfy the demands of the morphologist when it was found that the heart of *Albula* and the intestine of *Chirocentrus* showed conditions capable of being interpreted as transitional characters connecting Ganoids with Teleosteans. To the palæontologist a wide separation of these two types was still less acceptable, since it was made dependent on soft structures not capable of fossilization, and therefore not available in the study of fossils. Moreover, palæontology claims to be able to demonstrate from fossil remains a continuity of the series from Ganoid to Teleostean, or, in other words, a direct genetic relationship of these types. Thus the view taken by Owen in 1866, and yet more distinctly expressed by Lütken in 1868, has been resuscitated in the most recent classification, even with the term proposed by the former for the assemblage of Ganoids and Teleosteans, viz., *Teleostomi*.

Arrangement.

The separation of *Branchiostoma* into a class distinct from that of *Pisces*—*Acrania*—which has been proposed by Haeckel, is a view now generally adopted. Cope has gone a step farther, and similarly separated the *Cyclostomi* and the extinct Ostracoderms in a class of vertebrates which he has named *Agnatha*, and which would be characterized by the want of paired fins and the supposed total absence of a lower jaw. In the class of fishes proper four types are distinguished by the presence or absence of a suspensorium, and by the development of cranial dermal ossifications and of an osseous gill-cover. Weighty objections against the class *Agnatha* have been raised by several

ichthyologists, especially by R. H. Traquair, but the Copean arrangement has been adopted in the main by Smith Woodward. These palæichthyologists are also agreed as to the Chondropterygian affinities of the *Acanthodii*, which formerly had been provisionally placed among the Ganoids, or were regarded as an annectent type between Ganoids and Chondropterygians. As far as the main divisions of extinct and living *Cyclostomi* and *Palæichthyes* are concerned, the systematic arrangement, modified by Traquair's recent researches into the Ostracoderms, appears as follows :—

Class : **Agnatha.**
- I. Subclass : CYCLOSTOMI.
  With three Orders : (*a*) *Hyperoartia* (Lampreys) ; (*b*) *Hyperotreti* (Myxinoids) ; (*c*) *Cycliæ* (Palæospondylus).
- II. Subclass : OSTRACODERMI.
  With four Orders : (*a*) *Heterostraci* (Cœlolepidæ, Psammosteidæ, Drepanaspidæ, Pteraspidæ) ; (*b*) *Osteostraci* (Cephalaspidæ, Ateleaspidæ, &c.) ; (*c*) *Antiarchi* (Asterolepidæ, Pterichthys, Bothrolepis, &c.) ; (*d*) *Anaspida* (Birkeniidæ).

Class : **Pisces.**
- I. Subclass : ELASMOBRANCHII.
  With four Orders : (*a*) *Pleuropterygii* (Cladoselache) ; (*b*) *Ichthyotomi* (Pleuracanthidæ) ; (*c*) *Acanthodii* (Diplacanthidæ and Acanthodidæ) ; (*d*) *Selachii* (divided from the structure of the vertebral centres into Asterospondyli and Tectospondyli).
- II. Subclass : HOLOCEPHALI.
  With one Order : *Chimæroidei.*
- III. Subclass : DIPNOI.
  With two Orders : (*a*) *Sirenoidei* (Lepidosiren, Ceratodus, Uronemidæ, Ctenodontidæ) ; (*b*) *Arthrodira* (Homosteus, Coccosteus, Dinichthys).
- IV. Subclass : TELEOSTOMI.
  - *A.* Order : *Crossopterygii.*
    With four Suborders : (1) *Haplistia* (Tarassius) ; (2) *Rhipidistia* (Holoptychiidæ, Rhizodontidæ, Osteolepidæ) ; (3) *Actinistia* (Cœlacanthidæ) ; (4) *Cladistia* (Polypterus).
  - *B.* Order : *Actinopterygii.*
    With about twenty Suborders : (1) *Chondrostei* (Palæoniscidæ, Platysomidæ, Chondrosteidæ, Sturgeons) ; (2) *Protospondyli* (Semionotidæ, Macrosemiidæ, Pycnodontidæ, Eugnathidæ, Amiidæ, Pachycormidæ) ; (3) *Aetheospondyli* (Aspidorhynchidæ, Lepidosteidæ) ; (4) *Isospondyli* (Pholidophoridæ, Osteoglossidæ, Clupeidæ, Leptolepidæ, &c.) ; (5) *Plectospondyli* (Cyprinidæ, Characinidæ) ; (6) *Nematognathi* ; (7) *Apodes ;* and the other Teleosteans.

Morphological and Anatomical Work.

Of the contributions to our knowledge of the morphology of fishes, none perhaps claim a higher interest than those dealing with the origin and evolution of the paired fins. Guided by the hypothetical analogy to the origin of the median fins, some morphologists (Thacker, Mivart, Dohrn, Wiedersheim) maintained that the paired fins were similarly evolved out of a lateral skin-fold, a theory which, from a palæontological point of view, has found strong support in the discovery of the structure of the paired fins of *Cladoselache* (B. Dean and S. Woodward) from the Upper Devonian, the most primitive type of shark as yet known. Also the paired series of abdominal spines of the Acanthodian, *Climatius*, is referred to as strongly suggesting an originally continuous fin-fold. The lateral fold is supposed to have been the continuation of the embryonic median fold, which on reaching the vent split into a right and left branch, and was supported by short parallel cartilaginous rods extending outwards from the body-wall. In the post-branchial and pelvic regions the fold with its cartilages broadened into fin-like flaps, while the intermediate portion disappeared. Such, indeed, is the condition of the fins in *Cladoselache*, in which these organs would not have served in locomotion, but had merely the function of "balancers" (*Ptychopterygium*) (Dean). In the

Fins.

further course of evolution, the archipterygial stage is reached by the fusion and shortening of the endoskeletal parts, the area of the fin being increased by the development of dermal rays, while, finally, the endoskeletal elements become correlated with the dermal rays, instead of with the axial skeleton. This view of the origin of the paired fins has been criticized by Semon and Gegenbaur, and certainly it has not been supported by the former's researches into the development of the fins in embryonal *Ceratodus*. According to Gegenbaur, the archipterygium is the most primitive form of fin. "An archipterygium has been the starting-point for the Crossopterygian fin as well as that of Selachians and Dipnoans; and each of these three divisions shows a modification of its own of a primitive condition which is now no more in existence, and of which palæontological evidence has hitherto not been forthcoming." According to Gegenbaur, the paired fins took their origin from the fusion of the cartilages of the posterior gill-bars, but he admits this to be merely a hypothesis (*Morphol. Jahrbuch*, xxii., 1895, pp. 119–160).

Dipnoi.—Owing to the supposed great rarity of *Lepidosiren paradoxa*, no advance was made in our knowledge of its morphology for some time after its first discovery. Many specimens, however, have more recently been obtained from Paraguay and the basin of the river Amazon, by which we have become acquainted with many new facts of its organization. J. Graham Kerr has studied the development of the ova and

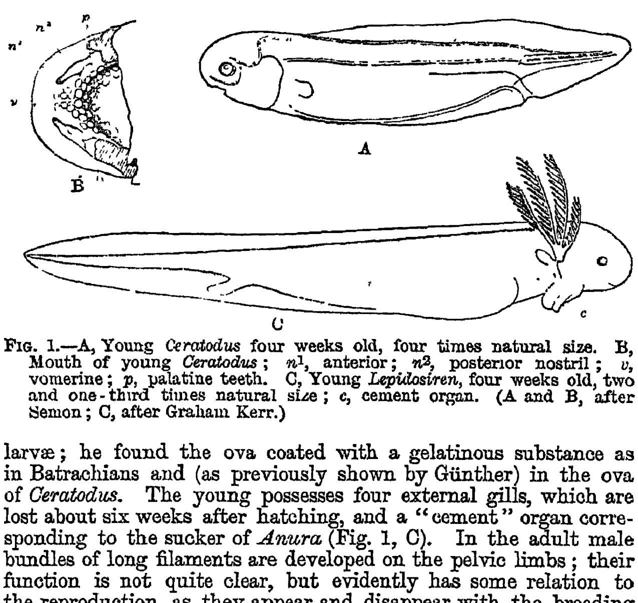


FIG. 1.—A, Young *Ceratodus* four weeks old, four times natural size. B, Mouth of young *Ceratodus* ; n^1, anterior ; n^2, posterior nostril ; *v*, vomerine ; *p*, palatine teeth. C, Young *Lepidosiren*, four weeks old, two and one-third times natural size ; *c*, cement organ. (A and B, after Semon ; C, after Graham Kerr.)

larvæ ; he found the ova coated with a gelatinous substance as in Batrachians and (as previously shown by Günther) in the ova of *Ceratodus*. The young possesses four external gills, which are lost about six weeks after hatching, and a "cement" organ corresponding to the sucker of *Anura* (Fig. 1, C). In the adult male bundles of long filaments are developed on the pelvic limbs ; their function is not quite clear, but evidently has some relation to the reproduction, as they appear and disappear with the breeding season. The morphology of the skull, and its comparison with that of other *Dipnoi*, is the subject of an elaborate paper by T. W. Bridge. *Ceratodus* also has received due attention on the part of morphology. W. Baldwin Spencer has examined in detail the arterial and venous system, pointing out its agreement in some respects with the Piscine, in others with the Batrachian type. R. Semon has collected valuable materials, and completed his researches into the external portion of the development, and into the development of the paired fins. The young of *Ceratodus* do not possess either external gills or a cement organ. In a larva four weeks old the pectoral limb projects as a short button-like flap, and the pelvic limb makes its first appearance fully a fortnight later. At that age the vomerine and palatine teeth commence to show as rounded tubercles, the latter about six in number on each side, quite distinct from one another, but corresponding to the prongs of the fully-developed tooth (Fig. 1, A, B).

Amia.—The morphology of *Amia*, particularly with regard to its cranial osteology, has been made the subject of detailed investigation by T. W. Bridge (1877), J. van Wijhe (1882), M. Sagemehl (1883), R. W. Shufeldt (1885), L. Schmidt (1892), and E. P. Allis (1897–1898). Sagemehl views the skull of *Amia* as a direct advance of conditions which already obtain in the Selachian skull, more especially in that of the *Notidanidæ*, the least differentiated type of sharks. Speaking of the skeleton generally, Shufeldt maintains that although it possesses many of the characters in common with Teleosteans, it is, on the other hand, still stamped with characters,

more particularly in its vertebral column, of a veritable palæoichthyic type.

Ostariophysi.—The peculiar communication between the auditory organ and the air-bladder, which from its discoverer has been named "Weber's Apparatus," is considered by Sagemehl (*Morphol. Jahrb.*, 1884) to indicate a genetic relationship of the four families which possess it (*Siluridæ, Cyprinidæ, Characinidæ, Gymnotidæ*). They constitute a separate division among Teleosteans, for which he proposes the name *Ostariophysi.* He also points out the many resemblances of the *Erythrinina* to *Amia*, from which he draws the inference that the ancestor of the Characines could not have been very remote from that Ganoid.

Brain.

The results of the morphological researches into the structure of the brain may be summarized thus:—The brain of fishes is characterized (1) by its relatively small size; (2) by the thinness of the walls of the neural tube, with tumour-like swellings of certain parts, and, accordingly, by the great width of the ventricles; (3) by greatly developed *Lobi inferiores;* and (4) by extensive areas of the neural tube retaining their epithelial condition, for instance, the median zone of the cerebellum. Lampreys possess a brain of the lowest type: the *bulbi olfactorii* are sessile, and pass directly into the prosencephalon, no *lobi optici* or cerebellum have been differentiated, and the roof of the brain has retained its purely epithelial character. This low condition is approached by the lowest forms of sharks and the sturgeons, although it shows in these fishes an advance by the differentiation of a cerebellum without folds. In the higher forms of sharks the ventricles are much reduced and the cerebellum shows an asymmetrical and much complicated structure. The differences which are to be observed in the various types are due to the varying position of the eyes and nostrils (*Chimæra, Cestracion, Raja*) or to the general configuration of the head (*Zygæna, Myliobatis*). Brains like that of *Isistius* represent by the form of their prosencephalon a transition to the cerebrum of *Acipenser*, *i.e.*, that of Teleosteans (Burckhardt). Whilst the brain of the *Holocephali* is only a Selachian brain slightly modified, that of *Dipnoi* approaches closely the brain of *Polypterus.* The brain of the *Ganoidei ossei* shows different grades of development, and Goronowitsch has demonstrated that they gradually lead to the Teleostean brain. In the latter only a few characters can be recognized as common to all the members of the subclass: the centres of the prosencephalon are greatly reduced and covered by a purely epithelial layer (Rabl-Rückhard); the optic lobes, on the other hand, are highly differentiated, and the cerebellum, although unpaired externally, is paired in internal structure and in development (Schäfer). Folds of the cerebellum lead to the formation of a portion of the so-called *valvula cerebelli*, which is homologous to a portion of the Selachian cerebellum. The *Scombridæ, Siluridæ, Gymnotidæ*, and *Mormyridæ* are families in which the brain shows a particularly high grade of development. In *Pleuronectidæ* the brain takes no part in the asymmetry of the head.

Lateral line system.

The lateral line system has been examined by many morphologists, from its most primitive condition in certain Selachians to its most highly specialized forms in bathybial Teleosteans, viz., by Solger (1880), G. Fritsch (1886), and Garman (1888) in Plagiostomes and Chimæra; by Allis (1889) and Collinge (1894) in Ganoids; by Sède de Licoux (1884) and Guitel (1891) in Teleosteans; and finally by Garman (1899) in deep-sea fishes. The last-named author comes to the conclusion that although in its inception the lateral canal system was tactile in function, and continues to be so in its primitive forms, the additional and very complex apparatus present in many bathybial fishes has assumed other functions; in them it acts as an illuminating and electrical organ, as an organ by means of which "the species or the sex of the individual is recognized, the members of the school are kept together, the prey is captured, and the enemy avoided," probably acting also as an organ of taste.

Morphologists seem now to be agreed as to the physiological function of the so-called *phosphorescent* or *luminous* organs. They prove to be more generally distributed among oceanic fishes than was previously known. Johann and Burckhardt have demonstrated their presence in a number of sharks, all of which, however, belong to the family *Spinacidæ.* These organs are extensively distributed over the lower half of the body, similar in structure in all the various species, and exhibit a primitive type of development. Singularly, they are found in the pelagic genera of *Spinacidæ*, and seem to be absent in the bathybial (*Centrophorus*).

Trophonematous gestation.

In some viviparous Chondropterygians (*Spinax niger, Scymnus lichia, Centrina, Acanthias vulgaris, Torpedo oculata, Trygon pastinaca, Myliobatis aquila*) the mucous membrane of the uterine dilatation of the oviduct has been observed to be beset with glandular villi, which in some cases were supposed to bear a relation to the nutrition of the embryo. However, views on this matter were very vague until Wood-Mason and Alcock obtained in India fresh specimens in sufficient number to follow up the whole course of gestation. Their observations were made on species of *Pteroplatea, Trygon*, and *Myliobatis.* In these genera the embryo (or embryos) is destitute of any enveloping membrane, and is free in the uterus. At the earlier stage of development the embryo is attached to a large yolk-sac over which a cloud of delicate branchial filaments is spread, issuing from the gill-slits (not the spiracles). These filaments assist in absorbing the nutritive yolk. As this source of nutrition is consumed the yolk-sac and the branchial filaments disappear, but in their place there arise from the whole surface of the mucosa of the uterus those glandular villi which are now destined to supply a new nutriment to the embryo, and which have been named *trophonemata* (Fig. 2). Only those situated opposite to the spiracles of the embryo attain to full functional development, growing in a bunch into these openings. They secrete a milky fluid which reaches the pharynx through the spiracles. During this stage the stomach is not differentiated structurally or functionally; the milk passes through it, and is assimilated in the spiral gut.

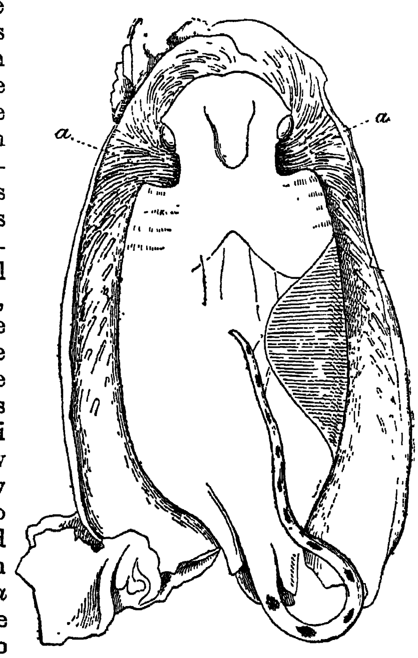


FIG. 2.—Gravid uterus of *Pteroplatea micrura*; *a*, bundles of trophonemata. (After Alcock.)

Reproduction of Cyclostomes. — The difference which obtains between *Hyperoartia* and *Hyperotreti* as regards their generative products has been known for a long time, but it has only recently been shown to extend also to the mode of their reproduction. Both *Myxine* and *Bdellostoma* are hermaphrodites, and, according to Nansen and J. T. Cunningham, the ova and sperm of *Myxine* ripen at different periods of life, each individual being a male first, and being transformed into a female at a more advanced age (protandric condition). The fertilization is not known.

Leptocephali.—The larval forms which are known under the name of *Leptocephalus* have been the subject of investigation by several Italian naturalists (Bellotti, Calandruccio, Facciola, Grassi); they generally confirm Gill's statement that the *Leptocephali* proper represent normal stages of development of *Murænidæ.* Those investigators claim to have demonstrated the Leptocephalid stage of nearly all the Mediterranean Murænoids, besides the Common Eel, the larva of which had been described as *Leptocephalus brevirostris.* It seems that the fishes of some of the other oceanic families of Teleosteans go through a similar Leptocephalid stage with the same embryonic characters. (See EEL.)

Faunistic Work.

Of the contributions by which our knowledge of the fish-fauna of certain regions has been advanced, the following may be specially referred to:—

Wallace's line.

In the Equatorial Zone two sections have been distinguished, one of the chief characteristics being the presence or absence of Cyprinoid fishes. The two sections are termed accordingly Cyprinoid and Acyprinoid divisions, the former including the African and Indian, the latter the Pacific and tropical American regions. As for other classes of animals, so for fresh-water fishes, the so-called Wallace's line was regarded as a sharp line

of demarcation between the two divisions, or more especially between the Indian and tropical Pacific faunas. Max Weber has now shown that, although the Cyprinoids offer a sufficiently distinctive character for those two faunas, Wallace's line has no significance in determining the boundary between them. The islands west of it owe the great variety of their truly Indian fish-fauna to their large size and to their longer connexion with the Indian continent, whence they also derived their Cyprinoids. On the other hand, the islands east of the line were separated at an earlier geological period, before Cyprinoids could reach them, and on account of their small size did not offer hydrographic conditions similarly favourable for the differentiation of a variety of forms. Celebes, the largest of these eastern islands, which at present would seem to be well adapted for the production of a rich fish-fauna, was formerly divided into several smaller islands, with short and insignificant rivers. Its fish-fauna is still very poor, but such as it is, and as Weber's collections have shown it to be, it bears the character of an impoverished Indian fauna, and therefore it cannot be referred to the Australian region.

African region.

With the opening up to civilization of the interior of tropical Africa many additions have been made to our knowledge of its fresh-water fishes; the list of described species has been nearly trebled. Differentiation, as far as specific, and even generic, characters are concerned, obtains in a high degree, and does not depend merely on locality. A surprising number of allied but clearly distinct species of the same genus may occur in the same river or lake, under identical physical conditions, as is shown in Boulenger's recent contributions on the fauna of Lake Tanganyika and the river Congo. This great variety is apparent especially in the families of *Mastacembelidæ*, *Chromides*, *Siluridæ*, and *Mormyri*, and reminds us of a similar abundance of fish life in the fresh waters of tropical America. However, numerous as these accessions to the fauna are, they have given no reason for modifying our views as to its general character, with one remarkable exception, viz., the occurrence in the extreme south of the continent of a species of the characteristically Antarctic genus *Galaxias*. The discovery even of a single representative of a genus limited to the Tasmanian, New Zealand, and Patagonian subregions is most significant, although it cannot affect our view that in all other respects the fish-fauna of South Africa is an impoverished branch of the African fauna generally.

Deep-sea fauna.

The deep-sea explorations which were undertaken subsequently to the *Challenger* expedition have largely extended our knowledge of the oceanic fish-fauna. Their results have been published in the magnificent works mentioned in the bibliographical notes. More than 600 true bathybial fishes are now known from depths of 1000 fathoms and more. Garman's list includes the names of about 1050 species of fishes that have been found below the 100-fathoms line, but this number seems to be excessive, since this author considers that individuals apparently identical, but captured at widely distant localities, should be specifically separated, although this "could hardly be done by the characters ordinarily used in specific diagnoses." Of the new forms many show points of special interest, but all are more or less nearly related to previously known types. A great deal of evidence (if such was needed) has been accumulated to show the gradual transition of the surface fauna into the bathybial. A much larger number of surface fishes than were known before have been met with in deep water (from 100 to 500 fathoms), *Pleuronectidæ* peculiar to deep water have been discovered, and in the Arctic regions certain bathybial types seem frequently to appear close to the surface. This intermingling of surface with bathybial fishes obtains chiefly on the slopes in the neighbourhood of land. As to the truly oceanic areas, Alexander Agassiz's experience is distinctly against the supposed existence of a "mid-water" fauna; he considers the zones intermediate between the 200-fathoms line and the bottom to be azoic. With regard to fishes, however, there is no reason why certain forms should not permanently inhabit intermediate zones, as pelagic fishes are free swimmers for nearly the whole of their life without being tied to the proximity of *terra firma*. The results of more recent explorations are not confirmatory of Agassiz's view.

The surmise that the depths of the ocean have been gradually peopled from the surface is supported by palæontology, and it is evident that this process continues to the present time. The Chalk and other Upper Cretaceous formations have yielded a number of deep-sea Teleosteans, such as *Berycidæ*, *Scopelidæ*, *Bathythrissidæ*, *Clupeidæ*, *Halosauridæ*. At the period when Physostomous fishes predominated we find that families of that type composed the fossil bathybial fauna; a few Anacanths were added to it when this type appeared in the early Tertiary period, and the highly modified eels were a still later immigration. In connexion with these notes on the bathybial fish-fauna, it should be mentioned that Alcock has found among the collections of the *Investigator* a Brotuline Ophidiid (*Saccogaster*), which is evidently viviparous, and naturally we may suppose that this peculiar form of propagation obtains also in other bathybial members of this group.

Systematic Work

Cyclostomi.—Among the multitude of new forms discovered in recent years the most remarkable is a small fossil from the Lower Old Red Sandstone of Scotland, which has been recognized by R. H. Traquair as the sole representative that has been preserved from geological times of the subclass *Cyclostomata*, and described by him under the name of *Palæospondylus gunni* (Fig. 3). It differs from all the other Cyclostomes by the calcification of its skeleton. The body is spindle-shaped, naked; the vertebral column formed by numerous ossified rings; abdominal portion with short neurals, caudal with long neurals and hæmals; brain-case complete, with a pair of trabeculo-palatine enlargements, and posterior (parachordal) auditory capsules of enormous size, terminating in front in a ring of calcified cirri which surround a large single nasal opening. The list of living Cyclostomes has also been enriched by the discovery on the coast of Chile of a remarkable form which differs from all the other known Lampreys in possessing large, well-developed, functional eyes. It has been described by L. Plate, and named *Macrophthalmia*.

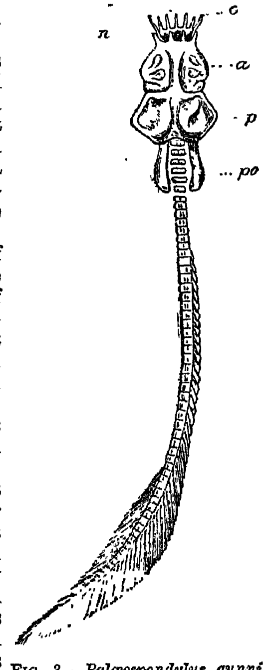


FIG. 3.—*Palæospondylus gunni.* (After Traquair.) *n*, Nasal opening surrounded by cirri (*c*); *a*, trabeculo-palatine part; *p*, parachordal part; *po*, post-occipital plates.

Ostracodermata.—In another recent contribution by R. H. Traquair our knowledge of the *Ostracodermata* is much advanced, certain genera which rested hitherto on very fragmentary evidence being made more fully known (*Thelodus*, *Drepanaspis*), while others (*Lanarkia*, *Ateleaspis*, *Birkenia*, and *Lanasius*) are new additions to this subclass. The last two prove to be types of a distinct order of Ostracoderms, *Anaspida*; they comprise small, laterally compressed fishes without paired fins, but with a single small dorsal and a heterocercal tail (Fig. 4). Both these genera are armed with a median ventral series of large spines. Their association with the Ostracoderms, however, is provisional, as they differ with regard to the structure of their dermal scutes (which are

developed in *Birkenia* at least) from the other members of this subclass. All these fossils belong to the fauna of the Scottish Silurian rocks.

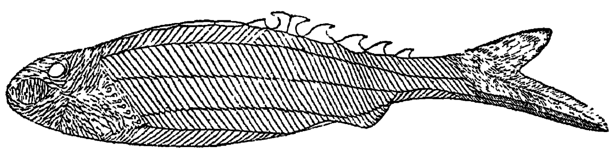


FIG. 4.—*Birkenia elegans.* (After Traquair.)

In the marl-shales of Gothland (Sweden) a form of *Cyathaspis* occurs, for which G. Lindström claims that it is not only the oldest fish, but the oldest vertebrate known; he refers that formation to the Lower Silurian.

Plagiostomata.—Among the Plagiostomes the genus *Cladoselache* (Fig. 5) from the Lower Carboniferous shales of Ohio claims special attention; it is one of the few fossil sharks whose structure is fairly well known, thanks to the labours of Dean and Smith Woodward, who consider it to be, with regard to its paired fins, the most

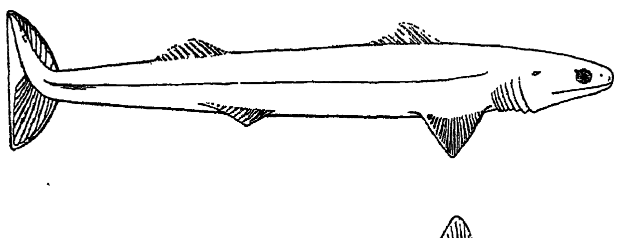


FIG. 5.—*Cladoselache fyleri.* (After Dean.)

primitive form of shark known, and the type of a separate "order," *Pleuropterygii.* The general form of the body is shark-like, but the mouth and nostrils are terminal; two dorsal fins, without spine; no claspers are developed in the ventral fins, which, like the pectorals, are believed to have had the merely initial function of "balancers"; notochord without calcification; teeth upon broad, multicuspid bases, several series functional at the same time.

The genus *Pleuracanthus* (*Xenacanthus*), although named from fragments long ago, is now known almost in its entirety, so that A. Fritsch has been enabled to represent it in a nearly complete restoration (Fig. 6). It proves to be one of the most important

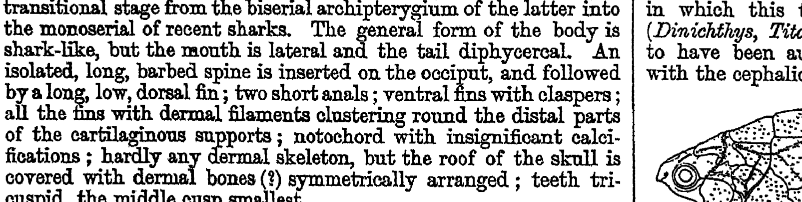


FIG. 6.—*Xenacanthus decheni.* *d*, Dorsal; *c*, caudal; a^1, a^2, anal fins. (After Fritsch.)

types connecting sharks with the Dipnoi, its pectoral fin being a transitional stage from the biserial archipterygium of the latter into the monoserial of recent sharks. The general form of the body is shark-like, but the mouth is lateral and the tail diphycercal. An isolated, long, barbed spine is inserted on the occiput, and followed by a long, low, dorsal fin; two short anals; ventral fins with claspers; all the fins with dermal filaments clustering round the distal parts of the cartilaginous supports; notochord with insignificant calcifications; hardly any dermal skeleton, but the roof of the skull is covered with dermal bones (?) symmetrically arranged; teeth tricuspid, the middle cusp smallest.

Chlamydoselache, a genus of the family of *Notidanidæ*, is the most remarkable addition to our knowledge of living sharks. It has greatly excited the attention of some naturalists, one regarding it as the oldest living type of vertebrata another making it the representative of a distinct suborder (*Selachophichthyoidei*), while to a third it has revealed the nature of the mysterious "sea-serpent." The gill-slits, six in number, are protected by broad dermal frills. The teeth are similar in both jaws, each consisting of three slender, curved cusps, separated by a pair of rudimentary denticles. According to Rose, the cusps represent separate teeth in the embryo, subsequently coalescing into a single tooth with broad bases. This shark has been associated with several extinct types, chiefly on account of its dentition. Its frilled gill-coverings remind one of a similar condition in *Cladoselache* and *Acanthodes;* but while it must be admitted to possess, like the other *Notidanidæ*, certain primitive features, it cannot be traced back farther than to teeth found in Pliocene strata of Tuscany. The history of its discovery is perhaps unique in ichthyology. Discovered first in a Japanese collection as a unique specimen in 1884, it was claimed to be a deep-sea shark in 1887—a surmise which proved to be correct when it was re-discovered off Madeira in 1889, and finally in the Varanger fjord in 1896. The habits of *Notidanus* are likewise bathybial.

A genus belonging to the family *Lamnidæ*, having the dentition of, and being generally closely allied to, *Odontaspis*, has been described from European Chalk formations and the Chalk of Mount Lebanon under the name of *Scapanorhynchus* (Fig. 7). It is distinguished

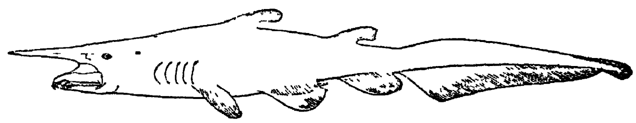


FIG. 7.—*Scapanorhynchus owstoni*, from Japan (After Jordan.)

by a peculiar prolongation of the rostrum into a long, pointed blade; it possesses distinct spiracles. This genus seems to have been a dominant type among the sharks of the Cretaceous seas, and scientific interest in it is increased by the fact that a species generically not separable from the fossil forms has recently been discovered living in Japanese seas.

Holocephali.—The small number of living Chimæras has received an addition by the discovery in the depths of the North-western Atlantic and the Japanese Sea of a form which has been described under the name of *Harriotta* (Fig. 8), and which is characterized

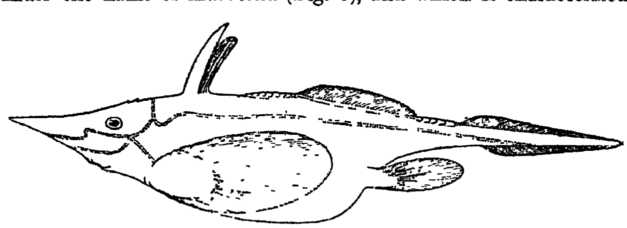


FIG. 8.—*Harriotta raleighana.* (After Goode and Bean.)

by a greatly elongated snout, the absence of a prehensile cephalic appendage, and very small rudimentary claspers. It should be remembered, however, that the two latter are secondary sexual characters, which are likewise in an undeveloped condition in the young stage of Chimæra.

Arthrodira.—The systematic position of the family *Coccosteidæ* is still rather doubtful. While Smith Woodward, with Cope, is inclined to refer them as a "suborder" to the Dipnoans, Dean considers that the existing evidence is equally in favour of their relationship to the sharks. However, much has been done towards a better knowledge of their organization. Traquair has worked out the details of the cranial, dorsal, and ventral armature of *Coccosteus* (Fig. 9) and *Homosteus* (Fig. 10) from the Old Red Sandstone of Scotland, while Newberry and Claypole have described a number of forms from passage beds between the Devonian and Carboniferous systems of North America, in which this type reached a gigantic size and development (*Dinichthys*, *Titanichthys*, *Mylostoma*, &c.). All these fishes seem to have been autostylic. The dorsal shield was so articulated with the cephalic as to admit of a considerable extent of vertical

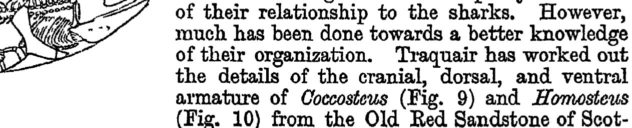


FIG. 9.—*Coccosteus decipiens.* (After Traquair.)

motion of the head (*Arthrodira*). Pectoral fins unknown, if present; tail probably diphycercal. Some of the American genera show a very distinct pineal foramen.

Chondrostei.—The structure of the Liassic genus *Chondrosteus* has been more completely made out, and its position more clearly defined. Traquair, who has paid much attention to this type,

considers that its affinities seem to radiate towards *Acipenser*, *Polyodon*, and the *Palæoniscidæ*, the distance from *Acipenser* being the least. It is confined to the Lias, while *Acipenser* and a fish allied to *Polyodon* (*Crossopholis*) have not yet been found in earlier than Eocene formations.

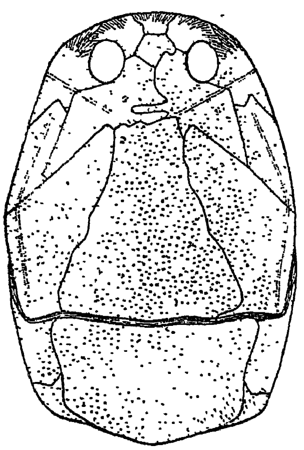


FIG. 10.—Cranial buckler of *Homosteus milleri*. (After Traquair.)

New Bathybial Fishes.—The following genera belong to the most striking additions to the fauna of the deep sea:—

Lopholatilus, a genus of *Trachinidæ*, distinguished by a large adipose flap on the nape in front of the dorsal fin, and a fleshy prolongation of the labial fold, extending beyond the angle of the mouth. Discovered in 1879, in from 70 to 130 fathoms of water, on the Atlantic coast of the United States, it attracted considerable attention by its sudden temporary disappearance, an immense number of individuals having been destroyed by climatic causes.

Rhodichthys, a genus of *Ophidiidæ*. Head thick, body or tail strongly compressed, the latter tapering, enveloped in a thin transparent, scaleless skin; vent immediately behind the humeral symphysis; snout swollen, overlapping the wide mouth; teeth in the jaws weak, none on the palate; eye of moderate size; ventrals reduced to two filaments, each bifid, and inserted on the hyoid; vertical fins continuous, but with caudal rays differentiated; gill-openings very wide; uniform bright red. Discovered by the Norwegian Expedition in the Arctic Ocean in 1280 fathoms.

Lamprogrammus, a genus of *Ophidiidæ*, distinguished by the extraordinary development of the lateral canal system. A series of luminous organs runs along the lateral line, each organ resting upon a very large scale, the whole being covered by the skin and a band of small scales much smaller than those of the body. No ventral fins. Three species are known, from depths of 400 to 700 fathoms, two being taken in the Indian Ocean by the *Investigator*, the third in the Gulf of Panama by the *Albatross*.

Sciadonus, a curious, Leptocephalus-like genus of *Ophidiidæ*. Snout very blunt; no eyes; vertical fins united at their bases, ventrals small, filaments close together, below the humeral symphysis; no cephalic spines; teeth small, in villiform bands; abdominal cavity long, with the vent far behind the head; bones of the head thin and soft. Obtained by the *Albatross* east of the Cocos Islands in 1010 fathoms.

Rondeletia, a scaleless genus of *Alepocephalidæ*. Body oblong, compressed; head very large; mouth wide; eyes of moderate size; teeth in the jaws in bands, coarsely granular; palate toothless; supra-occipital bones, with a pair of strong spines projecting forward over the orbits; dorsal and anal opposite; pectorals and ventrals small; no adipose fin; no lateral line; gills wide. Taken by the *Albatross* off the east coast of the United States in 960 to 1640 fathoms.

Cetomimus, another genus of *Alepocephalidæ*. Body moderately compressed, scaleless; mouth very wide; eyes very small; teeth in granular bands on all the bones of the mouth, tongue, and throat; dorsal and anal opposite; no adipose fin; pectorals short, ventrals none; lateral line consisting of two canals connected vertically by numerous transverse grooves; gills wide. Taken by the *Albatross* off the east coast of the United States in 1040 to 1530 fathoms.

Halimochirurgus (Fig. 11), a genus of *Sclerodermis*, distinguished

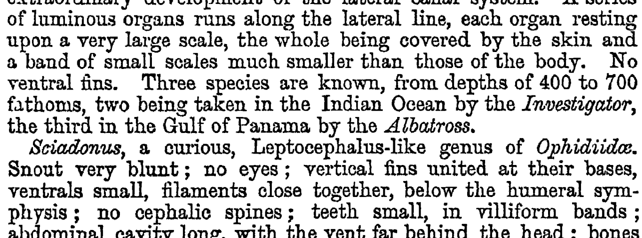


FIG. 11.—*Halimochirurgus centriscoides* (After Alcock.)

by its exceedingly long snout, which forms a curved tube with a short terminal mouth opening upwards. Tail short; a row of minute conical teeth in each jaw; eye large; two large dorsal spines, each ventral consisting of a huge spine articulating with the pelvic bone. This remarkable form is almost the only representative of the Scleroderms in the deep sea. It was captured by the *Investigator* off Cape Comorin in 143 fathoms.

AUTHORITIES.—The following selection from the extremely extensive ichthyological literature which has appeared during the period 1880–1900 will supplement the bibliographical notice in the former article. I. **The General Subject**:—B. DEAN. *Fishes, Living and Fossil.* New York, 1895.—II. **Palæontological**:—A. FRITSCH. *Fauna der Gas-Kohle und der Kalksteine der Permformation Böhmen's*, vols. i.–iii. Prague, 1879–94.—K. A. VON ZITTEL. *Handbuch der Palaeontologie*, vol. iii. Munich, 1887.—A. SMITH WOODWARD. *Catalogue of Fossil Fishes in the British Museum*, vols. i.–iii. London, 1889–95. The appearance of this work marks an epoch in ichthyological literature; when finished, it will be the most complete compendium of fossil fishes which has as yet been published. The concluding volumes will deal with the Teleosteans.—A. SMITH WOODWARD. *Outlines of Vertebrate Palæontology for Students of Zoology.* Cambridge, 1898.—E. D. COPE. "Synopsis of the Families of Vertebrata," *Amer. Natur.*, October 1889.—J. S. NEWBERRY. "The Palæozoic Fishes of North America," *Mon. U.S. Geol. Surv.*, vol. vi., 1890.—J. V. ROHON. "Die obersilurischen Fische von Oesel, Thyestidae und Tremataspidae," *Mém. Ac. Imp. Sc. St-Pétersb.*, xxxviii., 1892.—O. JAEKEL. *Die Selachier von Bolca, ein Beitrag zur Morphogenie der Wirbelthiere.* Berlin, 1894.—B. DEAN. "Contributions to the Morphology of Cladoselache," *Journ. Morphol.*, ix., 1894.—R. H. TRAQUAIR. "The Asterolepidæ," *Mon. Palæont. Soc.*, 1894; "Report on Fossil Fishes collected by the Geological Survey of Scotland in the Silurian Rocks of the South of Scotland," *Trans. Roy. Soc. Edin.*, xxxix., 1899.—L. DOLLO. "Sur la Phylogénie des Dipneustes," *Bull. Soc. Belge Géol.*, vol. ix., 1895. III. **Faunistic** (recent fishes):—A. *Great Britain.*—F. DAY. *The Fishes of Great Britain and Ireland*, 2 vols. London, 1880–84.—J. T. CUNNINGHAM. *The Natural History of the Marketable Marine Fishes of the British Islands.* London, 1896.—W. C. M'INTOSH and A. J. MASTERMAN. *The Life-Histories of the British Marine Food-Fishes.* London, 1897.—Numerous important researches into the development, life-conditions, and distributions, carried out at the Biological Laboratories at Plymouth and St Andrews and during the survey of the fishing grounds of Ireland, have been published by W. L. CALDERWOOD, J. T. CUNNINGHAM, E. W. L. HOLT, W. M'INTOSH, and PRINCE in the *Journ. Mar. Biolog. Assoc.*, *The Reports of the Fishery Board of Scotland*, *Scient. Trans. R. Dublin Soc.*, and other periodicals.—B. *Denmark and Scandinavia.*—W. LILLJEBORG. *Sveriges och Norges Fiskar*, 3 vols. Upsala, 1881–91.—F. A. SMITH. *A History of Scandinavian Fishes by B. Fries, C. U. Ekström, and C. Sundevall, with Plates by W. von Wright.* Second edition, revised and completed by F. A. S. Stockholm, 1892.—A. STUXBERG. *Sveriges och Norges Fiskar.* Göteborg, 1895.—C. G. J. PETERSEN. *Report of the Danish Biological Station.* Copenhagen, 1802–1900 (annual reports containing much information on fishes of and fishing in the Danish seas).—C. *Finland.*—G. SUNDMAN and A. J. MELA. *Finland's Fiskar.* Helsingfors, 1883–91.—D. *Germany.*—K. MÖBIUS and F. HEINCKE. "Die Fische der Ostsee," *Bericht Commiss. Untersuch. deutsch. Meere.* Kiel, 1883.—F. HEINCKE, E. EHRENBAUM, and G. DUNCKER have published their investigations into the life-history and development of the fishes of Helgoland in *Wissenschaftl. Meeresuntersuchungen.* Kiel and Leipzig, 1894–99.—E. *Switzerland.*—V. FATIO. *Faune des Vertébrés de la Suisse: Poissons*, 2 vols. Geneva and Basel, 1882–90.—F. *France.*—E. MOREAU. *Histoire naturelle des Poissons de la France*, 3 vols. Paris, 1881. *Supplement.* Paris, 1891.—G. *Pyrenean Peninsula.*—D. CARLOS DE BRAGANÇA. *Resultados das Investigações scientificas feitas a Bordo do Yacht "Amelia." Pescas maritimas. A Pesca do Atum no Algarve.* Lisbon, 1899.—H. *Italy and Mediterranean.*—P. DODERLEIN. *Manuale Ittiologico del Mediterraneo.* Palermo, 1881–91 (not completed; interrupted by the death of the author).—E. W. L. HOLT. "Recherches sur la réproduction des Poissons osseux, principalement dans le Golfe de Marseille," *Ann. Mus. Mars.*, V. Marseilles, 1899.—I. *Western and Central Asia.*—L. LORTET. "Poissons et Reptiles du Lac de Tibériade," *Arch. Mus. d'Hist. Nat. Lyon*, iii., 1883.—S. HERZENSTEIN. *Wissenschaftliche Resultate der von N. M. Przewalski nach Central Asien unternommenen Reisen: Fische.* St Petersburg, 1888–91 (in continuation).—G. RADDE, S. KAMENSKY, and F. F. KAWRAISKY have worked out the Cyprinoids and Salmonoids of the Caucasus. Tiflis, 1896–99.—J. *Japan.*—F. STEINDACHNER and L. DÖDERLEIN. "Beiträge zur Kenntniss der Fische Japans," *Denkschr. Ak. Wien*, vols. 67 and 68, 1883.—K. *East Indies.*—F. DAY. *The Fauna of British India. Fishes*, 2 vols. London, 1889 (chiefly an abridgment of the author's *Fishes of India*).—M. WEBER. "Die Süsswasserfische des Indischen Archipels," *Zool. Ergebnisse e. Reise in Niederl. Ostind.*, iii. Leyden, 1894.—L. *Africa.*—G. A. BOULENGER. *Matériaux pour la Faune du Congo: Poissons nouveaux.* Brussels, 1898–99 (in continuation).—G. PFEFFER. *Die Thierwelt Ostafrikas: Fische.* Berlin, 1896.—G. A. BOULENGER, A. GÜNTHER, G. PFEFFER, F. STEINDACHNER, and D. VINCIGUERRA have published numerous contri-

butions to the fish-fauna of tropical Africa in various periodicals.—M. *North America.*—D. S. JORDAN and B. W. EVERMANN. *The Fishes of North and Middle America*, 4 vols. Washington, 1896–1900.—D. S. JORDAN and C. H. GILBERT. "The Fishes of Bering Sea," in *Fur-Seals and Fur-Seal Islands.* Washington, 1899.—The U.S. FISH COMMISSION have continued to publish annually a *Report* and a *Bulletin*, containing a vast amount of information on North American fishes and every subject having a bearing on the fisheries of the United States.—N. *South America.*—C. H. and R. S. EIGENMANN. "A Catalogue of the Fresh-water Fishes of South America," *Proc. U.S. Nat. Mus.*, xiv. Washington, 1891.—The same authors, G. A. BOULENGER, F. STEINDACHNER, and C. BERG have published contributions in periodicals on this fauna.—O. *Australia.*—J. E. TENISON-WOODS. *Fish and Fisheries of New South Wales.* Sydney, 1882.—J. DOUGLAS-OGILBY and E. R. WAITE are authors of numerous papers on Australian fishes in *Proc. Linn. Soc. N. S. Wales.*—P. *Madagascar.*—H. E. SAUVAGE. *Histoire physique, naturelle et politique de Madagascar, par A. Grandidier*, xvi.: *Poissons.* Paris, 1891.—Q. *Oceanic Fishes.*—R. COLLETT. *Norske Nordhavs Expedition: Fiske.* Christiania, 1880.—C. F. LÜTKEN. *Dijmphna-Togtets Zoologisk-botaniske Udbytte: Kara-Havets Fiske.* Copenhagen, 1886.—L. VAILLANT. *Expéditions scientifiques du Travailleur et du Talisman: Poissons.* Paris, 1888.—A. AGASSIZ. *Three Cruises of the U.S. Coast and Geodetic Survey Steamer "Blake."* Boston and New York, 1888.—A. ALCOCK. *Illustrations of the Zoology of H.M.S. "Investigator": Fishes.* Calcutta, 1892–99 (in progress).—A. ALCOCK. *Descriptive Catalogue of the Indian Deep-sea Fishes in the Indian Museum.* Calcutta, 1899 (contains references to all the previous papers of the author on the subject).—R. COLLETT. *Résultats des Campagnes scientifiques accomplies par Albert I. Prince de Monaco: Poissons provenant des campagnes du Yacht "l'Hirondelle."* Monaco, 1896.—R. KOEHLER. *Résultats scientifiques de la Campagne du "Caudan."* Paris, 1896.—C. H. GILBERT and F. CRAMER. "Report on the Fishes dredged in Deep Water near the Hawaiian Islands," *Proc. U.S. Nat. Mus.*, xix. Washington, 1896.—G. B. GOODE and T. BEAN. *Oceanic Ichthyology.* Washington (1895), 1896.—C. LÜTKEN. "Spolia Atlantica," *Vidensk. Selsk. Skr.*, vii. and ix. Copenhagen, 1892–98.—C. LÜTKEN. *Danish Ingolf Expedition*, ii.: *Ichthyological Results.* Copenhagen, 1898.—S. GARMAN. "Reports on an Exploration off the West Coasts of Mexico, Central and South America, and off the Galapagos Islands in charge of Alexander Agassiz, by the U.S. Fish Commission Steamer *Albatross*, during 1891," *Mem. Mus. Comp. Zool.*, vol. xxiv. Cambridge, U.S.A., 1899. IV. **Anatomical and Morphological.**—A very useful and complete list, systematically arranged, of the extremely numerous contributions which would fall under this head, has been prepared by DEAN, *Fishes, Living and Fossil*, pp. 231–251. (A. GU.)

Idaho, one of the north-western states of the American Union, lying in the northern part of the inner mountain region of the Rocky Mountains and Cascade Range. Large tracts are still unexplored, and only a small portion of the land belonging to the United States has been surveyed. The Bitter Root and Priest River forest reserves occupy parts of the state. Lying wholly or partially in the state are the Fort Hall, Duck Valley, Lemhi, Cœur d'Alene, and Fort Lapwai (school) Indian reservations. United States land offices are situated at Boise, Hailey, Blackfoot, Lewiston, and Cœur d'Alene; federal military posts are at Boise, Fort Hall, and Cœur d'Alene (Fort Sherman). The climate is diverse and changeable. The mean annual temperature at Lewiston is 56°, at Boise 51°. In the lower valleys the temperature is seldom below zero in winter, but temperature of 100° is not unusual in summer; dark or cloudy days are exceptional. The annual rainfall in southern Idaho varies from 11 to 16 inches; in the summer months it is insufficient for most crops.

Population.—The population in 1890 was 84,385 (51,290 males and 33,095 females; 66,929 native and 17,456 foreign-born; 4223 Indians). The population in 1900 was 161,772, showing an increase of 91·7 per cent. for the decade. The total land surface is approximately 84,290 square miles, and the density per square mile was 1·9 in 1900, as compared with 1·0 ten years earlier. There were thirty-three incorporated cities, towns, or villages in 1900, of which five had a population exceeding 2000. These five were Boise with 5957, Pocatello with 4046, Lewiston with 2425, Moscow with 2484, and Wallace with 2265 inhabitants. Of the total population in 1900, 93,367 (57·7 per cent.) were males and 68,405 (42·3 per cent.) females; 137,168 native-born and 24,604 (15·2 per cent.) foreign-born; 154,495 were white and 7277 (4·5 per cent.) coloured, of whom 293 were negroes, 1467 Chinese, 1291 Japanese, and 4226 Indians.

Education.—The public educational system includes the University of Idaho at Moscow (389 students and 23 teachers); two normal schools, at Lewiston and Albion; the common schools of the 750 districts (31,884 students and 793 teachers); and the graded schools of about 25 "independent" districts. The percentage of illiterates is 5·14. In 1900 the number of persons of school age (5 to 20 years) was 54,964. Out of 53,932 males of voting age 2936 were illiterate (unable to write), of whom 781 were Chinese and Japanese and 970 were Indians. A few colleges and schools are maintained by religious denominations. Schools for the education of Indians are supported and administered by the Federal Government. The state penitentiary and a soldiers' home are situated at Boise, and an asylum for the insane at Blackfoot. Of eighty newspapers and periodicals published in 1899 in Idaho, five were daily, four semi-weekly, sixty-six weekly, one semi-monthly, and four monthly.

Religion.—In 1900 it was estimated that an aggregate of 35,000 communicants included 22,000 Mormons, 8000 Catholics, 1700 Methodists, 1200 Presbyterians, and 1000 Baptists.

Mining.—Mining, stock-grazing, and agriculture are the chief industries, though manufacturing, fisheries, and lumbering have been somewhat developed. Placer mining has been prosecuted profitably in the river valleys of every county in the state, and has been succeeded by extensive quartz-mining as the parent ledges of the placer deposits have been discovered. Though gold and silver are most mined, copper, lead, and iron constitute a large part of the mineral output. Opals and sapphires are the most common of the precious stones found in various parts of the state. Deposits of coal, mica, marble, sandstone, salt, and sulphur are also worked. Of lead, 61,239 tons were produced in 1898; of copper, 36,367 pounds were produced in 1893. The gold produced in 1895 was of the value of $1,779,600, in 1898, $1,895,566; silver in 1895, $4,021,780, in 1898, $6,796,541. In 1899 Idaho yielded more than one-fifth of the total lead product of the United States, and ranked fourth among the states in the production of silver.

Agriculture.—Next to mining, the most important industry is the grazing of horses, cattle, and sheep. The grazing lands amount to not less than 25,000,000 acres. The cultivable area of about 15,000,000 acres is utilized for a variety of crops, according to altitude and humidity or aridity of climate. Wheat, oats, barley, and other grains, and turnips, potatoes, and other vegetables are supplemented with a large yield (especially in the lower valleys) of many kinds of fruits and berries. Forage crops, chiefly of timothy, clover, and alfalfa, are almost universal. In the southern part of the state agriculture is dependent on irrigation. The acreage, production, and value of the principal crops in 1900 were as follows: Wheat, 149,261 acres, yielding 3,104,629 bushels, valued at $1,428,129; oats, 36,881 acres, yielding 1,349,845 bushels, valued at $539,938; barley, 12,165 acres, yielding 399,012 bushels, valued at $199,506; potatoes, 5030 acres, yielding 684,080 bushels, valued at $321,518; hay, 235,394 acres, yielding 659,103 tons, valued at $4,284,170. In the case of the last three crops the value is the farm value 1st December. On the 1st January the number and value of farm animals were as follows: 127,821 horses, $2,863,504; 2,658,662 sheep, $7,444,254; 33,075 milch cows, $1,055,092; 364,853 other cattle, $8,672,748.

Assessment and Banks.—The assessed valuation of property for taxation in 1899 was $46,719,990. The amount of the bonded and other indebtedness in 1900 was $427,500. There are ten national banks, with an aggregate capital of $600,000, an aggregate surplus of $275,374, and aggregate deposits of $1,829,286; there are also eighteen state banks and private banks, with an aggregate capital of $366,550.

Railways.—The railways operated in the state are the Oregon Short Line (765 miles), the Northern Pacific (188 miles), the Great Northern (83 miles), the Oregon Railway and Navigation lines (87 miles), the Boise, Nampa, and Owyhee and Idaho Northern (40 miles), and the Pacific and Idaho Northern (40 miles), with a total mileage of 1203 miles.

Manufactures.—According to the U.S. census of 1900, the number of manufacturing establishments in the state (excluding 75 having an annual product of less than $500 each, and one Government establishment) was 591, with a total invested capital of $2,941,524. There were 97 salaried employees and an average number of 1477 wage-earners. The added values of the products in the different establishments amounted to $4,020,532. There were 34 establishments devoted to flouring and grist mill products, with a capital of $569,107 and annual products of $832,207; and 117 establishments devoted to lumber and timber products, with a capital of $913,352 and annual products of $937,665.

Settlement.—From 1848 to 1853 the territory comprised in the state was a part of the territory of Oregon; from 1853 to 1859 it was partly in the territory of Oregon and partly in the territory of Idaho (including part of Montana until 1864 and part of Wyoming until 1868) until 1890, when the state was organized with its present boundaries. The permanent settlement of the territory dates from the discovery of gold in 1860, though a few trading-posts and Indian missions had been established earlier. The capital of the territory of Idaho was at first at Lewiston, but was removed to Boise in 1863. Two uprisings of the Indians in the Nez Percés war of 1877 and the Shoshone war of 1878 occasioned much loss of life and property to settlers.

Administration.—The legislature consists of twenty-one senators and forty-nine representatives, serving for terms of two years, and its sessions are biennial. The governor exercises a qualified veto on legislation. The lieutenant-governor presides over the Senate, and a speaker over the House of Representatives. The governor and other executive officers are elected by popular vote for terms of two years. The Australian ballot is prescribed by law, and the suffrage in all elections may be exercised by both men and women, citizens of the United States, after six months of residence in the state. In taxation the chief reliance is placed on the general property tax, licenses, and poll taxes. State aid to persons (except paupers or other dependants) or corporations is prohibited. Corporations, whether public or private, may be created only by general laws. Impeachments are made by the House of Representatives and tried by the Senate.

Justice.—The supreme court consists of a chief justice and two associate justices, elected biennially for terms of six years. Five district courts in the state are held by judges elected for terms of four years. Probate judges and justices of the peace are elected in the counties and precincts. Idaho is in the Eighth Federal Circuit, and the entire state constitutes one Federal district. In legal precedure it is a "code" state as distinguished from "common-law" states. (See LAW: *United States.*) In a civil action three-fourths, and in a criminal action for a misdemeanour five-sixths, of a jury may render a verdict. The pardoning power is reposed in a Board of Pardons, consisting of the governor, secretary of state, and attorney-general.

Politics.—Before 1897 all the governors, senators, and representatives of the state had been Republicans, though the electoral vote had been cast for the candidate of the Populists for President in 1893. Since 1896, however, Democrats, Silver Republicans, and Populists, by the "fusion" of their parties, have been elected to the offices of governor, senator, and representative, while the electoral vote of the state has been cast in favour of a fusion candidate for President. (J. P. D.)

Idar, or EDAR, a native state of India, forming part of the Mahi Kantha agency, within the Gujarat division of Bombay. It has an area of 1900 square miles, and had a population in 1881 of 258,429 and in 1891 of 302,134. The estimated gross revenue in 1897–98 was Rs.6,28,670, of which Rs.27,065 was expended on public works; there is a tribute to the Gaekwar of Baroda of Rs.30,340. The line of railway from Ahmedabad through Parantij to Ahmednagar (55 miles) runs mainly through this state. Much of the territory is held by kinsmen of the Raja on feudal tenure. The town of Idar is 64 miles north-east of Ahmedabad. Population (1891), 7086.

Iddesleigh, Stafford Henry Northcote, 1st EARL OF (1818–1887), British statesman, was born in London, 27th October 1818. His ancestors had long been settled in Devonshire. After a successful career at Balliol College, Oxford, he became in 1843 private secretary to Mr Gladstone at the Board of Trade. He was afterwards legal secretary to the Board; and, after acting as one of the secretaries to the Great Exhibition of 1851, co-operated with Sir Charles Trevelyan in framing the report which revolutionized the conditions of appointment to the Civil Service. He entered Parliament in 1855 as Conservative M.P. for Dudley, and was elected for Stamford in 1858, a seat which he exchanged in 1866 for North Devon. Steadily supporting his party, he became President of the Board of Trade in 1866, Secretary of State for India in 1867, and Chancellor of the Exchequer in 1874. In the interval between these last two appointments he had been one of the commissioners for the settlement of the *Alabama* difficulty with the United States, and on Mr Disraeli's elevation to the House of Lords in 1876 he became leader of the Conservative party in the Commons. As a finance minister he was largely dominated by the lines of policy laid down by Mr Gladstone; but he distinguished himself by his dealings with the Debt, especially his introduction of the New Sinking Fund (1876), by which he fixed the annual charge for the Debt in such a way as to provide for a regular series of payments off the capital. His temper as leader was, however, too gentle to satisfy the more ardent spirits among his own followers, and party cabals (in which Lord Randolph Churchill—who had made a dead set at the "old gang," and especially Sir Stafford Northcote—took a leading part) led to Sir Stafford's transfer to the Lords in 1885, when Lord Salisbury became Prime Minister. Taking the title of Earl of Iddesleigh, he was included in the Cabinet as First Lord of the Treasury. In Lord Salisbury's 1886 ministry he became Secretary of State for Foreign Affairs, but the arrangement was not a comfortable one, and his resignation had just been decided upon when on 12th January 1887 he died very suddenly at Lord Salisbury's official residence in Downing Street. Lord Iddesleigh was elected Lord Rector of Edinburgh University in 1883, in which capacity he addressed the students on the subject of "Desultory Reading." He had little leisure for letters, but amongst his works were *Twenty Years of Financial Policy* (1862), a valuable study of Gladstonian finance, and *Lectures and Essays* (1887). His biography, by Mr Andrew Lang, appeared in 1890.

Idle. See BRADFORD.

Idria, a mining town in the Austrian duchy of Carniola. In 1892 there were 1116 miners employed in the quicksilver mines and 224 labourers in the smelting works. In 1898, 4913 metric centners of refined mercury were recovered, amounting in value to over £95,700. It is calculated that the state monopoly has had a clear profit of £2,000,000 from these mines in the period 1814–80. Population (1890), 4906; (1900), 5772.

Iglau (Czech, *Jihlava*), an autonomous town in Moravia, Austria. It is second only to the capital, Brünn,

in size and population, and is a German enclave. It has the principal tobacco and cigar factory of the state monopoly (which gives employment to 2500 hands), and has, besides, a large and important textile and glass industry, steam corn and saw-mills, pottery and brewing. Population, mostly Germans and Roman Catholic, but with a sprinkling of Czechs (1890), 23,700; (1900), 24,387.

Ignatief, Nicholas Pavlovitch, COUNT (1832———), Russian diplomatist, was born at St Petersburg on the 29th of January 1832, and became at the age of seventeen an officer of the Guards. His diplomatic career began at the Congress of Paris, after the Crimean war, where he took an active part as military attaché in the negotiations regarding the rectification of the Russian frontier on the Lower Danube. Two years later he was sent with a small escort on a dangerous mission to Khiva and Bokhara. The khan of Khiva laid a plan for detaining him as a hostage, but he eluded the danger, and returned safely, after concluding with the khan of Bokhara a treaty of friendship. His next diplomatic exploit was in the Far East, as plenipotentiary to the court of Peking. When the Chinese Government was terrified by the advance of the Anglo-French expedition of 1860 and the burning of the Summer Palace, he worked on their fears so dexterously that he obtained for Russia not only the left bank of the Amur, the original object of the mission, but also a large extent of territory and sea-coast south of that river. This success was supposed to prove his capacity for dealing with Orientals, and paved his way to the post of ambassador at Constantinople, which he occupied from 1864 till 1877. Here his chief aim was to liberate from Turkish domination and bring under the influence of Russia the Christian nationalities in general and the Bulgarians in particular. His restless activity in this field, mostly of a semi-official and secret character, culminated in the Russo-Turkish war of 1877–78, at the close of which he negotiated with the Turkish plenipotentiaries the treaty of San Stefano. As the war which he had done so much to bring about did not eventually secure for Russia advantages commensurate with the sacrifices involved, he fell into disfavour, and retired from active service. Shortly after the accession of Alexander III. in 1881, he was appointed minister of the interior on the understanding that he would carry out a nationalist, reactionary policy, but his shifty ways and his administrative incapacity so displeased his imperial master that he was dismissed in the following year. After that time he exercised no important influence in public affairs.

Ignatius, Epistles of.—If the Epistles ascribed to Ignatius of Antioch are genuine, they are of the greatest importance both for their Christology and for their evidence as to the early growth of ecclesiastical organization; and the subject has risen to such importance in recent years, and has been so carefully studied, that it calls for fresh treatment. The subject is complicated by the fact that the so-called Acts of his Martyrdom, formerly much relied upon, are now acknowledged on all hands to be spurious, and by the fact that the letters have come down to us in three different forms: (1) The *shorter Greek recension* (known as G¹), consisting of letters to the Ephesians, Magnesians, Trallians, Romans, Philadelphians, Smyrneans, and to Polycarp; it is known to us in one codex only, the Medicean MS. at Florence, from which it was published by Vossius in 1664. There is also a very exact Latin version (made in England, by Robert Grosseteste or one of his scholars, and published by Usher in 1644), fragments of a Syriac translation, a complete Armenian version from the Syriac, and fragments of a Sahidic version first published by Lightfoot. The *Epistle to the Romans* is found also (apart from the other epistles) with the *Martyrdom*, both in Greek and Syriac. (2) The *longer Greek recension* (G^2), consisting of the seven letters above mentioned with additions, and also letters from Mary to Ignatius, Ignatius to Mary, to the Tarsians, Philippians, Antiochenes, and to Hero. This exists in several MSS. and in a Latin version (to some copies of which are appended three additional letters known only in Latin, and apparently composed in that language: to St John, to the Blessed Virgin, and from the Blessed Virgin to Ignatius); whilst the Armenian version mentioned above contains also renderings of the additional letters of this recension. G^2 was published in 1557 by Pace, and two years later, independently, by Gessner. (3) The *shorter Syriac recension* (S), containing three letters (to the Ephesians, Romans, and to Polycarp) in a form much shorter than that of G^1. It was published in 1846 by Cureton from two MSS. brought from the Nitrian desert. Another MS. was found in 1847 and used by Cureton for his *Corpus Ignatianum* (1849), and additional fragments have been published subsequently by Lands and Mösinger.

Which, then, of these three forms, if any, is genuine? The criticism falls into three main periods: (*a*) Down to the finding of G^1. During this period the three letters only extant in Latin were given up, but otherwise opinion was divided. Baronius and other Roman Catholics accepted G^2, subject to possible interpolations, whilst the Magdeburg Centurators and others recognized only the first seven (as being mentioned by Eusebius, *H. E.* iii. 36), and held that these were interpolated. (*b*) Since the publication of G^1, few attempts have been made to defend G^2; the additional matter has by degrees been entirely discarded, and it has been shown by Zahn and Lightfoot that G^2 was composed after the middle of the 4th century, in all probability by the redactor of the APOSTOLICAL CONSTITUTIONS (*q.v.*). Opinions differed as to G^1: Pearson defended it against Daillé and Salmasius in the 17th century, whilst in the 19th Baur held that it was forged after A.D. 150 to uphold the "theory of the Catholic Church" as then recently invented. (*c*) The publication of S reopened the whole question. Cureton unhesitatingly accepted it and rejected G^1; so did Bunsen, and many other English and German scholars, including Ritschl and Lipsius; on the other hand, Baur held that S was derived from G^1 and not *vice versa*, whilst Hefele, Denzinger, Uhlhorn, Jacobson, and others declared for the genuineness of G^1. Little by little S was rejected, mainly because its contents lacked anything like internal unity. Lipsius and Lightfoot, amongst others, gave it up in favour of G^1; and the question, so far as it concerns S, may now be said to be closed. Meanwhile, fresh critical examination has resulted strongly in favour of G^1. The opinion of Renan and others, that the *Epistle to the Romans* is of different origin from the other epistles, has been disproved by Harnack. Zahn, Funk, and other German scholars have vindicated the genuineness of the whole seven. Above all, the case has been exhaustively studied by Bishop Lightfoot. His careful comparison of the Greek of the portions of G^1 which exist also in S with that of those which do not, shows conclusively that they are one in origin; whilst a similar comparison in the case of G^1 and G^2 leads to the opposite conclusion. There is no longer any doubt, then, that, of the forms which we possess, G^1 is the original, and that it shows no sign of compilation, the style of the letters being the same throughout. Further, after a study of the whole question which for minuteness and accuracy is unequalled, he unhesitatingly decides that the seven letters are the genuine epistles of Ignatius. In England at the present time the matter is generally regarded

as settled; in Germany, too, these conclusions are very widely though not universally accepted, and Harnack, who formerly dated the epistles about 140, now agrees that a date in the lifetime of Trajan is possible. Objections are indeed raised against this date, and against the genuineness of the letters, on the ground that they show signs of having been written with a definite theological motive; that they deal with heresies of a date later than that of Ignatius; that the ecclesiastical order disclosed in them is also of a later date, and that the same thing is true of the title καθολικὴ ἐκκλησία (*ad Smyrn.* viii.). But such objections are not hard to answer. It is doubtless true, although the fact used to be denied, that Ignatius writes with the definite aim of exalting the episcopal office as the guarantee of the unity of the Church, but nevertheless it occupies in his letters a much less developed position than, *e.g.*, in the writings of Irenæus. The heresies referred to in the letters have at least as much analogy with those of earlier date as with those of later. And although Ignatius uses the title καθολικὴ ἐκκλησία, he does so from a point of view different from that which is involved in the later use of the title.

On the whole it is safe to say, with Uhlhorn, that the objections to the genuineness of the letters from internal evidence are so flimsy that they cannot stand against any real external evidence; and this is supplied by the abundant use of the letters which is made by Polycarp in his *Epistle to the Philippians*, witnessed to in turn by Irenæus. Until it is proved that Polycarp's epistle is interpolated throughout, the genuineness of the seven letters cannot reasonably be impeached again.

The known facts with regard to Ignatius rest almost entirely upon the Letters, for, as we have said, the Acts of his Martyrdom are spurious. He was bishop of Antioch; he was condemned to death, and conveyed from Antioch to Rome by a guard of soldiers, to be put to death by beasts in the amphitheatre. The letters to the Ephesians, Magnesians, Trallians, and Romans were sent from Smyrna, where Ignatius was able to be in communication with Polycarp, the bishop of Smyrna. Thence he passed on to Alexandria Troas, where the other three letters were written. Thence, it is to be presumed, he crossed to Europe, and suffered martyrdom in Rome; but of this we have no evidence of early date.

BIBLIOGRAPHY.—(Bishop) J. B. LIGHTFOOT, *The Apostolic Fathers*, part ii. 2nd edition, London, 1889.—TH. ZAHN. *Ignatius von Antiochien*, Gotha, 1873; *Patrum Apost. Opera*, Lipsiae, 1876.—A. HARNACK. *Chronologie der altchristlichen Litteratur.* Leipzig, 1897.—HERZOG-HAUCK. *Realencyklopädie*, vol. ix., art. "Ignatius von Antiochien," by G. UHLHORN. (W. E. CO.)

Igualada, a town of Spain, in the province of Barcelona. The local industries have developed since 1880, especially the manufactures of cotton, linen, wool, ribbons, cloth, chocolate, soap, brandies, leather, cards, and nails. The surrounding districts, though hilly, are well cultivated, and send many products of agriculture to the fairs in the town. There is a narrow-gauge railway connecting Martorell, Barcelona, and Tarragona. Little has been done even for primary education. Population (1887), 10,201; (1897), 10,419.

Iki, an island belonging to Japan, lying off the north-western coast of Kiushiu, in 33° 45′ N. lat. and 129° 40′ E. long. It has a circumference of 86 miles, an area of 51 square miles, and a population of 36,530. The island is, for the most part, a tableland about 500 feet above sea-level. The anchorage is at Gonoura, on the south-west. A part of Kublai Khan's Mongols landed at Iki when about to invade Japan in the 13th century, for it lies in the direct route from Korea to Japan *viâ* Tsushima. In the immediate vicinity are several rocky islets.

Iletsk, formerly FORT ILETSKAYA ZASCHITA, a town of Russia, government and 45 miles south of Orenburg, near the Ilek river, a tributary of the Ural. A large bed of excellent rock-salt of great thickness, representing the richest rock-salt deposit known, is worked here to the extent of from 16,000 to 24,000 tons annually. The place is resorted to for its salt, mud, or brine baths and koumiss cures. Population, 11,802.

Ilford, or GREAT ILFORD, a town in the Romford parliamentary division of Essex, England, on the Roding, 7 miles east-north-east of London by rail. A portion of Hainault Forest lies within the parish. There are a library and reading-room, a drill hall, and swimming baths. The Hospital of St Mary and St Thomas, founded in the 12th century as a leper hospital, now contains almshouses and a chapel, and belongs to the marquis of Salisbury, who as "Master" is required to maintain a chaplain and six aged inmates. Claybury Hall is a lunatic asylum (1893) of the London County Council. There are large photographic dry-plate works, and paper mills. Area of civil parish (an urban district), 8493 acres. Population (1881), 7645; (1901), 41,240. LITTLE ILFORD is a parish on the west side of the Roding, with an area of 768 acres. Population (1891), 3969; (1901), 17,915.

Ilfracombe, a watering-place in the Barnstaple parliamentary division of Devonshire, England, on the Bristol Channel, 225 miles west of London, on the London and South-Western Railway. The town has advanced in favour as a popular seaside resort, and the number of winter visitors has also steadily increased. It has been connected with the Great Western Railway system by coach from Minehead, and in the summer the Midland Railway run handsome steamers from Sharpness in connexion with their system. A Victoria Promenade for inclement weather was erected in 1888 on the townward base of the Capstone Rock, and a Baptist chapel in 1891, whilst the town and harbour have been generally improved. Area of parish (an urban district), 5627 acres. Population (1881), 6255; (1901), 8557.

Ilhavo, a town of Portugal, district Aveiro, 3 miles south-west of Aveiro. It has a fine parish church, and is famous for the beauty of its women. Wheat, millet, vegetables, fruits, and wine are cultivated. Nearly 2000 of the people, using 550 boats, are engaged in fishing, the annual value being about £12,200. It was founded by a colony of Pelasgic Greeks. Population (1890), 10,762; (1900), 12,545.

Ilion, a village of Herkimer county, New York, U.S.A., on the river Mohawk, the Erie canal, and the New York Central and Hudson River Railway. It has manufactures of agricultural implements, small-arms, sewing-machines, and typewriters. Population (1900), 5138, of whom 755 were foreign-born.

Ilkeston, a municipal borough (1887) and market town in the Ilkeston parliamentary division of Derbyshire, England, 9 miles east-north-east of Derby by rail. Recent structures include two Established churches, a large Wesleyan church, and a hospital. Area, 2526 acres. Population (1881), 14,122; (1891), 19,744; (1901), 25,383.

Ilkley, a town and railway station in the Otley parliamentary division of Yorkshire, England, on the Wharfe, 10 miles north by west of Bradford. The neighbourhood is famous for its romantic scenery, and the town has become a favourite health resort. All Saints' Church, restored in 1860, is mostly ancient, and contains interesting memorials; there are also another church, a Roman Catholic and other places of worship. Here and at Ben

Rhydding, 1 mile to the east, there are nearly a dozen hydropathics, all built since the middle of the 19th century. The oldest and largest of these stand high up amongst the grouse moors, and thus derive the full benefit of the bracing air. The place occupies the site of an old Roman station. Its institutions embrace a museum of local antiquities, a grammar school, the Siemens Convalescent Home, the Ilkley Bath Charitable Institution, a golf course; and 5 miles higher up the valley is Bolton Abbey. Area of civil parish (an urban district), 3822 acres. Population (1851), 811; (1881), 4736; (1901), 7455.

Ill, a river of Germany, entirely within the imperial territory of Alsace-Lorraine. It rises on a north foothill of the Jura, south-west of Basel, flows north-north-east parallel with the Rhine, which it enters from the left 11 miles below Strasburg. Its course lies for the most part through low meadowland; and the stream, which is 130 miles long, receives numerous small affluents, which pour out of the short, narrow valleys of the Vosges. It is navigable as far as Colmar, a distance of 60 miles. It is on this river, and not on the Rhine, that the principal towns of Upper Alsace are situated—*e.g.*, Mülhausen, Ensisheim, Colmar, Schlettstadt, and Strasburg. The Ill feeds two important canals, the Rhine and Marne canal and the Rhine–Rhone canal, both starting from the neighbourhood of Strasburg.

Ille-et-Vilaine, a department in the north-west of France, bordering on the English Channel.

Area, 2699 square miles. The population increased from 621,384 in 1886 to 622,039 in 1896, but decreased to 611,477 in 1901. Births in 1899, 14,893, of which 722 were illegitimate; deaths, 13,916; marriages, 4834. There were in 1896, 921 schools, with 96,000 pupils. The illiterate composed 6 per cent. of the population. Of the cultivated land in 1896, amounting to 1,472,801 acres, 1,114,485 acres are plough-land and almost all the rest grass-land. Of the cereals, wheat in 1899 yielded the value of £1,460,000; barley, £260,000; buckwheat, £490,000; oats, £378,000. Green crops amounted to the value of £190,000; natural pasture and grass lands, £860,000. The department produces a little linen, hemp, and colza; and its apples for cider yielded the value of £749,000 in 1899. The department owned in 1899, 69,340 horses, 352,890 cattle, 30,480 sheep, and 107,980 pigs. The value of milk products in 1899 was £1,880,000. The mining industry produces only a little iron, but other minerals to the value of about £112,000. The other industries are in a backward state. Rennes, the capital, had 74,006 inhabitants in 1901.

Iller, a river of Bavaria, rising in the south-west extremity of the kingdom, among the Algäuer Alps, and flowing north past Kempten and Memmingen, forming for some distance the boundary between Bavaria and Würtemberg, and eventually striking the Danube (right bank) just above Ulm. It is in character a mountain torrent, and causes frequent inundations. Its total length is 103 miles; between Kempten and Ulm it has a fall of over 2000 feet.

Illinois, a state of the United States of America, bounded on the N. by Wisconsin, on the E. by Indiana and the Wabash and Ohio rivers, on the S. by the Ohio, and on the W. by the Mississippi. It was named after its principal river, which had itself been named from a confederacy of North American Indians who once occupied the territory. The state was admitted into the Union, 3rd December 1818. Its capital is Springfield, and the existing constitution was adopted in 1870. Under the law of 1901 the state has twenty-seven votes in the electoral college. Its representation in Congress, dating from 1903, consists of two senators and twenty-five representatives. Prior to 1860 the Democratic party prevailed in Illinois in every Presidential election. Prior to 1857 the Democrats always elected the Governor. Since that time the Republicans have carried the state, except in 1890, when the Democrats elected their state ticket and obtained a majority in the General Assembly, and in 1892, when they again carried the state for their state and national tickets. In 1889 the Republicans passed an obnoxious compulsory school law, which alienated the German Lutheran vote and was in some degree responsible for these defeats. In 1900 the popular vote for Presidential electors was: Republican, 597,985; Democratic, 503,061; Prohibition, 17,626.

Administration.—The executive department consists of a governor, lieutenant-governor, secretary of state, auditor of public accounts, treasurer, superintendent of public instruction, and attorney-general. Each holds office for four years, except the treasurer, who holds for two. The governor receives a salary of $6000 per annum, and has in addition the use and occupation of the executive mansion. The law-making power is vested in a General Assembly, composed of a Senate and House of Representatives. The Senate consists of 51 members, elected for four years, and the House of 153 members, elected for two years. A senator must have attained the age of twenty-five years, and a representative twenty-one years. The legislature meets biennially in odd years; the elections are held in even years. Since 1895 members receive $1000 for regular sessions, and $5 a day for special sessions. They are allowed $50 a session for stationery, and 10 cents a mile to and from the seat of government. A two-thirds vote of each House is necessary to pass a Bill over the governor's veto. Minority representation in the House is secured by the constitution.

Justice.—The Supreme Court consists of seven judges, elected in judicial districts. They hold office for nine years. Under the law of 1897 they receive a salary of $7000 per annum. They must be thirty years of age. Since 1897 the law requires the Supreme Court to meet at Springfield only. The circuit and superior court judges hold office for six years, and the county court judges for four years. The legislature is authorized to create in districts appellate courts, from which appeals lie to the Supreme Court. Four such courts have been established. The appellate courts are held by judges of the circuit courts. The judges of the circuit and superior courts of Cook (Chicago) county receive under a law of 1901 a salary of $10,000 a year. The legislature may provide for a probate court in counties having a population of over 50,000.

Education.—The state has made a great advance in its educational institutions since 1890. It has twenty-five colleges and universities. The more important of these are the University of Chicago, in Chicago; Northwestern University, having departments in Chicago and Evanston; and the State University in Champaign. These institutions have a large attendance of students, satisfactory standards and equipment. The property of the University of Chicago amounts to $12,000,000, and that of Northwestern to $5,000,000. The State University is supported by state funds. Mention should be made, among others, of Lake Forest University at Lake Forest, Knox College at Galesburg, Illinois College at Jacksonville, Wheaton College at Wheaton, the Illinois Wesleyan University at Bloomington, and the Female College at Rockford. The Armour Institute of Technology in Chicago is one of the best endowed institutions of its kind in the United States. In 1897 George M. Pullman left $1,200,000 to establish a manual training school in the town of Pullman. The Lewis Institute in Chicago has property in excess of $1,000,000. In Chicago are flourishing schools of law, medicine, theology, dentistry, and pharmacy. The state maintains out of the public funds 4 normal schools. There are 311 high schools, in which, 30th June 1900, 38,620 students were enrolled, 14,934 males and 23,686 females. The number graduated from the high schools that year was 4708—1578 males and 3130 females. The number of high schools having a course of study of three years was 88; a course of four years, 218; and a course of five years, 5. The number of school districts in 1900 was 11,771, and the number of teachers employed 26,313—6950 men and 19,363 women. The whole number of public schools was 12,762. The number of private schools was 785, the number of teachers 3908—1342 men and 2566 women. The number of children of school age, six to twenty-one years, was 1,588,895, and of this number 958,911 were enrolled in the public schools and 142,496 in private; the total attendance being 1,101,407. The average daily attendance was 737,576. The average school year was 142·8 days. The highest monthly salary paid to male teachers in the public schools was $300, and to female teachers $280. The average monthly salary paid to male teachers was $60·42, and to female

teachers $53·27. The total amount of public money expended for the year ending 30th June 1900 was $18,167,219·32. Since 1873 there has been an annual state tax for school purposes of $1,000,000. The school district tax levy for 1899 was $15,850,804, or $16·53 per pupil enrolled. The permanent school funds, the income alone being available, amount to $17,429,569. The estimated value of the school property in 1900 was $51,403,089. This is exclusive of the property under private control. In 1899 a law was passed providing free text-books for children in public schools. The constitution prohibits the appropriation of any public fund in aid of any educational institution under sectarian control. Under the census of 1900 the percentage of males of voting age who were illiterate was 4·8.

Military.—In the war against Spain in 1898 the state rendered prompt and efficient service. The Fifth Illinois regiment was the first volunteer regiment in the United States to be mustered into the Federal service in that war. The total number of men furnished to the army was 13,647, divided as follows: infantry, 12,194; cavalry, 1275; light artillery, 178. The state had in its military service, 1st January 1901, 7122 officers and men. These were divided into eighty-six companies of infantry, eight of cavalry, two of artillery, one of engineers, and one signalling corps. The total number of officers and men in the naval militia was 631: 56 officers, 99 petty officers, and 476 enlisted men. During the war of the Rebellion the state furnished to the army of the United States 259,092 men; the quota demanded by the President was 244,496.

Prisons.—The appropriation for 1900 for the ordinary expenses of each of the two prisons was $90,000. The prison at Joliet returned unexpended to the treasury $25,000. The appropriation for the reformatory at Pontiac was $266,100. This provided for improvements and running expenses; $50,000 was returned to the treasury. The number of prisoners in confinement in the state prisons on 1st January 1901 was as follows: at Joliet, 1198 males and 61 females; at Menard, 855 males; at Pontiac, 1282 males. A law of 1895 established the parole (ticket-of-leave) system in the punishment of adult criminal offenders, except in cases of treason, murder, and rape. No prisoner is eligible to go upon parole until he has served the minimum term provided by law for the crime of which he was convicted. Each paroled prisoner must report once a month to the prison authorities, and six months of good behaviour secures final release. For 1900 there were 1662 applications for parole, and 631 were granted.

Charities.—A Board of State Commissioners of Public Charities has supervision of the charities and correctional institutions, state prisons excepted. The following are the institutions maintained: Northern Hospital for Insane, Elgin; Eastern Hospital for Insane, Kankakee; Western Hospital for Insane, Watertown; Central Hospital for Insane, Jacksonville; Southern Hospital for Insane, Anna; Asylum for Incurable Insane, Peoria; Asylum for Insane Criminals, Chester; Soldiers' and Sailors' Home, Quincy; Soldiers' Widows' Homes, Wilmington; Charitable Eye and Ear Infirmary, Chicago; State Home for Female Juvenile Offenders, Geneva; Institution for Education of Deaf and Dumb, Jacksonville; Institution for Education of the Blind, Jacksonville; Asylum for Feeble-minded Children, Lincoln; Soldiers' Orphans' Home, Normal. Under the law governing commitment and detention of lunatics 4846 insane cases were tried in the courts during the biennial period ending 30th June 1900. Of this number 2669 were males and 2177 females; 3451 were tried by jury, and 1395 by commission. The number of inmates in asylums for the insane on 30th June 1900 was 6438. For the two years beginning 1st July 1899 the General Assembly appropriated to state charitable institutions $4,350,161; for ordinary expenses $3,153,520, and for special purposes $1,196,641. The total valuation of the property belonging to the fifteen state charitable institutions as reported on 30th June 1900 was $7,400,000. In 1899 "An Act to establish the Illinois State Colony for Epileptics" was passed. The state Board of Charities estimated the number of epileptics in 1900 as 5000.

Agriculture.—Illinois occupies a leading position among agricultural states. In the value of its farms, at the census of 1890, it stood first among the states of the Union. The state lies in the centre of a great agricultural valley, and the diversity of soil and climate enables it to produce a great variety of cereals, vegetables, and fruits. Its black soil has great fertility. Since September 1895 a permanent state fair has been maintained at Springfield, chiefly for the benefit of the agricultural and horticultural interests. The fair grounds contain 156 acres, and the buildings were erected at great expense. The Dome Building, which is used for agricultural exhibits, has the dome from the Horticultural Hall of the World's Fair at Chicago in 1893. According to the census of 1890, the total acreage of farms in the state was 30,498,277; 25,669,060 were improved, and 4,829,217 unimproved. The number of farms cultivated by the owners was 158,848; the number rented for money was 29,182; the number rented for a share of the products was 52,651. The number of families occupying farms was 252,953, and of this number 160,065 owned their farms. The number of farms under 50 acres was 49,448; 50 and under 100, 68,746; 100 and under 500, 119,684; 500 and under 1000, 2420; 1000 and over, 383. The value of farm lands, fences, and buildings was $1,262,870,587; of farm implements and machinery, $34,456,938; of live stock, $180,431,662; of farm products, $184,759,013. The cost of fertilizers purchased, $124,977.

The United States Department of Agriculture gave the following statistics of the grain production of the state for 1900:—

	Wheat.	Oats.	Corn.	Barley.	Rye.	Buckwheat.	Potatoes.	Hay.
Acreage	1,383,236	3,516,918	7,139,898	13,365	73,877	4,476	166,262	1,668,834
Number of bushels .	17,982,068	133,642,884	264,176,226	342,144	1,270,684	67,140	15,296,104	2,119,419[1]
Average yield per acre	13·0	38·0	37·0	25·6	17·2	15·0	92	1·27[1]
Average value per acre	$8·32	$8·74	$11·84	$12·03	$8·08	$9·75	$37·72	$10·66
Value of crop . . .	$11,508,524	$30,737,863	$84,536,392	$160,808	$597,221	$43,641	$6,271,403	$17,803,120

The figures in the following table are of 1st January 1900:—

	Number.	Value.	Average Price per Head.
Milch cows .	1,021,236	$37,070,867	$36·30
Other cattle .	1,303,018	41,197,518	31·62
Sheep . . .	637,719	2,532,383	3·97

The beet-sugar crop is estimated at 1800 tons. The state is first among the states in the Union for the value of the crops of corn and oats, and of milch cows, and in the number of sheep and swine. It holds second place as to horses and meat cattle. Chicago is the greatest live-stock market in the world.

Manufactures.—In 1900 the state held third place in the Union as respects alike the value of its manufactured products, the cost of materials used, and capital invested. The following are the general statistics for 1890 and 1900:—

	1890.	1900.	Per cent. of Increase.
Number of establishments . . .	20,482	38,360	87·3
Capital . . .	$502,004,512	$776,829,598	54·7
Wage-earners, average number . .	280,218	395,110	41·0
Total wages . .	$142,873,265	$191,510,962	34·0
Cost of materials used	$529,019,089	$739,754,414	39·8
Value of products .	$908,640,280	$1,259,571,105	38·6

The most important of the different manufacturing industries was that of slaughtering and meat-packing, with 64 establishments, an aggregate capital of $71,229,262, 27,861 wage-earners (besides salaried officials, clerks, &c.), and products valued at $287,922,277. The size of other leading industries in 1900 is shown by the following table:—

Industry.	Establishments.	Wage-earners.	Value of Products.
Agricultural implements . . .	94	18,231	$42,033,796
Cars, steam railway .	17	9,314	24,845,606
Clothing, men's .	900	14,977	37,378,717
Flouring and grist mill products .	871	2,111	31,006,294
Foundry and machine-shop products .	758	31,851	63,878,352
Iron and steel . .	26	16,642	60,144,081
Liquors, distilled and malt . . .	114	3,607	57,941,897

Railways.—Illinois holds first place in railway mileage. The State Railway and Warehouse Commission reported, 30th June 1900, for steam railways in Illinois a total mileage of 10,817·10 main line and branches; total capital per mile, $63,172; total income of passenger department, including mails and express, $25,458,150; freight income, $69,510,827; total earnings and

[1] Number of tons.

income, $107,806,152; total expenditures, $93,072,220; passengers carried, 42,153,557; passenger earnings per mile of road, $2914; tons of freight carried, 83,667,441; freight earnings per mile, $5990; railway employees, 88,047; aggregate amount paid to employees, $51,360,689; tons of steel rails laid during year, 120,194; number of stations, 2761; passengers killed, 12, injured, 137; employees killed, 199, injured, 2122; trespassers killed, 503, injured, 490; taxes paid by railways, $4,379,611. Total mileage of elevated and inter-urban lines was 14,968; capital, $83,067,300; income, $4,248,286; and passengers carried, 74,415,958.

Insurance.—In 1893 the insurance department, formerly a part of the State Auditor's office, became a separate state department under the control of a superintendent appointed by the governor, subject to confirmation by the Senate. The number of life insurance companies entitled to do business in Illinois, 31st December 1899, was 45. Their total assets were $1,590,891,959; liabilities, $1,363,246,210; surplus, $227,645,748. The number of fraternal beneficiary societies authorized to do business was 94. Their admitted assets, $14,290,653; and their unadmitted assets, $959,409. Their liabilities were $5,575,598. The number of assessment life associations was 30. Their total income for 1899 was $14,460,090; total disbursements, $11,179,096. Admitted assets were $12,966,243; unadmitted, $1,736,616. Their total liabilities were $6,325,464. The number of assessment accident associations was 8. The number of fire and marine insurance companies was 203; 23 were mutual companies, 48 foreign, having branches in the United States, and 126 were joint-stock companies of other states. The net cash surplus of the fire and marine insurance companies authorized to do business in Illinois in 1900 was, 31st December 1899, $97,812,478; their income, $164,217,137; expenditures, $166,109,193.

Coal.—In amount of bituminous coal mined the state holds second place. For the year ending 30th June 1900 there were fifty-two counties producing coal. The total number of mines was 920, but of this number only 323 were shipping mines. The total output of all mines in tons of 2000 pounds was 25,153,929. The aggregate home value of the total product was $22,510,360. The total number of persons employed was 39,384, of whom 35,203 were at work underground. The number of men accidentally killed was 95, and the number injured so as to lose a week or more of time, 61. The average days of active operations for shipping mines was 214. The number of mines in which mining machines were used was 65, and the number of mining machines in use was 430. The average value per ton, all grades at the mine, was $0·8949. The chief mining counties are Vermilion, Sangamon, La Salle, St Clair, Macoupin, Madison, Bureau, Grundy, and Williamson. A revised mining law became operative 1st July 1899. All mines are required to be in charge of certificated mine managers, mine examiners, and hoisting engineers, where the services of the last-mentioned class are necessary. The number of men permitted to work in any mine not having an escapement cannot in any circumstances exceed ten, and then only for the purpose of completing the escapement. The state is divided into seven inspection districts, and there are seven state mine inspectors appointed by the governor.

Banks.—The number of national banks on 13th December 1900 was 242. The amount of capital stock paid in was $35,996,900. Their surplus fund was $14,852,722; and undivided profits, $8,371,563. The amount of deposits was $191,236,702; and reserve held, $55,770,808. In 1887 Illinois for the first time passed an Act providing for the organization of savings-banks. The number of state banks in operation, 14th December 1900, was 155.

Debt.—On 1st November 1900, and for a number of years prior thereto, the principal of the bonded debt outstanding has been $18,500. These bonds ceased to draw interest 1st January 1882, and although called in by the governor, have never been presented for payment. The state constitution prohibits the state from loaning its credit or making appropriations in aid of railways or canals, and a similar prohibition is placed on counties, cities, towns, and other municipalities. Neither can the state loan its credit to, or in aid of, any public or other corporation, association, or individual. The state may, to meet casual deficits, contract debts not to exceed in the aggregate $250,000; and no other debt, except for repelling invasion, suppressing insurrection, or defending the state in war, can be contracted until submitted to a vote of the people and approved by a majority of the votes cast. No county, city, township, school district, or other municipal corporation can incur indebtedness exceeding 5 per cent. on the value of the taxable property. In 1890, 46 of the 103 counties of the state were free from debt.

Revenues and Taxation.—Receipts in the state treasury from all sources from 1st October 1898 to 30th September 1900 were $16,645,925; disbursements for the same period were $14,027,970. The balance in the state treasury, 1st October 1900, was $2,617,955. Under charter of the Illinois Central Railway that company is bound to pay into the state treasury semi-annually 7 per cent. of its gross annual earnings, and is relieved from all other taxes on its property. The state has received from the company, 30th April 1900 inclusive, $18,392,243. The inheritance tax brought to the state treasury, from 1st October 1898 to 30th September 1900, $958,785. The total value of all property assessed for taxes for 1899, as fixed by the State Board of Equalization, was $953,099,468. Total number of horses assessed in 1899 was 1,222,048, value $10,127,085; cattle, 2,256,759, value $11,350,995; mules and asses, 108,458, value $957,769; sheep, 630,677, value $453,729; hogs, 2,730,652, value $2,285,546. The assessed value of railway property was $79,072,674. The equalized value of personal property was $183,526,987; of town and city lots, $373,742,282; railway personal property, $1,789,666; railway lands, $222,010; railway town and city lots, $1,048,956.

Churches.—The number of church organizations within the state, census 1890, was 8296; the number of church edifices, 7352; the seating capacity, 2,260,619; the value of church property, $39,715,245; the number of communicants, 1,202,588; the percentage of population, 31·43. Church membership was divided as follows: Catholics, 475,474; Methodists, 189,358; Baptists, 109,640; Presbyterian, 77,213; Lutheran, 116,807; Disciples of Christ, 60,867; Protestant Episcopal, 20,854; Congregational, 35,830. In respect of the value of church property the state ranked fourth.

Population.—Illinois ranks third in population among the states of the Union, under the census of 1900. The population was 4,821,550, and the gain for the decade was 995,199. The numerical increase was greater than in any previous decade of the state's history. The gain in the previous decade was 748,480. The number of males was 2,472,782, and females 2,348,768. The number of native-born was 3,854,803, and of foreign-born 966,747. The total white population was 4,734,873, the native white population was 3,770,238. The average number of persons to the square mile, under the census of 1900, was 86·0; and under that of 1890, 68·3. The number of males of voting age in 1900 was 1,401,456. Of this number 932,574 were native-born and 468,882 foreign-born; 1,370,209 were white, and 31,247 coloured. There were 29 cities in 1890 having a population exceeding 5000, and 51 in 1900. Of the 930 incorporated cities, towns, and villages in the state in 1900, 614 had less than 1000 inhabitants; 878 less than 5000; 27 more than 5000, but less than 10,000; 14 more than 10,000, but less than 20,000; 4 more than 20,000, but less than 25,000; and 7 more than 25,000. These seven with their populations were as follows:—

Chicago	1,698,575
Peoria	56,100
Quincy	36,252
Springfield	34,159
Rockford	31,051
East St Louis	29,655
Joliet	29,353

(H. W. R.)

Illustration.—In a general sense illustration is as old as Art itself. There has never been a time since civilization began when artists were not prompted to pictorial themes from legendary, historical, or literary sources. But the art of illustration, as now understood, is a comparatively modern product. The tendency of modern culture has been to make the interests of the different arts overlap. The theory of Wagner, as applied to opera, for making a combined appeal to the artistic emotions, has been also the underlying principle in the development of that great body of artistic production which in painting gives us the picture containing "literary" elements, and, in actual association with literature in its printed form, becomes what we call "illustration." The illustrator's work is the complement of expression in some other medium. A poem can hardly exist which does not awaken in the mind at some moment a suggestion either of picture or music. The sensitive temperament of the artist or the musician is able to realize out of words some parallel idea which can only be conveyed, or can be best conveyed, through his own medium of music or painting. Similarly, music or painting may, and often does, suggest poetry. It is from this inter-relation of the emotions governing the different arts that illustration may be said to spring. The success of illustration lies, then, in the instinctive transference of an idea from one medium to another; the more spontaneous it be and the less laboured in application, the better. But when this

common ground has been stated, it must be recognized that illustration introduces a fresh personality, and, therefore, the risk of departure in feeling from the idea which was in the writer's mind. There is this drawback appertaining to illustration—that while, as art, it may be fine, as illustration it may be very imperfect. So, also, does the converse hold good. Thus the *Bab Ballads* and the *Ingoldsby Legends* have been more adequately illustrated than the works of Shakespeare. But if to illustrate is a natural artistic impulse, the freedom of the artist to a large extent follows. The written word remains unchanged, and the illustrations may be taken apart from their context. It is only a particular edition, and not the literary essence of a book, that illustration can damage.

Leaving on one side the illuminated manuscripts of the Middle Ages, which have been treated in the ninth edition of this work under ILLUMINATION, we start with the fact that illustration in the accepted sense was coincident with the invention of printing. Italian art produced many fine examples, notably the outline illustrations to the *Poliphili Hypnerotomachia*, printed by Aldus at Venice in the last year of the 15th century. Other early works exist, the products of unnamed artists of the French, German, Spanish, and Italian schools; while of more singular importance, though not then brought into book form, were the illustrations to Dante's *Divine Comedy* made by Botticelli at about the same period. The sudden development of engraving on metal and wood drew many painters of the Renaissance towards illustration as a further opportunity for the exercise of their powers; and the line-work, either original or engraved by others, of Pollajuolo, Mantegna, Michelangelo, and Titian (to name only a few) has its place in the gradual enlargement of illustrative art. The German school of the 16th century committed its energies even more vigorously to illustration; and many of its artists are now known chiefly through their engravings on wood or copper, a good proportion of which were done to the accompaniment of printed matter. The names of Dürer, Burgmair, Altdorfer, and Holbein represent a school whose engraved illustrations possess qualities which have never been rivalled, and remain an invaluable aid to imitators of the present day.

Illustration has generally flourished in any particular age in proportion to the health and vigour of the artistic productions in other kinds. No evident revival in painting has come about, no great school has existed during the last four centuries, which has not set its mark upon the illustration of the period and quickened it into a medium for true artistic expression. The etchers of the Low Countries during the 17th century, with Rembrandt at their head, were to a great extent illustrators in their choice of subjects. In France the period of Watteau and Fragonard gave rise to a school of delicately engraved illustration, exquisite in detail and invention. In England Hogarth came to be the founder of many new conditions, both in painting and illustration, and was followed by men of genius so distinct as Reynolds on the one side and Bewick on the other. With Reynolds one connects the illustrators and engravers for whom now Bartolozzi supplies a surviving name and an embodiment in his graceful but never quite English art. But it is from Bewick that the wonderfully consistent development of English illustration begins to date. Bewick marks an important period in the technical history of wood-engraving as the practical inventor of the "tint" and "white line" method of wood-cutting; but he also happened to be an artist. His artistic device was to give local colour and texture without shadow, securing thereby an altogether novel amount of truth, side by side with a precision of outline which allowed no form to be lost. And though, in consequence, many of his best designs have somewhat the air of a specimen plate, he succeeded in bringing into black-and-white illustration an element of colour which had been wholly absent from it in the work of the 15th and 16th century German and Italian schools. Bewick's method started a new school; but the more racy qualities of his woodcuts were entirely dependent on the designer being his own cutter; and the same happy relationship gave distinct characteristics to the nearly contemporary work of Blake and of Calvert. Blake's wonderful *Illustrations to the Book of Job*, while magnificent in their conventional rendering of light and shade, still retain the colourlessness of the old masters, as do also the more broadly handled designs to his own books of prophecy and verse; but in his woodcuts to Philips's *Pastorals* the modern tendency towards local colour makes itself strongly felt. So wonderfully, indeed, have colour and tone been expressed in these rough wood-blocks, that more vivid impressions of darkness and twilight falling across quiet landscape have never been produced through the same materials. The pastoral designs made by Edward Calvert on similar lines can hardly be over-praised. Technically these engravings are far more able than those from which they drew their inspiration.

Progress in England.

With the exception of the two artists named, and in a minor degree of Stothard and Flaxman, who also produced original illustrations, the period from the end of the 18th century till about the middle of the 19th was less notable for the work of the designer than of the engraver. The delicate plates to Rogers's *Italy* were done from drawings which Turner had not produced for purposes of illustration; and the admirable lithographs of Prout and Bonington were merely studies of architecture and landscape made in a material that admitted of indefinite multiplication. It is true that Géricault came over to England about the year 1820 to draw the English race-horse and other studies of country life, which were published in London in 1821, and that other fine work in lithography was done by James Ward, G. Cattermole, and somewhat later by J. F. Lewis. But illustration proper, subject-illustration applied to literature, was mainly in the hands of the wood-engravers; and these, forming a really fine school founded on the lines which Bewick had laid down, had for about thirty years to content themselves with rendering the works of ephemeral artists, among whom Haydon and Martin stand out as the chief lights. It must not be forgotten, however, that while the day of a serious English school of illustration had not yet come, Great Britain possessed an indigenous tradition of gross and lively caricature; a tradition of such robust force and vulgarity that, by the side of some choicer specimens of Gillray and Bunbury, the art of Rowlandson appears almost refined. This was the school in which George Cruikshank, John Leech, and the Dickens illustrators had their training, from which they drew more and more away; until, with the help of *Punch*, just before the middle of the 19th century, English caricaturists had learned the secret, which in France has not yet been discovered, of how to be apposite and amusing without scurrility and without libel.

It was in about the year 1832 that the illustrated weekly paper started on its career in England, and almost by accident determined under what form a great national art was to develop itself. While in France the illustrators were making their triumphs by means of lithography, English illustration was becoming more and more identified with wood-engraving. The demand for a method of illustration, easy to produce and easy to print, for books

and magazines of large circulation and moderate price, forced the artist before long into drawing upon the wood itself; and so soon as the artist had asserted his preference for facsimile over "tint," the school which came to be called "of the 'sixties" was in embryo, and waited only for artistic power to give it distinction. The engraver's translation of the artist's painting or wash-drawing into "tint" had largely exalted the individuality of the engraver at the expense of the artist. But from the moment when the designer began to put his own lines upon the wood, new conditions shaped themselves; and though the artist at times might make demands which the engraver could not follow, or the engraver inadequately fulfil the expectation of the artist, the general tendency was to bring designer and engraver into almost ideal relations—an ideal which nothing short of the artist being his own engraver could have equalled. Out of an alliance cemented by their common use and understanding of the material on which they worked came the school of facsimile or partial-facsimile engraving which flourished during the 'sixties, and lasted just so long as its conditions were unimpaired—losing its flavour only at the moment when "improved" mechanical appliances enabled the artist once more to dissociate himself from the conditions which bound the engraver in his craft.

Influence of wood-engraving.

Before the fortunate circumstances which governed the work of the 'sixties became decisive, illustrations of a transitional character but tending to the same end had been produced by John Tenniel, John Gilbert, Birket Foster, Harrison Weir, T. Creswick, W. Mulready, and others; but their methods were too vague and diffuse to bear as yet the mark of a school; no single influence gave a unity to their efforts. On some of them Menzel's illustrations to Kügler's *Frederick the Great*, published in England in 1844, may have left a mark: Gilbert certainly shows traces of the influence of Delacroix and Bonington in the free, loose method of his draughtsmanship, independent of accurate modelling, and with here and there a paint-like dab of black to relieve a generally colourless effect; while Tenniel, with cold, precise lines of wire-drawn hardness, remained the representative of the past academic style, influencing others by the dignity of his fine technique, but with his own feeling quite untouched by the Pre-Raphaelite and romantic movement which was soon to occupy the world of illustration. In greater or less degree it may be said of the work of all these artists that, as it antedates, so to the end does it stand somewhat removed in character from, the school with which for a time it became contemporary. The year which decisively marked the beginning of new things in illustration was 1857, the year of the Moxon *Tennyson* and of Wilmott's *Poets of the Nineteenth Century*, with illustrations by Rossetti, Millais, Holman Hunt, and Ford Madox Brown. In these artists we get the germ of the movement which afterwards came to have so wide a popularity. At the beginning, Pre-Raphaelite in name, poetic and literary in its choice of subjects, the school quickly expanded to an acceptance of those open-air and everyday subjects which one connects with the names of Walker, Houghton, Pinwell, and North. The illustrations of the Pre-Raphaelites were eminently thoughtful, full of symbolism, and with a certain pressure of interest to which the epithet of "intense" came to be applied. As an example of their method of thought-transference from word to form, Madox Brown's drawing for the Dalziel Bible of "Elijah and the Widow's Son" may be taken. The restoration of life to a dead body, of a child to its mother, is there conveyed with many illustrative touches and asides, which become clumsy when stated in words. The hen bearing her chicken between her wings is a perfectly direct and appropriate pictorial symbol, but a far more imaginative stroke is the shadow on the wall of a swallow flying back to the clay bottle where it has made its nest. Here is illustration full of literary symbolism, yet wholly pictorial in its means; and in this it is entirely characteristic of Pre-Raphaelite feeling, with its method of suggesting, through externals, consideration as opposed to mere outlook. Of this phase Rossetti must be accounted the leader, but it was Millais who, by the sheer weight of his personality, carried English illustration along with him from Pre-Raphaelitism to the freer romanticism and naturalistic tendencies of the 'sixties. Rossetti, with his poetic enthusiasm, his strong personal magnetism, and dramatic power of composition, may be said to have brought about the awakening; it was Millais who, by his rapid development of style, his original and daring technique, turned it into a movement. When he started, there were many influences behind him and his fellow-workers—among older foreign contemporaries, those of Menzel and Rethel; and behind these again something of the old masters. But through a transitional period, represented by his twelve drawings of "The Parables," which appeared first in *Good Words*, Millais emerged into the perfect independence of his illustrations to Trollope's novels, *Framley Parsonage* and *The Small House at Allington*, his own master and the master of a new school. Depicting the ugly fashions of his day with grave dignity and distinction, and with a broad power of rendering type in work which had the aspect of genre, he drew the picture of his age in a summary so embracing that his illustrations attain the rank almost of historical art. For art of this sort the symbolism of the Pre-Raphaelites lost its use: the realization in form of a character conveyed by an author's words, the happy suggestion of a locality helping to fix the writer's description, the verisimilitudes of ordinary life, even to trivial detail, carried out with real pictorial conviction, were the things most to be aimed at. Pictorial conviction was the great mark of the illustrative school of the 'sixties. The work of its artists has absorbed so completely the interest and reality of the letterpress that the results are a model of what faithful yet imaginative illustration should be. In the illustrated magazines of this period, *Once a Week*, *Good Words*, *Cornhill*, *London Society*, *The Argosy*, *The Leisure Hour*, *Sunday at Home*, *The Quiver*, and *The Churchman's Family Magazine*, as well as others, is to be found the best work of this new school of illustrators; and with the greater number of them it cannot be mistaken that Millais is the prevailing force.

Pre-Raphaelite movement.

Influence of Millais.

By their side other men were working, more deeply influenced by the old masters, and by the minuteness and hard, definite treatment of form which the Pre-Raphaelite school had inculcated. Foremost of these was Frederick Sandys, a draughtsman of great technical power, precise in outline and detail. His method shows a blend of the styles of Dürer, Holbein, and Rethel, with an acceptance of the more modern devices which suggest colour and tone. His illustrations, scattered through nearly all the magazines which have been named, show always a decorative power of design, and are full of fine drawing and fine invention, but remain resolutely cold in handling and lacking in imaginative ardour. The few illustrations done by Burne-Jones at this period show a whole-hearted following of Rossetti, but a somewhat struggling technique; and the same qualities are to be found in the work of Arthur Hughes, whose illustrations in *Good Words for the Young* (1869) have a charm of tender poetic invention showing through the faults and persistent uncertainty of his draughtsmanship. Higher technical

qualities single out the work of Frederick Shields for notice: his illustrations to Defoe's *History of the Plague* have a certain affinity to the work of Sandys; but, with less power over form, they show a more dramatic sense of light and shade, and at their best can claim real and original beauty. The formality of feeling and composition, and the strained, stiff quality of line in Lord Leighton's designs to *Romola* (1863), do a good deal to mar one's enjoyment of their admirable draughtsmanship. Many fine drawings done at this period by Leighton, Poynter, Armstead, and Burne-Jones, characterized by fine, hard draughtsmanship and close cross-hatching, did not appear until the year 1880 in the "Dalziel Bible Gallery," when the methods of which they were the outcome had fallen almost out of use.

Deeply influenced by the broad later phases of Millais's black-and-white work were those artists whose tendency lay in the direction of idyllic naturalism and popular romance, the men to whom more particularly is given the name of the period and school "the 'sixties," and whose more immediate leader, as far as popular estimation goes, was Frederick Walker. With his, one may roughly group the names of Pinwell, Houghton, North, Keene, Lawless, Mahoney, Morten, and, with a certain reservation, W. Small and G. du Maurier. In no very separate category stand two other artists whose contributions to illustration were but incidental, John Pettie and J. M'Neill Whistler. The broad characteristics of this variously related group were a loose, easy line suggestive of movement, a general fondness for white spaces and open-air effects, and in the best of them a thorough sense of the serious beauty of domestic and rural life. They treated the present with a feeling rather idyllic than realistic; when they touched the past it was with a courteous sort of realism, and a wonderful inventiveness of detail which carried with it a curious charm of conviction. Walker's method shows a broad and vivid use of black and white, with a fine sense of balance, but very little preoccupation for decorative effect. Pinwell had a more delicate fancy, but less freedom in his technique—less ease, but more originality of composition. In Houghton's work one sees a swift, masterful technique, full of audacity, noble in its economy of means, sometimes rough and careless. His temperament was dramatic, passionate, satiric, and witty. Some of his best work, his "Scenes from American Life," appeared in the pages of the *Graphic* as late as the years 1873–74. There are indications in the work of Lawless that he might have come close to Millais in his power of infusing distinction into the barest materials of everyday life, but he died too soon for his work to reach its full accomplishment. North was essentially a landscape illustrator, notable for the dignity and sense of subject he was able to infuse into compositions which were without figure interest. The delicate sense of beauty in du Maurier's early work became lost in the formal but graceful conventions of his later *Punch* drawings. It was in the pages of *Punch* that Keene, the greatest impressionist illustrator England has produced, secured his chief triumphs. The two last-named artists outstayed the day which saw the break-up of the school of which these are the leading names. It ran its course through a period when illustrated magazines formed the staple of popular consumption, before the illustrated newspapers, with their hungry rush for the record of latest events, became a weekly feature. Its waning influence may be plainly traced through the early years of the *Graphic*, which started in 1869 with some really fine work, done under transitional conditions before the engraver's rendering of tone-drawings once more ousted facsimile from its high place in illustration.

"The 'Sixties."

In connexion with this transitional period, drawings for the *Graphic* by Houghton, Pinwell, Herkomer, E. J. Gregory, H. Woods, Charles Green, H. Paterson (Mrs Allingham), and William Small deserve honourable mention. Yet it was the last-named who was mainly instrumental in bringing about the change from line-work to pigment, which, by removing the limitations that had flavoured the artist's work and made it native to its environment, depressed the artistic value of illustration during the 'seventies and the 'eighties to almost absolute mediocrity. Several artists of great ability practised illustration during this period: in addition to those *Graphic* artists already mentioned there were Luke Fildes, Frank Holl, S. P. Hall, Paul Renouard, and a few others of smaller merit. But the interest was for the time shifting from black-and-white work and turning to colour. Kate Greenaway began to produce her charming idyllic renderings of children in mob-caps and long skirts delicately outlined and tinted. Walter Crane on somewhat similar lines designed his illustrated nursery rhymes, *Baby's Opera*, *Baby's Bouquet*, and the like; while Randolph Caldecott took the field with his fresh and breezy scenes of hunting life and carousal in the times most typical of the English squirearchy. Working with a broad outline, suggestive of the brush by its easy freedom, and adding washes of conventional colour for embellishment, he was one of the first in England to show the beginnings of Japanese influence. Even more dependent upon colour were his illustrated books for children; while in black and white, in his illustrations to *Bracebridge Hall* (1876), for instance, pen and ink began to replace the pencil, and to produce a new and more independent style of draughtsmanship. This style, clear and straightforward but without much subtlety, was taken up and followed by many artists of ability, by Harry Furniss, Hugh Thomson, and others, till the influence of E. A. Abbey's more mobile and more elaborate penmanship came to produce a still further development in the direction of fineness and illusion, and that of Phil May, with Linley Sambourne for his teacher, to simplify and make broad for those who aimed rather at a journalistic and shorthand method of illustration. (See also CARICATURE and CARTOON.)

Under the absolutely liberating conditions of "process reproduction" (see PROCESS) the latest developments in illustration on its lighter and more popular side are full of French influences, or ready to follow the wind in any fresh direction, whether to America or Japan; but on the graver side they show a strong leaning towards the older traditions of the 'sixties and of Pre-Raphaelitism. It would be rash from the random and often undistinguished cleverness of the popular school to select names which may have very little permanent standing: the title of the weekly paper which started them on a prosperous career, the *Sketch*, will indicate where their works may be found and their style studied, just as in the first volume of *Black and White* may be seen the one serious attempt to revive in connexion with a weekly publication a worthier and less flighty tradition of illustration. A more successful motive force in that direction came from the founding by William Morris of the Kelmscott Press in 1891 (see WILLIAM MORRIS, and BOOK-PRINTING), through which were produced a series of decorated and illustrated books which aimed frankly at a revival of mediæval taste. In Morris's books decorative effect and sense of material claimed mastery over the whole scheme, and subdued the illustrations to a sort of glorious captivity into which no breath of modern spirit could be breathed. The illustrations of Burne-Jones filled with a happy touch of archaism the decorative borders of William Morris; and only a little less happy, apart from their imaginative inferiority, were the serious efforts of Walter Crane and one or two others to fulfil the requirements of pages which would not abate a decade of their mediæval standpoint to fit with more nicety the requirements of the illustrator. Directly under the Morris influence arose the "Birmingham school," with an entire devotion to decorative methods and still archaic effects which tended sometimes to rather inane technical results. Among its leaders may be named Arthur Gaskin, C. M. Gere, and E. H. New; while work

Contemporary illustrators.

not dissimilar but more independent in spirit had already been done by Selwyn Image and H. P. Horne in the *Century Guild Hobby-Horse*. But far greater originality and force belonged to the work of a group, known for a time as the neo-Pre-Raphaelites, which joined to an earnest study of the past a scrupulously open mind towards more modern influences. Its earliest expression of existence was the publication of an occasional periodical, the *Dial* (1889 to 1897), but before long its influence became felt outside its first narrow limits. The technical influence of Abbey, but still more the emotional and intellectual teaching of Rossetti and Millais, together with side-influences from the few great French symbolists, were, apart from their own originality, the forces which gave distinction to the work of C. S. Ricketts, C. H. Shannon, R. Savage, and their immediate following. Beauty of line, languorous passion, symbolism full of literary allusions, and a fondness for the life of any age but the present, are the characteristics of the school. Their influence fell very much in the same quarters where Morris found a welcome; but an affinity for the Italian rather than the German masters (shown especially in the "Vale Press" publications), and a studied note of world-weariness, kept them somewhat apart from the sturdy mediævalism of Morris, and linked them intellectually with the decadent school initiated by the wayward genius of Aubrey Beardsley. But though broadly men may be classed in groups, no grouping will supply a formula for all the noteworthy work produced when men are drawn this way and that by current influences. Among artists resolutely independent of contemporary coteries are W. Strang, whose grave, rugged work shows him a pupil, through Legros, of Dürer and others of the old masters; T. Sturge Moore, an original engraver of designs which have an equal affinity for Blake, Calvert, and Hokusai; W. Nicholson, whose style shows a dignified return to the best part of the Rowlandson tradition; and E. J. Sullivan. Among decorative and romantic illustrators of no particular school may be named G. Moira, Byam Shaw, Anning Bell, R. Spence, Mary S. Florence, J. D. Batten, Patten Wilson, and C. Robinson—all artists of considerable inventive faculty, but of rather irresolute imagination and style. In the closing years of the 19th century Aubrey Beardsley became the creator of an entirely novel style of decorative illustration. Drawing inspiration from all sources of European and Japanese art, he produced, by the force of a vivid personality and extraordinary technical skill, a result which was highly original and impressive. To a genuine liking for analysis of repulsive and vicious types of humanity he added an exquisite sense of line, balance, and mass; and partly by *succès de scandale*, partly by genuine artistic brilliance, he gathered round him a host of imitators, to whom, for the most part, he was able to impart only his more mediocre qualities.

United States.

In America, until a comparatively recent date, illustration bowed the knee to the superior excellence of the engraver over the artist. Not until the brilliant pen-drawing of E. A. Abbey carried the day with the black-and-white artists of England did any work of real moment emanate from the United States, unless that of Elihu Vedder be regarded as an exception. Even now it has no school of illustration properly so called, but its leading magazines contain work of individual power which cannot be overlooked. Howard Pyle is a brilliant imitator of Durer; he has also the ability to adapt himself to draughtsmanship of a more modern tendency. C. S. Reinhart was an artist of directness and force, in a style based upon modern French and German examples; while of greater originality as a whole, though derivative in detail, is the fanciful penmanship of Alfred Brennan. Other artists who stand in the front rank of American illustrators, and whose works appear chiefly in the pages of *Scribner's*, *Harper's*, and the *Century Magazine*, are W. T. Smedley, F. S. Church, R. Blum, Wenzell, A. B. Frost, and in particular C. Dana Gibson, the last of whom has gained a reputation in England as an American du Maurier.

France.

The record of modern French illustration goes back to the day when political caricature and the Napoleonic legend divided between them the triumphs of early lithography. The illustrators of France at that period were also her greatest artists. Of the historical and romantic school were Raffet, Charlet, Géricault, Delacroix, Isabey, and Achille Devéria, many of whose works appeared in *L'Artiste*, a paper founded in 1831 as the official organ of the romanticists; while the realists were led in the direction of caricature by two artists of such enormous force as Gavarni and Daumier, whose works, appearing in *La Lithographie Mensuelle*, *Le Charivari*, and *La Caricature*, ran the gauntlet of political interference and suppression during a troubled period of French politics—which was the very cause of their prosperity. Behind these men lay the influence of the great Spanish realist Goya. Following upon the harsh satire and venomous realism of this famous school of pictorial invective, the influence of the Barbizon school came as a milder force; but the power of its artists did not show in the direction of original lithography, and far more value attaches to the few woodcuts of J. F. Millet's studies of peasant life. In these we see clearly the tendency of French illustrative art to keep as far as possible the authentic and sketch-like touch of the artist; and it was no doubt from this tendency that so many of the great French illustrators retained lithography rather than commit themselves to the middleman engraver. Nevertheless, from about the year 1830 many French artists produced illustrations which were interpreted upon the wood for the most part by English engravers. Cunier's editions of *Paul et Virginie* and *La Chaumière Indienne*, illustrated by Huet, Jacque, Isabey, Johannot, and Meissonier, were followed by Meissonier's more famous illustrations to *Contes Rémois*. After Meissonier came Detaille and De Neuville, and, with a voluminous style of his own, Doré. By the majority of these artists the drawing for the engraver seems to have been done with the pen; and the tendency to penmanship was still more accentuated when from Spain came the influence of Fortuny's brilliant but restless technique; while after him, again, came Vierge, to make, as it were, the point of the pen still more pointed. During the middle period of the 19th century the best French illustration was serious in character; but among the later men, when we have recognized the grave beauty of Grasset's *Les Quatre Fils d'Aymon* (in spite of his vicious treatment of the page by flooding washes of colour through the type itself), and the delicate grace of Boutet de Monvel's *Jeanne d'Arc*, also in colours, it is to the illustrators of the comic papers that we have to go for the most typical and most audacious specimens of French art. In the pages of *Gil Blas*, *Le Pierrot*, *L'Écho de Paris*, *Le Figaro Illustré*, *Le Courrier Français*, and similar publications, are to be found, reproduced with a dexterity of process unsurpassed in England, the designs of Forain, Léandre, Willette, and Steinlen, the leaders of a school enterprising in technique, and with a mixture of subtlety and grossness in its humour. Caran d'Ache is also well known as a draughtsman of comic drama in outline.

Germany.

Among illustrators of Teutonic race the one artist who seems worthy of comparison with the great Menzel is Hans Tegner, if, indeed, he be not in some respects his technical superior; but apart from these two, the illustrators respectively of Kügler's *Frederick the Great* and Holberg's *Comedies*, there is no German, Danish, or Dutch illustrator who can lay claim to first rank. Max Klinger, A. Böcklin, W. Trübner, Franz Stück, and Hans Thoma are all symbolists who combine in a singular degree force with brutality; the imaginative quality in their work is for the most part ruined by the hard, braggart way in which it is driven home. The achievements and tendency of the present school of illustration in Germany are best seen in the weekly illustrated journal, *Jugend*, of Munich. Typical of an older German school is the work of Oberländer, a solid, scientific sort of caricaturist, whose illustrations are at times so monumental that the humour in them seems crushed out of life. Others who command high qualities of technique are W. Dietz, L. von Nagel, Hermann Vogel, H. Lüders, and Robert Haug. Behind all these men in greater or less degree lies the influence of Menzel's coldly balanced and dry-lighted realism; but wherever the influence of Menzel ceases, the merit of German illustration for the most part tends to disappear or become mediocre.

AUTHORITIES.—W. J. LINTON. *The Masters of Wood Engraving.* London, 1889.—C. G. HARPER. *English Pen Artists of To-day.* London, 1892.—JOSEPH PENNELL. *Pen Drawing and Pen Draughtsmen.* London, 1894; *Modern Illustration.* London, 1895.—WALTER CRANE. *The Decorative Illustration of Books.* London, 1896.—GLEESON WHITE. *English Illustration: "The 'Sixties": 1855-1870.* Westminster, 1897. —W. A. CHATTO. *A Treatise on Wood Engraving.* London, *n.d.* —BAR-LE-DUC. *Les Illustrations du XIX Siècle.* Paris, 1882. —T. KUTSCHMANN. *Geschichte der deutschen Illustration vom ersten Auftreten des Formschnittes bis auf die Gegenwart.* Berlin, 1899. (L. HO.)

TECHNICAL DEVELOPMENTS.

The history of illustration, apart from the merits of individual artists, during the period since the year 1875, is mainly that of the development of what is called Process (*q.v.*), the term applied to methods of reproducing a drawing or photograph which depend on the use of some mechanical agency in the making of the block, as distinguished from such products of manual skill as steel or wood engraving, lithography, and the like. There is good reason to believe that the art of stereotyping—the multiplication of an already existing block by means of moulds and casts—is as old as the 15th century; and the early processes were, in a measure, a refinement upon this: with the difference that they aimed at the making of a metal block by means of a cast of the lines of the drawing

itself, the background of which had been cut away so as to leave the design in a definite relief. Experiments of this nature may be said to have assumed practical shape from the time of the invention of Palmer's process called at first *Glyphography*, about the year 1844; this was afterwards perfected and used to a considerable extent under the name of *Dawson's Typographic Etching*, and its results were, in many cases, quite admirable, and often appear in books and periodicals of the first part of the period with which we are now concerned. The *Graphic*, for instance, published its first process block in 1876, and the *Illustrated London News* also made similar experiments at about the same time.

From this time begins the gradual application of photography to the uses of illustration, the first successful line blocks made by its help being probably those of Gillot, at Paris, in the early 'eighties. The next stage was to be the invention of some means of reproducing wash drawings. To do this it was necessary for the surface of the block to be so broken up that every tone of the drawing should be represented thereon by a grain holding ink enough to reproduce it. This was finally accomplished by the insertion of a screen, in the camera, between the lens and the plate—the effect of which was to break up the whole surface of the negative into dots, and so secure, when printed on a zinc plate and etched, an approximation to the desired result. Half-tone blocks (as they were called) of this nature (see PROCESS) were used in the *Graphic* from 1884 and the *Illustrated London News* from 1885 onwards, the methods at first in favour being those of Meisenbach and Boussod Valadon and Co.'s phototype. Lemercier and Petit of Paris, Angerer and Göschl of Vienna, and F. Ives of Philadelphia also perfected processes giving a similar result, a block by the latter appearing in the *Century* magazine as early as 1882. Processes of this description had, however, been used for some years before by Henry Blackburn in his *Academy Notes*.

During the decade 1875–85, however, the main body of illustration was accomplished by wood-engraving, which a few years earlier had achieved such splendid results. Its artistic qualities were now at a rather low ebb, although good facsimile engravings of pen-drawings were not infrequent. The two great illustrated periodicals already referred to during that period relied more upon pictorial than journalistic work. An increasing tendency towards the illustration of the events of the day was certainly shown, but the whole purpose of the journal was not, as at present, subordinated thereto. The chief illustrated magazines of the time, *Harper's*, the *Century*, the *English Illustrated*, were also content with the older methods, and are filled with wood-engravings, in which, if the value of the simple line forming the chief quality of the earlier work has disappeared, a most astonishing delicacy and success were obtained in the reproduction of tone.

Perhaps the most notable and most characteristic production of the time in England was colour-printing. The *Graphic* and the *Illustrated London News* published full-page supplements of high technical merit printed from wood-blocks in conjunction with metal plates, the latter sometimes having a relief aquatint surface which produced an effect of stipple upon the shading; metal was also used in preference to wood for the printing of certain colours. The children's books illustrated by Randolph Caldecott, Walter Crane, and Kate Greenaway at this time are among the finest specimens of colour-printing yet seen outside of Japan; in them the use of flat masses of pleasant colour in connexion with a bold and simple outline was carried to a very high pitch of excellence. These plates were generally printed by Edmund Evans. In 1887 the use of process was becoming still more general; but its future was by no means adequately foreseen, and the blocks of this and the next few years are anything but satisfactory. This, it soon appeared, was due to inefficient printing on the one hand, and, on the other, to a want of recognition by artists of the special qualities of drawing most suitable for photographic reproduction. The publication of Quevedo's *Pablo de Segovia* with illustrations by Daniel Vierge in 1882, although hardly noticed at the time, was to be a revelation of the possibilities of the new development; and a serious study of pen-drawing from this point of view was soon inaugurated by the issue of Joseph Pennell's *Pen Drawing and Pen Draughtsmen* in 1889, followed in 1892 by C. G. Harper's *English Pen Artists of To-day*, and in 1896 by Walter Crane's *Decorative Illustration of Books*. At this time also the influence of Aubrey Beardsley made itself strongly felt, not merely as a matter of style, but, by the use of simple line or mass of solid black, as an almost perfect type of the work most suitable to the needs of process. Wider experience of printing requirements, and finer workmanship in the actual making of the blocks, in Paris, Vienna, New York, and London, soon brought the half-tone process into great vogue. The spread of education has enormously increased the demand for ephemeral literature, more especially that which lends itself to pictorial illustration; and the photograph or drawing in wash reproduced in half-tone has of late to a great extent ousted line work from the better class of both books and periodicals.

Improvements in machinery have made it possible to print illustrations at a very high speed; and the facility with which photographs can now be taken of scenes such as the public delight to see reproduced in pictures has brought about an almost complete change in pictorial journalism. In addition, reference must be made to an extraordinary increase in the numbers and circulation of cheap periodical publications depending to a very large extent for popularity on their illustrations. Several of these, printed on the coarsest paper, from rotary machines, sell to the extent of hundreds of thousands of copies per week. It was inevitable that this cheapening process should not be permitted to develop without opposition, and the *Dial* (1889–97) must be looked on as a protest by the band of artists who promoted it against the unintelligent book-making now becoming prevalent. Much more effective and far-reaching in the same direction was the influence of William Morris, as shown in the publications of the Kelmscott Press (dating from 1891). In these volumes the aim was to produce illustrations and ornaments which were of their own nature akin to, and thus able to harmonize with the type, and to do this by pure handicraft work. As a result, a distinct improvement is to be found in the mere book-making of Great Britain; and although the main force of the movement soon spent itself in somewhat uninspired imitations, there can be no doubt of the survival of a taste for well-produced volumes, in which the relationship of type, paper, illustration, and binding has been a matter of careful and artistic consideration. Under this influence, a notable feature has been the re-issue, in an excellent form, of illustrated editions of the works of most of the famous writers.

Another significant outcome of the trend of popular education has been the rapid creation of a large literature devoted exclusively to art in one form or another. The *Art Journal* (1849), the *Magazine of Art* (1878), the *Studio* (1893), the *Artist* (in its illustrated form, 1895), and the *Connoisseur* (1901), as well as the considerable and important publications devoted to architecture and the like, have eagerly availed themselves of the new developments of illustration, and their pages have been the means of bringing before the public many experiments which might not otherwise have been tried. In addition to periodicals, large numbers of books of this nature are now issued, the cheapness and facility of the photographic processes making it possible to render treatises attractive to a much wider circle of readers than before, as well as to multiply evidence and example in a way that the older methods could never permit. But it is to be regretted that a large proportion of these—and indeed of most books of the day illustrated by half-tone blocks—are printed upon clay-faced paper, which it is believed cannot last many years.

The illustration of newspapers pure and simple is a matter of which we are probably only experiencing the beginnings of a great progress. *The Times* had occasionally published maps, but the printing of a portrait of Lefroy the murderer by the *Daily Telegraph* in 1881 was perhaps one of the earliest examples of journalistic enterprise in this direction. On 11th February 1895 the *Daily Chronicle* published an enlargement from a line drawing by Sir E. Burne-Jones, which was printed from a process line-block on a rotary machine; and since then illustrations of this kind are yearly becoming more frequent. They are generally in pure line, but the *Black and White Budget* has printed many half-tones in this manner.

In France the general movement has proceeded upon lines on the whole very similar. Process—especially what was called "Gillotage"—was adopted earlier, and used at first with greater liberality than in England, although wood-engraving has persisted effectively even up to our own time. The French have no periodicals which can compare with the *Daily Graphic*, or with the great illustrated weekly journals issued in the United Kingdom. Neither have they anything at all like the cheap and so-called "humorous" English papers. But in the various types of periodicals of which the *Revue Illustrée*, *Figaro Illustré*, and *Gil Blas Illustré* may be taken as examples, the most noticeable feature is a use of colour-printing, which is far in advance of anything generally attempted in Great Britain. A favourite and effective process is that employed for the reproduction of chalk drawings (as by Steinlen), which consists of the application of a surface-tint of colour from a metal plate to a print from an ordinary process block. *L'Illustration* still relies on older fashions, and publishes a considerable number of wood-engravings.

In Germany, *Jugend*, *Simplicissimus*, and other publications devoted to humour and caricature, employ colour-printing to a great extent with success. The organ of the artists of the younger German schools, *Pan* (1895), makes use of every means of illustration, and has especially cultivated lithography and wood-cuts, using these arts effectively but with some eccentricity. Holland

has also employed coloured lithography for a remarkable series of children's books illustrated by van Hoytema and others. The Viennese *Kunst und Kunsthandwerk* is an art publication which is exceptionally well produced and printed.

Illustration in the United States has some few characteristics which differentiate it from that of other countries. The later school of fine wood-engraving is even yet in existence. American artists also introduced an effective use of the process block, namely, the engraving or working over of the whole or certain portions of it by hand. This is generally done by an engraver, but in certain cases it has been the work of the original draughtsman, and its possibilities foreseen by him in making his drawing. The only other variant of note is the use of half-tone blocks superimposed for various colours; but the experiments of this nature in *Harper's* and *Scribner's* magazines cannot be said to have yet achieved all the success that may be expected. (E. F. S.)

Ilmenau, a town and summer resort of Germany, grand-duchy of Saxe-Weimar, at the north foot of the Thuringian Forest and 30 miles by rail south of Erfurt. The town stands picturesquely amongst wooded hills and is much frequented as a health-resort, and is in German literary history associated with Goethe's *Iphigenie.* It has manufactures of glass and porcelain, toys, gloves, and chemicals, iron and coal mines, and sawmills. Here is a grand-ducal castle, now used as administrative offices. Population (1885), 5483; (1895), 7958; (1900), 10,419.

Iloilo, capital of the province of the same name, situated on the south-east coast of Panay, one of the Philippine Islands. A small tidal river furnishes a well-protected port, suitable for ships of 15 feet draught, while ocean-going vessels can lie off the city in the roadstead between Panay and Guimaras. The town is irregularly built on low ground. Its streets are not paved. There were formerly many good shops and residences, but the town was burned by the Filipino insurgents on the landing of the American troops, 11th February 1899, and has not been fully rebuilt. Iloilo ranks next to Manila in commercial importance among Philippine cities. It was organized as a municipality under Spanish rule. It is a port of entry, and is the main shipping-point for the sugar grown in the Visayan Islands. Cocoanut oil, lime, vinegar, mats, and various articles of palm wood are manufactured. It has a good government house and a fine church. Population, about 12,000.

Imaizumi. See Gifu.

Imbros, a Turkish island in the Ægean, at the southern end of the Thracian Chersonese peninsula. It forms with Samothrace, about 17 miles distant, a caza (or canton) in the sanjak of Lemnos, and province of the Archipelago Isles. The island is the seat of a Greek bishopric. There is communication with the mainland by occasional vessels. The island is of great fertility—wheat, oats, barley, olives, sesame, and valonea being the principal products, in addition to a variety of fruits. The population is about 92,000, nearly all Turks.

Immigration. See Migration.

Impressionism.—The word "Impressionist" has come to have a more general application in England than in France, where it took currency as the nickname of a definite group of painters exhibiting together, and was adopted by themselves during the conflict of opinion which the novelty of their art excited. The word therefore belongs to the class of nicknames or battle-names, like "Romanticist," "Naturalist," "Realist," which preceded it, words into which the acuteness of controversy infuses more of theoretical purport than the work of the artists denoted suggests to later times. The painters included in such a "school" differ so much among themselves, and so little from their predecessors compared with the points of likeness, that we may well see in these recurring effervescences of official and popular distaste rather the shock of individual force in the artist measured against contemporary mediocrity than the disturbance of a new doctrine. The "Olympia" of Manet, hooted at the Salon of 1865 as subversive of all tradition, decency, and beauty, strikes the visitor to the Luxembourg rather as the reversion to a theme of Titian by an artist of ruder vision than as the demonstration of a revolutionary in painting. Later developments of the school do appear to us revolutionary. With this warning in a matter still too near us for final judgment, we may give some account of the Impressionists proper, and then turn to the wider significance sometimes given to the name.

The words *Impressioniste, Impressionisme,* are said to have arisen from a phrase in the preface to Manet's catalogue of his pictures exhibited in 1867 during the Exposition Universelle, from which he was excluded. "It is the effect," he wrote, "of sincerity to give to a painter's works a character that makes them resemble a protest, whereas the painter has only thought of rendering his impression." An alternative origin is a catalogue in which Claude Monet entitled a picture of sunrise at sea "Une Impression." The word was probably much used in the discussions of the group, and was caught up by the critics as characteristic.[1] At the earlier date the only meaning of the word was a claim for individual liberty of subject and treatment. So far as subject went, most, though not all of Manet's pictures were modern and actual of his Paris, for his power lay in the representation of the thing before his eye, and not in fanciful invention. His simplicity in this respect brought him into collision with popular prejudice when, in the "Déjeuner sur l'herbe" (1863), he painted a modern "Fête Champêtre." The actual characters of his painting at this period, so fancifully reproached and praised, may be grouped under two heads. (1) The expression of the object by a few carefully chosen values in flattish patches. Those patches are placed side by side with little attenuation of their sharp collision. This simplification of colour and tone recalls by its broad effects of light and silhouette on the one hand Velasquez, on the other the extreme simplification made by the Japanese for the purposes of colour-printing. Manet, like the other painters of his group, was influenced by these newly-discovered works of art. The image, thus treated, has remarkable hardiness and vigour, and also great decorative breadth. Its vivacity and intensity of aspect is gained by the sacrifice of many minor gradations, and by the judgment with which the leading values have been determined. This matching of values produces, technically, a "solid" painting, without glazing or elaborate transparency in shadows. (2) During this period Manet makes constant progress towards a fair, clear colour. In his early work the patches of blond colour are relieved against black shadows; later these shadows clear up, and in place of an indeterminate brown sauce we find shadows that are colours. A typical picture of this period is the "Musique aux Tuileries," refused by the Salon of 1863. In this we have an actual out-of-doors scene rendered with a frankness and sharp taste of contemporary life surprising to contemporaries, with an elision of detail in the treatment of a crowd and a seizing on the chief colour note and patch that characterize each figure equally surprising, an effort finally to render the total high-pitched gaiety of the spectacle as a banquet of sunlight and colour rather than a collection of separate dramatic groups.

For life of Édouard Manet (1833–1883) see Edmond Bazire. *Manet.* Paris, 1884. An idea of the state of popular feeling may be

[1] Mr H. P. Hain Friswell has pointed out that the word "impression" occurs frequently in Chevreul's book on colour; but it is also current among the critics. See Ruskin's chapter on Turner's composition—"impression on the mind."

gained by reading ZOLA's eloquent defence in *Mon Salon*, which appeared in *L'Événement* (1866) and *Édouard Manet* (1867), both reprinted in *Mes Haines* (Paris, 1880). The same author has embodied many of the impressionist ideals in Claude Lantier, the fictitious hero of *L'Œuvre*. Other writers belonging to Manet's group are THÉODORE DURET, author of *Les Peintres Français en 1867* and *Critique d'avant-garde*, articles and catalogue-prefaces reprinted 1885. See also, for Manet and others, J. K. HUYSMAN'S *L'Art Moderne* (1883) and *Certains*. Summaries of the literature of the whole period will be found in R. MUTHER, *The History of Modern Painting* (tr. London, 1896), not always trustworthy in detail, and Miss R. G. KINGSLEY, *A History of French Art* (1899). For an interesting critical account see W. C. BROWNELL, *French Art* (1892).

The second period, to which the name is sometimes limited, is complicated by the emergence of new figures, and it is difficult as yet, and perhaps will always remain difficult, to say how much of originality belongs to each artist in the group. The main features are an intenser study of illumination, a greater variety of illuminations, and a revolution in *facture* with a view to pressing closer to a high pitch of light. Manet plays his part in this development, but we shall not be wrong probably in giving to Claude Monet (born 1840) the chief rôle as the instinctive artist of the period, and to Camille Pissarro (born 1830) a very large part as a painter curious in theory and experiment. Monet at the early date of 1866 had painted a picture as daring in its naïve brutality of out-of-door illumination as the "Déjeuner sur l'herbe." But this picture has the breadth of patch, solidity, and suavity of paste of Manet's practice. During the siege of Paris (1870–71) Monet and Pissarro were in London, and there the study of Turner's pictures enlarged their ideas of the pitch in lighting and range of effect possible in painting, and also suggested a new handling of colour, by small broken touches in place of the large flowing touches characteristic of Manet. This method of painting occupied much of the discussion of the group that centred round Manet at the Café Guerbois, in the Batignolles quarter (hence called *L'École de Batignolles*). The ideas were: (1) Abolition of conventional brown tonality. But all browns, in the fervour of this revolt, went the way of conventional brown, and all ready-made mixtures like the umbers, ochres, siennas were banished from the palette. Black itself was condemned. (2) The idea of the spectrum, as exhibiting the series of "primary" or "pure" colours, directed the reformed palette. Six colours, besides white, were admitted to represent the chief hues of the spectrum. (3) These colours were laid on the canvas with as little previous mixture on the palette as possible to maintain a maximum of luminosity, and were fused by touch on the canvas as little as possible, for the same reason. Hence the "broken" character of the touch in this painting, and the subordination of delicacies of form and suave continuity of texture to the one aim of glittering light-and-colour notation. Justification of these procedures was sought in occasional features of the practice of Delacroix, of Watteau, of Chardin, in the hatchings of pastel, the stipple of water-colour. With the ferment of theory went a *parti pris* for translating all effects into the upper registers of tone (cf. Ruskin's chapter on Turner's practice in *Modern Painters*), and for emphasizing the colour of shadows at the expense of their tone. The characteristic work of this period is landscape, as the subject of illumination strictly observed and followed through the round of the day and of the seasons. Other pictorial motives were subordinated to this research of effect, and Monet, with a haystack, group of poplars, or church front, has demonstrated the variety of lighting that the day and the season bring to a single scene. Besides Pissarro, Alfred Sisley (1840–1899) is a member of the group, and Manet continues his progress, influenced by the new ideas in pictures like "Le Linge" and "Chez le Père Lathuille."

Edmond Degas (born 1834), a severe and learned draughtsman, is associated with this landscape group by his curiosity in the expression of momentary action and the effects of artificial illumination, and by his experiments in broken colour, more particularly in pastel. The novelty of his matter, taken from unexplored corners of modern life, still more the daring and irony of his observation and points of view, and the strangeness of his composition, strongly influenced by Japanese art, enriched the associations now gathering about the word "impressionist." Another name, that of Auguste Renoir (born 1841), completes the leading figures of the group. Any "school" programme would be strained to breaking-point to admit this painter, unless on the very general grounds of love of bright colour, sunlit places, and independence of vision. He has no science of drawing or of tone, but wins a precarious charm of colour and expression.

The landscape, out-of-doors line, which unites in this period with Manet's line, may be represented by these names: Corot, Jongkind, Boudin, Monet. Monet's real teacher was Eugène Boudin (1824–1898). (See GUSTAVE CAHEN'S *Eugène Boudin*. Paris, 1900.) They, and others of the group, worked together in a painters' colony at Saint Simeon, near Honfleur. It is usual to date the origin of *plein-air* painting, *i.e.*, painting out-of-doors, in an out-of-doors key of tone, from a picture Manet painted in the garden of De Nittis, just before the outbreak of war in 1870. This dates only Manet's change to the lighter key and looser handling. It was Monet who carried the practice to a logical extreme, working on his canvas only during the effect and in its presence. The method of Degas is altogether different, viz., a combination in the studio from innumerable notes and observations. It will be evident from what has been said above that impressionistic painting is an artistic ferment, corresponding to the scientific research into the principles of light and colour, just as earlier movements in painting coincided with the scientific study of perspective and anatomy. CHEVREUL'S famous book, already referred to, *De la loi du contraste simultané des Couleurs* (1838), established certain laws of interaction for colours adjacent to one another. He still, however, referred the sensations of colour to the three impossible "primaries" of Brewster—red, blue, and yellow. The Young-Helmholtz theory affected the palette of the Impressionists, and the work of Ogden Rood, *Colour* (Internat. Scientific Series, 1879–81), published in English, French, and German, furnished the theorists with formulæ measuring the degradation of pitch suffered by pigments in mixture.

The Impressionist group (with the exception of Manet, who still fought for his place in the Salon) exhibited together for the first time as L'Exposition des Impressionistes at Nadar's, Boulevard des Capucines, in 1874. They were then taken up by the dealer Durand-Ruel, and the succeeding exhibitions in 1876, 1877, 1879, 1880, 1881, 1882, and 1886, were held by him in various galleries. The full history of these exhibitions, with the names of the painters, will be found in two works: FÉLIX-FÉNÉON, *Les Impressionistes en 1886* (Paris, 1886), and G. GEFFROY, *La Vie Artistique* (*Histoire de l'Impressionisme*, in vol. for 1894). See also G. LECOMTE, *L'Art Impressioniste d'après la Collection privée de M. Durand-Ruel* (Paris, 1892); DURANTY, *La Peinture Nouvelle* (1876). Besides the names already cited, some others may be added: Madame Berthe Morisot, sister-in-law of Manet; Paul Cézanne, belonging to the Manet-Pissarro group; and later, Gauguin. J. F. Raffaëlli applied a "characteristic" drawing, to use his word, to scenes in the dismal suburbs of Paris; Forain, the satiric draughtsman, was a disciple of Degas, as also Zandomeneghi. Miss Mary Cassatt was his pupil. Caillebotte, who bequeathed the collection of Impressionist paintings now in the Luxembourg, was also an exhibitor; and Boudin, who linked the movement to the earlier schools.

The first exhibitions of the Impressionists in London were in 1882 and 1883, but their fortunes there cannot be pursued in the present article, nor the history of the movement beyond its originators. This excludes notable figures, of which M. Besnard may be chosen as a type.

In Manet's painting, even in the final steps he took towards "*la peinture claire*," there is nothing of the "decomposition of tones" that logically followed from the theories of his followers. He recognized the existence in certain illuminations of the violet shadow, and he adopted in open-air work a looser and more broken touch. The nature of his subjects encouraged such a handling, for the painter who attempts to note from nature the colour

values of an elusive effect must treat form in a summary fashion, still more so when the material is in constant movement like water. Moreover, in the river-side subjects near Paris there was a great deal that was only pictorially tolerable when its tone was subtracted from the details of its form. Monet's painting carries the shorthand of form and broken colour to extremity; the flowing touch of Manet is chopped up into harsher, smaller notes of tone, and the pitch pushed up till all values approach the iridescent end of the register. It was in 1886 that the *doctrinaire* ferment came to a head, and what was supposed to be a scientific method of colour was formulated. This was *pointillisme*, the resolution of the colours of nature back into six bands of the rainbow or spectrum, and their representation on the canvas by *dots* of unmixed pigment. These dots, at a sufficient distance, combine their hues in the eye with the effect of a mixture of coloured *lights*, not of pigments, so that the result is an increase instead of a loss of luminosity. There are several fallacies, however, theoretical and practical, in this "spectral palette" and pointillist method. If we depart from the three primaries of the Helmholtz hypothesis, there is no reason why we should stop at six hues instead of six hundred. But pigments follow the spectrum series so imperfectly that the three primaries, even if we could exactly locate them, limit the palette considerably in its upper range. The sacrifice of black is quite illogical, and the lower ranges suffer accordingly. Moreover, it is doubtful whether many painters have followed the laws of mixture of lights in their dotting, *e.g.*, dotting green and red together to produce yellow. It may be added that dotting with oil pigment is in practice too coarse and inaccurate a method. This innovation of *pointillisme* is generally ascribed to George Seurat (died 1890), whose picture, "La Grande Jatte," was exhibited at the Rue Laffitte in 1886. Pissarro experimented in the new method, but abandoned it, and other names among the *Pointillistes* are Paul Signac, Vincent van Gogh, and van Rysselberghe. The theory opened the way for endless casuistries, and its extravagances died out in the later exhibition of the *Indépendants* or were domesticated in the Salon by painters like M. Henri Martin.

The first modern painter to concern himself scientifically with the reactions of complementary colours appears to have been Delacroix (Leonardo, it should be remembered, left some notes on the subject). It is claimed for Delacroix that as early as 1825 he observed and made use of these reactions, anticipating the complete exposition of Chevreul. He certainly studied the treatise, and his biographers describe a dial-face he constructed for reference. He had quantities of little wafers of each colour, with which he tried colour effects, a curious anticipation of pointillist technique. The pointillists claim him as their grandfather. See PAUL SIGNAC, "D'Eugène Delacroix au Néo-Impressionnisme" (*Revue Blanche*, 1898). For a fuller discussion of the spectral palette see the *Saturday Review*, 2nd, 9th, and 23rd February and 23rd March 1901.

In England the ideas connected with the word Impressionism have been refracted through the circumstances of the British schools. The questions of pitch of light and iridescent colour had already arisen over the work of Turner, of the Pre-Raphaelites, and also of G. F. Watts, but less isolated and narrowed, because the art of none of these limited itself to the pursuit of light. *Pointillisme*, after a fashion, existed in British water-colour practice. But the Pre-Raphaelite school had accustomed the English eye to extreme definition in painting and to elaboration of detail, and it happened that the painting of James M'Neill Whistler (Grosvenor Gallery, 1878) brought the battle-name Impressionism into England and gave it a different colour. Mr Whistler's method of painting is in no way revolutionary, and he prefers to transpose values into a lower key rather than compete with natural pitch, but his vision, like that of Manet under the same influences, Spanish and Japanese, simplifies tone and subordinates detail. These characteristics raised the whole question of *the science and art of aspect in modern painting*, and the field of controversy was extended backwards to Velasquez as the chief master of the moderns. "Impressionism" at first had meant individualism of vision, later the notation of fugitive aspects of light and of movement; now it came to mean breadth in pictorial vision, all the simplifications that arise from the modern analysis of aspect, and especially the effect produced upon the parts of a picture-field by attending to *the impression of the whole.* Ancient painting analyses aspect into three separate acts as form, tone, and colour. All forms are made out with equal clearness by a conventional outline; over this system of outlines a second system of light and shade is passed, and over this again a system of colours. Tone is conceived as a difference of black or white added to the tints, and the colours are the definite local tints of the objects (a blue, a red, a yellow, and so forth). In fully-developed modern painting, instead of an object analysed into sharp outlines covered with a uniform colour darkened or lightened in places, we find an object analysed into a number of surfaces or planes set at different angles. On each of these facets the character of the object and of the illumination, with accidents of reflexion, produces a patch called by modern painters a "value," because it is colour of a particular value or tone. (With each difference of tone, "value" implies a difference of hue also, so that when we speak of a different tone of the same colour we are using the word "same" in a loose or approximate sense.) These planes or facets define themselves one against another with greater or less sharpness. Modern technique follows this modern analysis of vision, and in one act instead of three renders by a "touch" of paint the shape and value of these facets, and instead of imposing a uniform ideal outline at all their junctions, allows these patches to define themselves against one another with variable sharpness.

Blurred definition, then, as it exists in our natural view of things, is admitted into painting; a blurring that may arise from distance, from vapour or smoke, from brilliant light, from obscurity, or simply from the nearness in value of adjacent objects. Similarly, much detail that in primitive art is elaborated is absorbed by rendering the aspect instead of the facts known to make up that aspect. Thus hair and fur, the texture of stuffs, the blades of grass at a little distance, become patches of tone showing only their larger constructive markings. But the blurring of definitions and the elimination of detail that we find in modern pictorial art are not all of this ready-made character. We have so far only the scientific analysis of a field of view. If the painter were a scientific reporter he would have to pursue the systems of planes, with their shapes and values, to infinity. Impressionism is the art that surveys the field and determines which of the shapes and tones are of chief importance to the *interested* eye, enforces these, and sacrifices the rest. Construction, the logic of the object rendered, determines partly this action of the eye, and also decoration, the effects of rhythm in line and harmony in fields of colour. These motives belong to all art, but the specially impressionist motive is the act of *attention* as it affects the aspect of the field. We are familiar, in the ordinary use of the eye, with two features of its structure that limit clearness of vision. There is, first, the spot of clear vision on the retina, outside of which all falls away into blur; there is, secondly, the action of *focus*. As the former limits clear definition to one spot in the field extended vertically and laterally, so focus limits clear definition to one plane in the third dimension, viz.,

depth. If three objects, A, B, and C, stand at different depths before the eye, we can at will fix A, whereupon B and C must fall out of focus, or B, whereupon A and C must be blurred, or C, sacrificing the clearness of A and B. All this apparatus makes it impossible to see everything at once with equal clearness, enables us, and forces us for the uses of real life, to frame and limit our picture, according to the immediate interest of the eye, whatever it may be. The painter instinctively uses these means to arrive at the emphasis and neglect that his choice requires. If he is engaged on a face he will now screw his attention to a part and now relax it, distributing the attention over the whole so as to restore the bigger relations of aspect. Sir Joshua Reynolds describes this process as seeing the whole "with the dilated eye"; the commoner precept of the studios is, "to look with the eyes half closed"; a third way is to throw the whole voluntarily out of focus. In any case the result is that minor planes are swamped in bigger, that smaller patches of colour are swept up into broader, that markings are blurred. The final result of these tentative reviews records, in what is blurred and what is clear, the attention that has been distributed to different parts, and to parts measured against the whole. The Impressionist painter does not allot so much detail to a face in a full-length portrait as to a head alone, nor to twenty figures on a canvas as to one. Again, he indicates by his treatment of planes and definitions whether the main subject of his picture is in the foreground or the distance. He persuades the eye to slip over hosts of near objects so that, as in life, it may hit a distant target, or concentrate its attack on what is near, while the distance falls away into a dim curtain. All those devices by which attention is directed and distributed, and the importance in space of an object established, affect impressionistic composition.

It is an inevitable misunderstanding of painting which plays the game of art so closely up to the real aspects of nature that its aim is that of mere exact copying. Painting like Manet's, accused of being realistic in this sense, sufficiently disproves the accusation when examined. Never did painting show a *parti pris* more pronounced, even more violent. The elisions and assertions by which Manet selects what he finds significant and beautiful in the complete natural image are startling to the stupid realist, and the Impressionist may best be described as the painter who out of the completed contents of vision constructs an image moulded upon his own interest in the thing seen and not on that of any imaginary schoolmaster. Accepting the most complex terms of nature with their special emotions, he uses the same freedom of sacrifice as the man who at the other end of the scale expresses his interest in things by a few scratches of outline. The perpetual enemy of both is the eclectic, who works for possible interests not his own.

Some of the points touched on above will be found amplified in articles by the writer in *The Albemarle* (September 1892), the *Fortnightly Review* (June 1894), and *The Artist* (March–July 1896). An admirable exposition of Impressionism in this sense is R. A. M. STEVENSON's *The Art of Velasquez* (1895). Mr Stevenson was trained in the school of Carolus Duran, where impressionist painting was reduced to a system. Mr Sargent's painting is a brilliant example of the system. (D. S. M.)

Ince-in-Makerfield, a township in the Ince parliamentary division of Lancashire, England, adjoining the borough of Wigan. The Leeds and Liverpool Canal intersects the township. There are large collieries, ironworks, forges, railway-waggon works, and cotton mills here. Walmesley Park, area 26 acres, was opened in 1895. Area, 2320 acres. Population of urban district (1901), 21,270.

Incense.—The article on incense in the earlier volumes of the *Ency. Brit.* (ninth edition) gives a full account of the nature, preparation, and use of incense in ancient as well as modern times, and in different parts of the world, but especially in the East. The object of the present article is to give some information as to the use of incense in the Church of England. Mr Scudamore (*Notitia Eucharistica*, 2nd ed., pp. 141–142) thus describes the method and extent of its employment at the mass prior to the Reformation: "According to the use of Sarum (and Bangor) the priest, after being himself censed by the deacon, censed the altar before the Introit began. The York rubric directed him to do it immediately after the first saying of the Introit, which in England was thrice said. The Hereford missal gives no direction for censing the altar at that time. The middle of the altar was censed, according to Sarum, Bangor, and Hereford, before the reading of the Gospel. According to Sarum and Bangor, the thurible, as well as the lights, attended the Gospel to the lectern. Perhaps the York rubric implies that this was done when it orders (which the others do not) the thurible to be carried round the choir with the Gospel while the Creed was being sung. In the Sarum and Bangor, the priest censed the oblations after offering them; then the space between himself and the altar. He was then, at Sarum, censed by the deacon, and an acolyte censed the choir; at Bangor the *Sinistrum Cornu* of the altar and the relics were censed instead. York and Hereford ordered no censing at the offertory. There is reason to think that, notwithstanding the order for the use of incense at every celebration, it was in practice burnt only on high festivals, and then only in rich churches, down to the period of the Reformation. In most parishes its costliness alone would preclude its daily use, while the want of an assistant minister would be a very common reason for omitting the rite almost everywhere. Incense was not burnt in private masses, so that the clergy were accustomed to celebrations without it, and would naturally forego it on any plausible ground." The ritual of the mass remained unchanged until the death of Henry VIII. (28th January 1547). In March 1548 the *Order of the Communion* was published and commanded to be used by royal proclamation in the name of Edward VI. It was the precursor of the Prayer Book, and supplemented the accustomed Latin service by additions in English to provide for the communion of the people in both kinds. But it was expressly stated in a rubric that the old service of the mass was to proceed without variation of any rite or ceremony until after the priest had received the sacrament, that is, until long after the last of the three occasions for the use of incense explained above. But on Whitsunday 1549 the first Prayer Book of Edward VI. came into use under an Act of Parliament (2 and 3 Ed. VI. ch. 1, the first Act of Uniformity) which required its exclusive use in public worship so as to supersede all other forms of service. Another Act, 3 and 4 Ed. VI. ch. 10, required the old service books to be delivered up to be destroyed. The first Prayer Book does not contain any direction to use or any mention of incense. It has been and still is a keenly controverted question whether incense did or did not continue to be in ceremonial use under the first Prayer Book or during the rest of Edward VI.'s reign. No evidence has hitherto been discovered which justifies us in answering this question in the affirmative. The second Prayer Book of Edward VI. (1552), published under the authority of the second Act of Uniformity (5 and 6 Ed. VI. ch. 1), contains no reference to incense. Edward VI. died on the 6th July 1553. Queen Mary by statute (1 Mary, sess. 2, ch. 2) abolished the Prayer Book, repealed the Acts of Uniformity, and restored "divine service and administration of sacraments as were most commonly used in

England in the last year of Henry VIII." The ceremonial use of incense thus became again an undoubted part of the communion service in the Church of England. A proclamation issued (6th December 1553) directed the churchwardens to obtain the proper ornaments for the churches; and the bishops (at any rate Bishop Bonnor, see *Visitation Articles 1554*, Cardwell's *Doc. Ann.* vol. i. pp. 149–153) in their visitations inquired whether censers had been furnished for use. Mary died 17th November 1558. On 24th June 1559 the second Prayer Book of Edward VI. (with a few alterations having no reference to incense) was again established, under the authority of the third Act of Uniformity (1 Eliz. ch. 2), as the exclusive service book for public service. There is no evidence of the ceremonial use of incense under Elizabeth's Prayer Book, or under the present Prayer Book of 1662 (established by the fourth Act of Uniformity, 13 and 14 Charles II. ch. 4) until the middle of the 19th century; and there is no doubt that as a ceremony of divine worship, whether at the Holy Communion or at other services, it was entirely disused. There are, however, a good many instances recorded of what has been called a fumigatory use of frankincense in churches, by which it was sought to purify the air, in times of public sickness, or to dispel the foulness caused by large congregations, or poisonous gases arising from ill-constructed vaults under the church floor. It seems also to have been used for the purpose of creating an agreeable perfume on great occasions, *e.g.*, the great ecclesiastical feasts. But this use of incense must be carefully distinguished from its ceremonial use. It was utilitarian and not symbolical, and from the nature of the purpose in view must have taken place before, rather than during, service. Of the same character is the use of incense carried in a perfuming pan before the sovereign at his coronation in the procession from Westminster Hall to the Abbey. This observance was maintained from James II.'s coronation to that of George III. In the general revival of church ceremonial which accompanied and followed the Oxford Movement incense was not forgotten, and its ceremonial use in the Pre-Reformation method has been adopted in a few extreme churches since 1850. Its use has been condemned as an illegal ceremony by the ecclesiastical courts. In 1868 Sir Robert Phillimore (Dean of the Arches) pronounced the ceremonial use of incense to be illegal in the suit of *Martin* v. *Mackonochie* (2 A. and E. L.R. 116). The case was carried to the Privy Council on appeal, but there was no appeal on the question of incense. Again, in 1870, the ceremonial use of incense was condemned by Sir Robert Phillimore in the suit of *Sumner* v. *Wix* (3 A. and E. L.R. 58).

Notwithstanding these decisions, it was insisted by those who defended the revival of the ceremonial use of incense that it was a legal custom of the Church of England. The question was once more elaborately argued in May 1899 before an informal tribunal consisting of the archbishop of Canterbury (Dr Temple) and the archbishop of York (Dr Maclagan), at Lambeth Palace. On 31st July 1899 the archbishops decided that the liturgical use of incense was illegal. The Lambeth "opinion," as it was called, failed to convince the clergy against whom it was directed any better than the judgments of the ecclesiastical courts, but at first a considerable degree of obedience to the archbishops' view was shown. Various expedients were adopted, as, *e.g.*, the use of incense just before the beginning of service, by which it was sought to retain incense without infringing the law as laid down by the archbishops. There remained, nevertheless, a tendency on the part of the clergy who used incense, or desired to do so, to revert to the position they occupied before the Lambeth hearing—that is, to insist on the ceremonial use of incense as a part of the Catholic practice of the Church of England which it is the duty of the clergy to maintain, notwithstanding the decisions of ecclesiastical judges or the opinions of archbishops to the contrary. (L. T. D.)

Income Tax.—*United Kingdom.*—An income tax was originally imposed by Mr Pitt in 1798, but it did not assume its present form until 1803. It lapsed in 1816, and was revived by Sir R. Peel's Government in 1842. It had always been regarded as a temporary measure, and is still renewed annually; but it has now become so important a feature of the fiscal system that there does not appear to be any prospect of its being again abandoned. Speaking broadly, it is a tax levied on all incomes derived from sources within the United Kingdom, or received by residents in the United Kingdom from other sources. But incomes under £160 are exempt; and an abatement is allowed of £160 on those between £160 and £400; of £150 on those between £400 and £500; of £120 on those between £500 and £600; and of £70 on those between £600 and £700. An abatement is also allowed on account of any premiums paid for life assurance, provided they do not exceed one-sixth of the total income. The existing limit of total exemption was fixed in 1894, when it was raised from £150; and the scale of abatements was last revised in 1898 by admitting incomes between £500 and £700. The rate of charge has been as high as 16d. (in 1855–57), and as low as 2d. (in 1874–76). Each penny of the tax was estimated to produce in 1898–99 a revenue of £2,248,000. The tax is assessed under five different schedules, known as A, B, C, D, and E. Under schedule A are charged the incomes derived from landed property, including houses, the annual value or rent being the basis of the assessment. A reduction is allowed from this value of one-eighth in the case of land and one-sixth in the case of houses. The occupier is liable for the tax, but is entitled, if not himself the owner, to deduct a proportionate part of the tax on paying his rent. Under schedule B are charged the profits arising from the occupation of land. The amount of such profits is assumed to be one-third of the annual value of the land as fixed for the purposes of schedule A; but the farmer may, if he chooses, be assessed under schedule D on his actual profits. Schedule C includes income derived from interest, &c., payable out of the public funds of this or any other country. Schedule D, which is the most important branch of the income tax and the most difficult to assess, includes profits arising from trade, from professional or other employment, and from foreign property. The assessment is in most cases made on an average of the receipts for three years. Schedule E covers the salaries and pensions of persons in the employment of the state or of public bodies, and of the higher officials of public companies, &c. The assessment and collection of the tax under schedules A, B, and D are in the hands of local authorities known as the General or District Commissioners of Taxes. They are appointed by the Land Tax Commissioners out of their own body, and, as regards assessment, are not in any way controlled by the executive Government. They appoint a clerk, who is their principal officer and legal adviser, assessors for each parish, and collectors. There is an appeal from their decisions to the High Court of Justice on points of law, but not on questions of fact. Assessments under schedules A and B are usually made every five years, and under schedule D every year. The interests of the revenue are looked after by officers of the Board of Inland Revenue, styled Surveyors of Taxes, who are stationed in different parts of the country. They are in constant communication with the Board and with the

public on all matters relating to the assessment and collection of the tax; they attend the meetings of the local commissioners, examine the assessments and the taxpayers' returns, and watch the progress of the collection. There are also three officers, known as Special Commissioners, who are appointed by the Crown and receive fixed salaries from public funds. For the purpose of schedule D, any taxpayer may elect to be assessed by them instead of by the local commissioners; and those who object to their affairs being disclosed to persons in their own neighbourhood may thus have their assessments made without any risk of publicity. The Special Commissioners also assess the profits of railway companies under schedule D, and profits arising from foreign or colonial sources under schedules C and D. The greater part of the incomes under schedule E is assessed by the commissioners for public offices, appointed by the several departments of the Government.

For further information reference should be made to DOWELL's *Income Tax Laws*, and the Annual Reports of the Commissioners of Inland Revenue, especially those issued in 1870 and 1885.

(G. H. M.)

United States.—One of the means adopted by the Federal Government for meeting its expenses during the Civil War was the levying of an income tax. By the Act of Congress of 5th August 1861 a tax of 3 per cent. was imposed on all incomes, with an exemption of $800, and was made payable on or before the 30th of June 1862. No tax, however, was assessed under the law. In March 1862 a new Income Tax Bill was introduced into the House of Representatives. This Act, which was signed 1st July 1862, imposed a tax of 3 per cent. on all incomes not over $10,000, and 5 per cent. on all incomes above that sum, with an exemption of $600. It was also provided that dividends of banks, insurance companies, and railways should be assessed directly; but the bondholder was allowed to deduct the dividend so assessed from his taxable income. In the case of Government salaries, the tax was deducted before the salaries were paid. The income tax was first levied in 1863. The rate was changed by Act of Congress in 1865, 1867, and 1870; and a joint resolution in 1864 imposed a special additional tax of 5 per cent. for that year. The tax was finally abolished in 1871. The total amount produced by the tax from the beginning was $376,150,209. The constitutionality of the Act was subsequently brought into question, but was upheld by a unanimous decision of the Supreme Court in 1880, which held that the tax was not a direct tax but an excise tax, and that Congress had a right to impose it so long as it was made uniform throughout the United States. On 27th August 1894 an Income Tax Act was passed as part of the Wilson Bill. By this Act it was provided that a tax of 2 per cent. on all incomes should be levied from 1st January 1895 to 1st January 1900, with an exemption of $4000. The legality of the tax was assailed chiefly on the ground that it was a direct tax, and not apportioned among the several states in proportion to their population. On 20th May 1895 the Supreme Court, by a vote of five to four, declared the tax to be unconstitutional.

Independence, capital of Jackson county, Missouri, U.S.A., three miles south of the Missouri on the high prairie, at an altitude of 950 feet. It is built on an undulating site, with a regular plan, and is on the Chicago and Alton and the Missouri Pacific Railways, besides being connected with Kansas City, 14 miles distant, by street railway. It is one of the oldest cities in Missouri, having been founded on the frontier in 1827. For many years thereafter it was the outfitting and starting point for emigrant and exploring parties for the Far West and the Pacific coast. Population (1880), 3146; (1890), 6380; (1900), 6974.

INDIA.

GEOGRAPHY AND STATISTICS.

INDIA, the great country of Asia under British rule or control, from which King Edward VII. takes the title of Emperor, in succession to the first British Empress of India, Queen Victoria, is a peninsula with a length extending from the 8th to the 37th degree of north latitude, or about 2000 miles. Its greatest breadth is nearly the same distance. To this the British have added the country of Burma, extending along the eastern side of the Bay of Bengal, and stretching inland to the frontiers of China, French Laos, and Siam. Besides the Andaman, Nicobar, and Laccadive Islands, the outlying station of Aden at the mouth of the Red Sea is politically included within the Indian Empire; while dots on the shore of the peninsula itself, representing old Portuguese and French settlements, break at intervals the continuous line of British territory.

Politically, India is divided into some thirteen provinces of varying size under direct British administration, and a number of native States, estimated at more than 200, which exercise more or less of the attributes of sovereignty under British control. According to Act of Parliament (52 and 53 Vict. c. 63, sec. 18, subsecs. 4 and 5), "British India" is interpreted to mean "all territories and places within His Majesty's dominions which are for the time being governed by His Majesty through the governor-general of India or through any other governor or officer subordinate to" him; and "India" is interpreted to mean "British India together with any territories of any native prince or chief under the suzerainty of His Majesty exercised through the governor-general of India, or through any other governor or officer subordinate to" him. Native States occupy about 38 per cent. of the total area, and contain about 23 per cent. of the total population. They vary in size from Haidarabad or the Nizam's Dominions (with an area of 83,000 square miles and a population of 11 millions) to a share of a petty village in Kathiawar. The one feature common to all alike is that ordinary British administration is excluded. In Anglo-Indian phraseology, all relations with them are "political" (see below, *Native States*). Except where otherwise mentioned, as in the section on population, the remainder of this article will deal only with British India.

Population.—The preliminary results of the census of 1901 will be given farther on. For all details of population recourse has had to be made to the census of 1891. In order to obtain the aggregate population of all India, it is necessary to include certain regions to which the census of 1891 did not extend. For the two independent States of Nepal and Bhutan in the Himalaya no trustworthy estimates are available. In the frontier State of Manipur (subordinate to Assam) the records of the census were destroyed in the disturbances of April 1891. In the State of Sikkim (subordinate to Bengal), in British Baluchistan (excluding Quetta), in some of the Shan States and other frontier tracts of Burma, and also in the hill tracts of Rajputana (mainly occupied by Bhils), only an informal registration was made, so far as possible synchronously with the census. In the Andaman Islands (outside the convict settlement of Port Blair), in the trans-Salween Shan States, and in the Kakhyen hill country lying between Burma and Assam, no enumeration was attempted. In the French settlements a census was taken simultaneously with that of British India. For the Portuguese possessions the returns are those of the census of 1887. The following table adds all these excluded items:—

Tract.	Number of Persons.
Sikkim (registered)	30,458
Manipur (estimated)	250,000
British Baluchistan (registered)	145,417
Cis-Salween Shan States (registered)	372,969
Burma Frontier Tracts	116,493
Rajputana Hill Tracts (registered)	204,241
French Settlements	282,923
Portuguese Possessions	561,384
Included in the Census	287,223,431
Aggregate	289,187,316

The census of 1891, which was taken over an area of 1,560,160 square miles, returned a total population of 287,223,431, the average density being 184 persons per square mile. The census of 1881 was taken over a somewhat smaller area, omitting Upper Burma and the State of Kashmir. For the same area, the population increased in ten years by no less than 27,821,420, or at the rate of 10·96 per cent. In British territory alone the increase was 19,294,509, or at the rate of 9·7 per cent.; in native States the increase was 8,526,911, or at the rate of 15·5 per cent. Some portion of this increase, especially in native States, is due to improved enumeration, as is evidenced by the higher rate of increase among females (11·16, compared with 10·77 per cent. for males). Some portion, again, is due to recovery from the famine of 1876–78, shown by the percentages of increase in Mysore (18·09), Madras (15·58), and Bombay (13·71), where that famine was most severe. Apart from these two considerations, it is noteworthy that the highest rates of increase were almost always found in the most thinly peopled tracts, such as Lower Burma, Sind, and the hills of Northern and Central India. The only considerable area that showed an actual decrease (1·4 per cent.) was the water-logged Doab of the North-Western Provinces; but in Northern Bengal the rate of increase fell to 4·7 per cent., and in Southern Behar to 2·8 per cent.

The accompanying table shows the area and population, distributed between British provinces and native States, according to the census of 1891.

The *linguistic* information ascertained by the census of 1891 did not extend to Rajputana, Central India, and Kashmir. It was confined to a total population of 262,047,440. Of these, 195,463,807, or 47·6 per cent., spoke languages of the Aryo-Indic group, of which the chief representatives are Hindi, Bengali, Marathi, Punjabi, Gujarati, and Uriya; 52,964,620, or 20·2 per cent., spoke languages of the Dravidian group, of which the chief representatives are Telugu, Tamil, Kanarese, and Malayalam; 7,293,928, or 2·8 per cent., spoke languages of the Tibeto-Burman group; 2,959,006, or 1·1 per cent., spoke languages of the Kolarian group, of which Sonthali is the chief representative; and 1,329,428, or ·5 per cent., spoke languages of the Aryo-Iranic group, chiefly represented by Pashtu or Pakhtu, the vernacular of the Afghans.

For the *ethnology*, the best evidence is derived from the classification of the census of 1891 according to caste or occupation. The largest group was that of respectable cultivators, who numbered 47,927,361, or 16·7 per cent. of the total. Next came the village menials (including leather-workers), who numbered 30,795,703, or 10·7 per cent. Military Hindus (including Rajputs, Jats, Marathas, and Gujars) numbered 29,393,870, or 10·2 per cent.; artisans, 28,882,551, or 10·1 per cent; cowherds and shepherds, 16,721,494, or 5·8 per cent.; forest tribes, 15,806,914, or 5·5 per cent.; priests (mostly Brahmans), 15,467,752, or 5·4 per cent.; and traders, 12,270,973, or 4·3 per cent.

Sex.—The classification of the census of 1891 according to sex showed that the female population was in defect by more than six millions. In other words, there were 958 females to every 1000 males. It was only in Upper Burma, Madras, and Bengal that the females were in excess. In the North-Western Provinces the deficiency fell to 923, and in the Punjab to 854 per 1000 males. After a careful examination of all the circumstances, the Census Commissioner (Mr J. A. Baines, C.S.I.) came to the following conclusions:—"In most parts of India proper there is a tendency, in a greater or less degree, to omit from the census record girls of from nine to fifteen, and wives of from fifteen to twenty or thereabouts; but in every part of the country except the north girls below five are returned as more numerous

Area and Population of British India and Native States, 1891.

Administrations.	Number of Divisions.	Number of Districts.	Area in Square Miles.	Number of Towns and Villages.	Number of Houses occupied.	Population, Census of 1891.					Density of Population to Square Mile.	Population, Census of 1881.	Increase or Decrease per cent.
						Males.	Females.	Total.	Urban.	Rural.			
Governor-General of India:													
Ajmer-Merwara	1	2	2,711	745	101,654	288,325	254,033	542,358	118,631	423,727	200	460,722	+17·7
Berar	1	6	17,718	5,824	591,008	1,491,826	1,405,665	2,897,491	360,711	2,536,780	164	2,672,673	+ 8·4
Coorg	1	1	1,583	497	26,806	95,907	77,148	173,055	15,511	157,544	109	178,302	− 2·9
Governors:													
Madras	..	22	141,189	57,079	6,709,990	17,619,395	18,011,045	35,630,440	3,406,105	32,224,335	252	30,827,113	+15·6
Bombay (including Aden)	6	24	125,144	25,204	3,380,640	9,793,981	9,107,142	18,901,123	3,502,678	15,398,445	151	16,505,967	+14·5
Lieutenant-Governors:													
Bengal	9	47	151,543	227,255	13,133,296	35,563,299	35,783,688	71,346,987	3,443,876	67,903,111	471	66,750,520	+ 6·9
North-Western Provinces and Oudh	1	49	107,503	106,200	8,225,191	24,303,601	22,601,484	46,905,085	5,314,328	41,590,757	436	44,150,507	+ 6·2
Punjab	10	32	110,667	34,842	3,127,823	11,255,986	9,610,861	20,866,847	2,413,704	18,453,143	188	18,843,186	+10·7
Burma {Lower	4	19	87,957	17,788	869,132	2,462,296	2,196,331	4,658,627	575,245	4,083,382	53	3,736,771	+24·7
Burma {Upper	4	17	83,473	10,981	554,472	1,414,005	1,532,928	2,946,933	371,404	2,575,529	35	..	..
Chief Commissioners:													
Central Provinces	4	18	86,501	34,355	2,158,668	5,397,304	5,386,990	10,784,294	739,592	10,044,702	125	9,838,791	+ 9·6
Assam	3	13	49,004	17,160	1,118,885	2,819,575	2,657,258	5,476,833	102,074	5,374,759	112	4,881,426	+11·3
Baluchistan Cantonments	..	..	..	2	4,543	23,864	3,406	27,270	27,270	..	..	..	..
Andaman Islands (Port Blair)	..	..	..	59	2,997	13,375	2,234	15,609	..	15,609	..	14,628	+ 6·7
Total, British Territory	44	250	964,993	537,991	40,005,105	112,542,739	108,630,213	221,172,952	20,391,129	200,781,823	229	198,860,606	+ 9 7
Native States:													
In connexion with:													
Bengal	4	4	35,834	17,217	621,228	1,673,186	1,623,193	3,296,379	16,542	3,279,837	93	2,786,446	+18·3
North-Western Provinces	1	2	5,109	2,318	132,815	409,470	383,021	792,491	103,188	689,303	155	741,750	+ 6·8
Punjab	3	34	38,299	20,115	713,735	2,324,091	1,939,189	4,263,280	456,544	3,806,736	111	3,860,761	+10·4
Central Provinces	5	15	29,435	10,407	409,096	1,089,011	1,071,500	2,160,511	38,656	2,121,855	73	1,709,720	+26·4
Madras	3	5	9,609	1,307	726,966	1,853,976	1,846,646	3,700,622	175,125	3,525,497	385	3,344,849	+10·6
Bombay	4	20	69,045	15,453	1,596,132	4,120,125	3,939,173	8,059,298	1,177,422	6,881,876	117	6,926,464	+16·1
Rajputana Agency	1	20	130,268	30,423	2,177,425	6,353,488	5,662,614	12,016,102	1,530,087	10,486,015	92	9,959,012	+20·2
Central India Agency	4	80	77,808	32,481	1,961,771	5,395,536	4,923,276	10,318,812	964,538	9,354,274	133	9,387,119	+ 9·9
Baroda	1	6	8,226	3,044	538,967	1,252,983	1,162,413	2,415,396	483,515	1,931,881	294	2,185,005	+10·5
Haidarabad	6	19	82,698	20,087	2,283,787	5,873,129	5,663,911	11,537,040	1,090,129	10,446,911	139	9,845,594	+17·2
Mysore	3	8	27,936	16,882	894,446	2,483,451	2,460,153	4,943,604	626,558	4,317,046	177	4,186,188	+18·1
Kashmir	..	..	80,900	8,419	447,993	1,353,229	1,190,723	2,543,952	197,743	2,346,209	31	..	..
Shan States (Outposts)	..	..	..	10	94	2,882	110	2,992	..	2,992	..	..	..
Total, Native States	35	213	595,167	178,163	12,504,455	34,184,557	31,865,922	66,050,479	6,860,047	59,190,432	111	54,932,908	+15·5
Grand Total, India	79	463	1,560,160	716,154	52,509,560	146,727,206	140,496,135	287,223,431	27,251,176	259,972,255	184	253,793,514	+10·9

than boys of that age. After that period, apart from wilful or ignorant omission, there is probably a real deficiency in the number of females, extending to about the twentieth year, and due to neglect, premature cohabitation, and unskilful midwifery. At a later period, hard work, as well as the results of the above influences, and among some classes excessive fecundity, tell on the female constitution, producing greater relative mortality than prevails in the other sex."

Religion.—The following table distributes the population in 1891 according to religion:—

Population classified according to Religion.

	Number.	Per cent.	Tracts where proportionately most numerous.
Hindus	207,731,727	72·34	The South and the mid-valley of the Ganges.
Mahommedans	57,321,164	19·96	Sind, Punjab, Eastern Bengal, and Kashmir.
Aborigines	9,280,467	3·23	Central Provinces, Central India, Bengal, and Assam.
Buddhists	7,131,361	2·48	Burma.
Christians	2,284,380	·79	The South, Burma, and Bengal.
Sikhs	1,907,833	·66	Punjab.
Jains	1,416,638	·49	Rajputana and Bombay.
Parsis	89,904	·03	Bombay.
Jews	17,194	·01	Bombay.
Others	42,763	·01	Kashmir, Madras, and Bengal.

The only term that requires explanation is "aborigines," which is here used as equivalent to "animistic," for all such wild tribes as are not locally acknowledged to have become either Hindus, Mussulmans, Buddhists, or Christians. Classified according to race, the aboriginal tribes numbered about 15,922,000.

The following table distributes the Christian population in 1891 according to sect:—

Table showing Distribution of Christian Sects.

	Number.	Per cent.
Church of England	295,016	12·9
Presbyterian	40,407	1·8
Baptist	191,746	8·4
Other Protestant	140,592	6·1
Roman Catholic	1,315,263	57·6
Syrian	200,467	8·8
Others	100,889	4·4

Classified according to another principle, Europeans numbered 168,000, of whom just half are estimated to be soldiers or the families of soldiers; Eurasians numbered 79,790; and native converts 2,036,590, of whom no less than 61 per cent. were Roman Catholics, and 10 per cent. Syrians of the Jacobite rite. In the native States of Madras, on the Malabar coast, Christians form one-fifth of the total population. Their number is also considerable among the Karens of Burma and the aboriginal tribes of Chota Nagpur.

Towns.—There is little tendency for the people to crowd into towns. According to the census of 1891, the urban population numbered 27,251,176, or 9·5 per cent. of the total, leaving 90·5 per cent. for the rural population. Again, as compared with 1881, the rate of increase in the urban population was only 9·4 per cent., compared with 10·9 per cent. for the general population. It must further be remarked that this urban population was contributed by 2035 towns, of which 505 had less than 5000 inhabitants. The number of towns with more than 20,000 was only 225. The accompanying table gives a list of all the towns in 1891 with more than 100,000 inhabitants. Bombay stands at the top, as the second most populous city in the British Empire. But if all the suburbs were added to Calcutta, and also Howrah on the opposite bank of the river, the total population of the metropolis on the Hooghly would be raised to more than a million. Haidarabad, Jaipur, Srinagar, Baroda, and Gwalior owe their importance entirely to the courts of large native States. Lucknow, Delhi, Mandalay, Agra, and Poona were formerly capitals. Rangoon and Karachi, as prosperous seaports, show the highest rate of increase. Cawnpore, Bangalore, and Ahmadabad are thriving centres of trade and manufacture.

List of Towns with a Population of more than 100,000.

Town.	Province, &c.	Population (1891).	Increase or decrease compared with 1881.	
			Number.	Per cent.
Bombay	Bombay	821,764	+48,568	+6·3
Calcutta	Bengal	741,144	+56,486	+24·1
Madras	Madras	452,518	+46,670	+11·5
Haidarabad	Deccan	415,039	+60,077	+13·0
Lucknow	Oudh	273,028	+11,725	+4·5
Benares	N.W.P.	219,467	+4,709	+2·2
Delhi	Punjab	192,579	+19,186	+11·1
Mandalay	Upper Burma	188,815	...	...
Cawnpore	N.W.P.	188,712	+37,268	+24·6
Bangalore	Mysore	180,366	+24,509	+15·7
Rangoon	Lower Burma	180,324	+46,148	+34·4
Lahore	Punjab	176,854	+19,567	+12·4
Allahabad	N.W.P.	175,246	+15,128	+9·4
Agra	N.W.P.	168,662	+8,459	+5·3
Patna	Behar	165,192	−5,462	−3·2
Poona	Bombay	161,390	+31,639	+24·4
Jaipur	Rajputana	158,905	+16,327	+11·4
Ahmadabad	Bombay	148,412	+20,791	+16·2
Amritsar	Punjab	136,766	−15,130	−10·0
Bareilly	Rohilkhand	121,039	+7,622	+6·7
Meerut	N.W.P.	119,390	+19,825	+19·9
Srinagar	Kashmir	118,960	...	...
Nagpur	Central Provinces	117,014	+18,715	+19·0
Howrah	Bengal	116,606	+11,400	+10·8
Baroda	Gujarat	116,420	+9,908	+9·3
Surat	Bombay	109,229	−615	−0·6
Karachi	Sind	105,199	+31,639	+43·0
Gwalior	Central India	104,083	+16,017	+18·2

Census of 1901.—The census of 1901, the third general census of India, was taken on the night of 1st March, and the preliminary returns were published on 14th March. They are given in the table on the following page, which shows the population, male and female, according to British provinces and native States, with the variations as compared with the census of 1891. The operations of the census of 1901 extended for the first time to the Shan States and hill tracts of Burma, to the border States of Manipur and Sikkim, to the troops stationed on the Afghan frontier, to almost the whole of Baluchistan, and to the Andaman and Nicobar islanders. The total population amounted to 294,266,701, compared with 287,223,431 in 1891, showing an increase of 7,043,270, or 2·42 per cent. But if the area not enumerated before be excluded, the increase is reduced to 4,283,069, or 1·49 per cent. In British territory alone the rate of increase is 4·44 per cent., against which there falls to be set off a decrease at the rate of 4·34 per cent. in native States. Some evidence of the general accuracy of the enumeration may be drawn from the fact that females have apparently increased more than males, the proportion of females to every 1000 males having risen from 958 to 963.

An examination of the details clearly reveals the effects of recent famine. In the native States of Rajputana, Central India, Bombay, and Baroda the aggregate decrease is more than 5½ millions, compared with an aggregate increase of more than 4 millions in the preceding decade. The Central Provinces show a decrease of nearly one million, compared with an increase of almost an identical amount. In each of the five Gujarat districts of Bombay there is a decrease, amounting altogether to nearly 400,000. Even where famine was not severe, the rate of increase generally diminished. In Bengal it

dropped from 6·9 to 4·7 per cent., most of the densely populated districts of Behar showing an actual decrease. In the North-Western Provinces it dropped from 6·3 to 1·6 per cent.; in the Punjab, despite the extension of canal irrigation, from 10·7 to 7·6 per cent.; and in Madras from 15·6 to 7·2 per cent. Only in Assam was the rate of increase higher than in the preceding decade; and here the whole of the increase may be attributed to the immigration of labourers on the tea gardens. Burma, which stands outside the Indian peninsula and has enjoyed unbroken prosperity, shows an exceptional increase of 18·7 per cent.

The preliminary returns of the census of 1901 show some variations in the size of the large towns. Calcutta now stands easily first, with a population of 843,487, having increased by about 24 per cent. in each of the two preceding decades. If the suburbs and Howrah be added, the total is raised to 1,279,511. In Bombay, on the other hand, the population decreased to 770,843, or by 6 per cent., owing to the continued effects of plague. Madras shows a steady rate of increase, to 509,397. Rangoon, the capital and chief port of Burma, rose from the eleventh to the sixth place in the list, with 232,326 inhabitants, being an increase of 29 per cent. The results of plague again appear at Karachi and Poona, which both suffered severely. Karachi, with 115,407 inhabitants, shows an increase of only 9 per cent., compared with an increase of 43 per cent. in the preceding decade. At Poona the population fell to 111,385, or by as much as 31 per cent. The same cause reduced the population of Bangalore to 159,030, or by 12 per cent. Two cities of the Madras presidency, Madura and Trichinopoly, rise to the class with more than 100,000 inhabitants.

Population of British India and Native States, 1901.

Political Divisions.	Males.	Females.	Total.	Variation on 1891.	
				Total Number.	Per cent.
BRITISH TERRITORY:					
Ajmer-Merwara	250,721	·225,609	476,330	−66,028	−12·2
Assam	3,142,561	2,979,640	6,122,201	+688,533	+12·7
Bengal	37,376,438	37,336,582	74,713,020	+3,366,050	+4·7
Berar	1,394,107	1,358,311	2,752,418	−144,622	−5·0
Bombay	9,595,805	8,988,691	18,584,496	−288,846	−1·5
Burma	4,705,094	4,516,067	9,221,161	+1.450,267	+18·7
Central Provinces	4,841,832	5,003,486	9,845,318	−938,976	−8·7
Coorg	100,214	80,247	180,461	+7,406	+4·3
Madras	18,853,024	19,355,585	38,208,609	+2,578,169	+7·2
N.W. Provinces and Oudh	24,620,961	23,075,363	47,696,324	+791,533	+1·8
Punjab	12,095,711	10,353,773	22,449,484	+1,582,637	+7·6
Baluchistan	445,603	365,208	810,811	...	...
Andaman and Nicobar Islands	18,581	5,918	24,499	..	..
Total	117,440,652	113,644,480	231,085,132	+9,818,563	+4·4
NATIVE STATES:					
Haidarabad	5,664,772	5,510,125	11,174,897	−362,143	−3·1
Baroda	1,007,944	942,983	1,950,927	−464,469	−19·2
Mysore	2,796,165	2,742,317	5,538,482	+594,878	+12·0
Kashmir	1,544,412	1,361,761	2,906,173	+362,221	+14·2
Rajputana	5,167,640	4,673,392	9,841,032	−2,175,070	−18·1
Central India	4,357,225	4,144,658	8,501,883	−1,816,929	−17·5
Bombay	3,504,975	3,386,716	6,891,691	−1,167,607	−14·5
Madras	2,100,313	2,090,009	4,190,322	+489,700	+13·2
Central Provinces	982,823	1,000,673	1,983,496	−177,015	−8·2
Bengal	1,899,704	1,836,011	3,735,715	+439,336	+13·3
N.W. Provinces	411,897	387,778	799,675	+7,184	+0·9
Punjab	2,417,932	2,020,884	4,438,816	+175,536	+4·1
Burma	609,895	618,565	1,228,460	...	...
Total	32,465,697	30,715,872	63,181,569	−2,868,910	−4·3
Grand Total	149,906,349	144,360,352	294,266,701	+6,949,653	+2·4

Agriculture.—Agriculture forms the main occupation of the inhabitants. According to the census of 1891, the number of persons employed in agriculture or in connexion with cattle was 175,381,239, being 61 per cent. of the total population. If we add, as we fairly may, most of those returned as general labourers, the proportion would rise to two-thirds. Of these, 149,931,159 were landholders or tenants, 18,673,206 agricultural labourers, and 3,645,849 employed with cattle. Agricultural statistics are now collected by a government department for every British province, though for Bengal the figures must be regarded as only approximate estimates. The two following tables give the returns according to provinces for 1897–98, which may be taken as an average year. The first of these tables shows that, out of the total area for which returns exist (excluding tributary States and mountainous or desert regions), forests cover 12 per cent., and an additional 25 per cent. is not available for cultivation. Of the remainder, 36 per cent. actually yielded crops in 1897–98, while 7 per cent. was current fallow and 20 per cent. cultivable waste. The second table shows the area under each of the principal crops. Of the total cultivated area in 1897–98, no less than 93 per cent. was devoted to food-crops of various kinds, including pulse. Rice alone covers 36 per cent., and wheat 10 per cent. But these two crops are very unevenly distributed. In Lower Burma hardly anything else is grown but rice; and rice is also the predominant crop in Eastern Bengal and Orissa, in the adjoining valleys of Assam, in the deltas of the Madras rivers, along the sea-coast under the Western Ghats, and among the hills of Chhattisgarh. Wheat, on the other hand, is grown mainly in the plains of the Punjab and the North-Western Provinces, in the valley of the Narbada, and generally throughout the Bombay presidency. Except in the rice tracts, the staple food of the people is derived from millet and other inferior grains, chiefly *jowar* and *bajra* in the

Industries and trade.

Table of Cultivated and Uncultivated Land, 1897–98.

Political Divisions.	Cultivated.		Uncultivated.		Forests.	Total.
	Actually Cropped.	Current Fallows.	Available for Cultivation.	Not Available for Cultivation.		
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
Bengal	55,128,700	3,684,313	12,144,609	20,728,847	5,091,116	96,777,585
North-Western Provinces	24,569,721	2,966,481	8,213,026	6,623,038	8,479,406	50,851,672
Oudh	8,318,890	923,441	3,393,582	2,317,145	589,603	15,542,661
Punjab	22,693,353	5,175,613	21,403,238	12,120,050	4,350,536	65,742,790
Lower Burma	6,478,339	398,084	15,967,821	26,014,478	4,617,758	53,476,480
Upper Burma	2,806,550	1,456,434	9,058,108	30,367,392	4,428,840	48,117,324
Central Provinces	15,390,504	4,080,059	14,369,164	4,055,076	11,297,971	49,192,774
Assam	2,247,318	1,248,610	7,380,158	999,550	2,297,715	14,173,351
Ajmer-Merwara	404,413	87,628	88,246	351,463	89,060	1,020,810
Coorg	206,541	36,156	45,561	156,471	567,531	1,012,260
Madras	24,250,708	5,896,998	6,269,680	13,479,129	12,082,354	61,978,869
Bombay	27,360,039	10,464,870	7,505,451	20,224,799	8,026,038	73,581,197
Berar	6,635,806	739,498	690,209	679,629	2,608,829	11,353,971
Pargana Manpur	6,350	1,141	10,250	1,357	19,773	38,871
Total	196,497,232	37,159,326	106,539,103	138,118,424	64,546,530	542,860,615

north, and *ragi* in the south. A little sugar-cane is grown everywhere, but it forms an important crop only in Northern India, from Bengal to the Punjab. Tobacco, also, is grown everywhere in garden plots, but chiefly in Bengal, Upper Burma, Madras, and Bombay. Oil-seeds of different kinds (chiefly linseed, mustard, and gingelly) are grown everywhere for local consumption, and for export in Bengal, the Central Provinces, Bombay, Madras, and the Punjab. Cotton also is widely distributed, the chief exports being derived from Berar, Bombay, the Central Provinces, and Madras. Jute is confined to Eastern Bengal, with a slight extension into the valleys of Assam.

Table of Land under Chief Crops, 1897–98.

Political Divisions.	Rice.	Wheat.	Other Food Grains.	Sugar Cane.	Cotton.	Oil Seeds.	Indigo.	Tobacco.
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
Bengal	40,142,400	1,570,600	11,150,400	972,700	167,700	4,178,600	555,200	648,300
North-Western Provinces	4,168,081	4,500,554	16,640,694	935,902	884,479	599,743	354,588	46,076
Oudh	2,364,108	1,497,573	6,014,557	212,252	36,008	201,035	24,451	12,746
Punjab	786,751	7,769,215	12,934,697	348,121	993,361	1,161,928	94,615	54,465
Lower Burma	5,912,734	14	49,330	11,190	13,311	28,727	2	32,740
Upper Burma	1,349,559	13,659	972,334	1,257	110,602	404,265	792	34,785
Central Provinces	4,817,343	2,172,739	6,552,623	26,953	669,064	1,761,043	21	12,887
Assam	1,614,292	70	57,658	21,340	2,225	175,983	4	1,414
Ajmer-Merwara	926	29,173	327,058	323	51,018	41,361	79	18
Coorg	95,247	. .	19,201	...	...	60	...	20
Madras	6,935,159	14,951	14,914,557	58,374	1,509,135	1,646,628	323,931	103,357
Bombay	2,551,752	1,982,044	18,834,853	56,892	2,328,609	1,948,614	12,769	81,109
Berar	42,999	394,129	3,546,140	3,159	2,150,709	416,090	61	20,522
Pargana Manpur	57	1,443	4,147	35	8	587	...	...
Total	70,781,408	19,946,164	92,018,249	2,648,498	8,916,229	12,564,664	1,366,513	1,048,439

The following table shows the area under irrigation, omitting Bengal and Assam. In the latter province there is no irrigation whatever, and in the former it is practised to an insignificant extent, as is also the case in Lower Burma. For the rest of British India, just one-fifth of the total area under crops was irrigated in 1897–98, the proportion in the large provinces ranging from 37 per cent. in the Punjab to 14 per cent. in Bombay. Excluding Sind, where more than three-fourths of the cultivated area requires irrigation, the proportion for Bombay would fall to 4 per cent., being little higher than in the Central Provinces. It was in the unirrigated tracts of Gujarat, Berar, and the Central Provinces that the famine of 1900 was felt with greatest severity. Government canals have been most widely extended in the Punjab, Sind, the North-Western Provinces, and Madras. Private canals are found chiefly in

Table of Certain Areas under Irrigation, 1897–98.

Political Divisions.	By Canals.		By Tanks.	By Wells.	Otherwise.	Total.	Total Area under Crops.
	Government. Acres.	Private. Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
North-Western Provinces	1,828,076	3,865	1,122,269	3,820,307	475,115	7,249,632	29,471,005
Oudh	...	...	853,594	1,592,513	67,735	2,513,842	10,757,831
Punjab	4,395,453	910,295	33,015	3,970,518	162,812	9,472,093	25,810,142
Lower Burma	779	1,112	483	...	3,707	6,081	6,479,253
Upper Burma	175,805	252,245	87,065	4,235	112,103	631,453	3,007,805
Central Provinces	...	8,291	462,598	75,959	15,780	562,628	16,525,231
Ajmer-Merwara	..	...	33,955	107,677	655	142,287	466,718
Coorg	1,370	...	...	...	...	1,370	207,245
Madras	2,644,650	30,966	1,969,678	1,083,014	147,066	5,875,374	27,212,085
Bombay	2,690,556	191,658	108,538	592,827	297,499	3,881,078	28,377,478
Berar	66	...	...	80,981	1,277	82,324	6,653,884
Pargana Manpur	...	...	...	292	...	292	6,455
Total	11,736,755	1,398,432	4,671,195	11,328,323	1,283,749	30,418,454	154,975,132

the Punjab, Upper Burma, and Sind. Irrigation from tanks is practised chiefly in Madras and the Central Provinces, irrigation from wells in the Punjab, the North-Western Provinces and Oudh, Madras, and Bombay. The principal crop grown on irrigated land is wheat; and altogether more than 90 per cent. of the total irrigated area in 1897–98 was devoted to food-crops (see also IRRIGATION).

Tea, Coffee, Indigo.—The principal agricultural products raised under European supervision and with the help of European capital are tea, coffee, and indigo. Tea is chiefly grown in the extreme north-east—in the two valleys of Assam and in the neighbourhood of Darjiling (Bengal). The following table shows the area under tea (both mature and immature plants) for the seven years 1893–99 :—

Tract.	1893.	1894.	1895.	1896.	1897.	1898.	1899.
	Acres.	Acres.	Acres	Acres.	Acres.	Acres.	Acres
Assam	256,625	268,796	276,290	291,909	310,550	325,823	331,151
Bengal	110,510	98,345	104,197	105,707	128,067	130,241	132,923
Madras	5,600	6,102	6,797	5,270	6,335	6,512	10,164
N.W.P.	7,419	7,652	8,514	7,919	7,965	7,924	7,854
Punjab	8,746	8,921	9,243	9,830	9,970	10,259	10,135
Native States	7,837	9,079	9,480	11,444	30,076	19,701	23,115
Burma	802	880	1,196	1,201	747	1,220	1,390
Total	397,539	399,775	415,717	433,280	493,710	501,680	516,732

In 1899 the total production was 186,525,000 ℔, of which more than two-thirds came from Assam and nearly one-fourth from Bengal. The total number of persons employed was 655,000, including 96,000 temporary labourers.

The cultivation of coffee is practically confined to the extreme south. It is subject to greater vicissitudes than that of tea, and is generally a less prosperous industry than it was in 1880. A considerable proportion is grown by natives, especially in Mysore. The following table shows the area under coffee for the seven years 1893–99 :—

Tract.	1893.	1894.	1895.	1896.	1897.	1898.	1899.
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres
Coorg	63,783	71,181	73,828	84,820	86,155	82,575	72,296
Madras	62,245	64,512	63,953	56,851	55,895	63,983	66,473
Mysore	132,520	136,032	138,670	141,528	125,876	128,079	128,010
Travancore and Cochin	6,244	6,589	7,033	5,748	7,840	6,384	7,069
Burma, Assam, &c.	198	248	267	319	308	548	450
Total	264,990	278,562	283,751	289,266	276,074	281,569	274,298

Owing to poor crops and low prices, the total export of coffee was only 225,000 cwts. in 1897–98, as compared with 312,000 cwts. in 1891–92. In 1899–1900 it rose again to 281,000 cwts. The total number of persons employed was returned as 110,000, of whom 83,000 were temporary labourers.

The cultivation of indigo is even more fluctuating than that of coffee. The normal area under indigo is 1,400,000 acres, of which more than one-third is in Bengal, about one-fourth in the North-Western Provinces, another fourth in Madras, and most of the remainder in the Punjab. European capital is almost confined to Behar in Bengal and the neighbouring districts of the north-west. In 1900 the total area under indigo was only 964,000 acres. The total exports of indigo ranged from 187,000 cwts. in 1895–96 to 111,000 cwts. in 1899–1900.

Textiles.—Next after agriculture, the spinning and weaving of cotton at steam mills is the most important industry in India, being chiefly concentrated in Bombay. The following table gives the principal statistics of this industry for the five years named :—

Year.	Mills.	Looms.	Spindles.	Persons Employed.
1882–1883	62	15,116	1,654,108	53,624
1887–1888	97	18,840	2,375,739	80,515
1892–1893	130	26,317	3,378,303	120,898
1897–1898	163	36,946	4,210,756	148,435
1899–1900	186	38,420	4,728,000	163,200

The total capital invested was more than Rx.15,000,000, almost entirely provided by joint-stock companies. The total consumption of raw cotton was estimated at 464,000 bales of 400 ℔ each; being more than half of the normal production. For 1899–1900 the total output of yarn was reported as 501,294,000 ℔, of which 62,071,000 ℔ (or 13 per cent.) was of counts above No. 20; but the production of these finer counts from imported cotton is steadily increasing. The total out-turn of woven goods was reported as 95,320,000 ℔. Of the total number of persons employed in 1897–98, 95,962 were adult males, 26,114 women, 15,789 young persons, and 10,570 children. Bombay possessed 70 per cent. of the mills and produced 83 per cent. of the woven goods. There were fourteen mills situated in native States and in French territory.

The spinning and weaving of jute, like the cultivation of the fibre, is practically confined to Bengal, the steam mills being concentrated round Calcutta. The following table gives the chief statistics of this industry for the five years named :—

Year.	Mills.	Looms.	Spindles.	Persons Employed.
1882–1883	20	5,633	95,737	42,797
1887–1888	25	7,389	146,302	56,007
1892–1893	27	8,976	181,172	67,291
1897–1898	35	13,615	274,907	95,934
1899–1900	33	14,021	293,218	101,630

The total capital invested exceeds Rx.5,000,000, almost entirely provided by joint-stock companies. No returns of the out-turn are available, but the total quantity of raw jute worked up in the Indian mills is about 7,000,000 cwts., compared with an export of about double that quantity. Of the total number of persons employed in 1897–98, 62,247 were adult males, 17,090 women, 5740 young persons, and 10,853 children, showing a much larger proportion of children than in cotton mills.

In 1898 there were four mills for spinning and weaving wool, with 588 looms and 21,444 spindles, employing 2904 persons. The capital invested was Rx.445,000, and the output for 1898 was nearly 3,000,000 ℔, valued at Rx.307,247, chiefly blankets and greatcoats for the army and police, made from the short-stapled Indian wool.

Other Manufactures.—There were in 1898 nine paper mills, employing 4187 persons. The capital invested was Rx.627,200, and the out-turn was 42,000,000 ℔, valued at Rx.610,000. The materials used are chiefly rags, grasses, jute cuttings, &c. Most of the paper used in Government offices is now obtained from these mills. The number of breweries, mostly at hill stations in the Himalaya, is 27, with an out-turn of about 6,000,000 gallons, half of which is purchased by the Commissariat Department. The local production of beer is about twice as large as the import. One boot factory at Cawnpore turned out no less than 735,000 pairs of boots for military purposes during the two years 1899 and 1900.

Other large industries are the rice mills and timber mills of Burma, the factories for ginning and pressing cotton throughout Western India, a few sugar refineries, the Barrakur iron works in Bengal, and the pottery works at Raniganj (also in Bengal).

In 1899 the total number of factories under inspection was 1110, employing 452,796 persons, of whom 65,303 were women, 27,459 young persons, and 27,459 children. During the year the number of accidents reported was 2603, of which 77 were fatal. The convictions for breaches of the Factory Act numbered only 3. In 1899–1900 the total number of joint-stock companies registered was 1340, with an aggregate paid-up capital of £23,625,850.

Coal.—The coal industry is progressing rapidly, especially in Bengal. The following table gives the output of all the coal mines in India for the seven years 1893–99 :—

Tract.	1893.	1894.	1895.	1896.	1897.	1898.	1899.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Bengal	1,915,000	2,036,000	2,718,000	3,038,000	3,142,497	3,622,090	3,883,000
Nizam's Dominions. .	157,000	241,000	293,000	263,000	365,550	394,622	401,000
Assam	164,000	169,000	173,000	177,000	185,533	200,329	226,000
Central Provinces . .	135,000	141,000	123,000	142,000	131,629	149,709	157,000
Central India (Rewa) .	94,000	133,000	118,000	115,000	124,778	134,726	164,000
Punjab	77,000	66,000	72,000	79,000	92,792	85,862	82,000
Baluchistan . . .	20,000	22,000	23,000	11,000	8,876	10,667	12,000
Upper Burma . . .	...	12,000	17,000	23,000	11,472	6,975	8,000
Total . . .	2,562,000	2,820,000	3,537,000	3,848,000	4,063,127	4,604,980	4,933,000

In 1898 the total output was valued at Rx.1,430,467 ; the average value being Rs.3·11 per ton, as compared with Rs.19·44 per ton for imported coal. The total number of persons employed in coal-mining in 1899 was 72,000, of whom 51,000 were adult males. Nearly one-third of the total output was consumed by the railways, which now use an insignificant proportion of imported coal (less than 3 per cent. in 1898). Bengal alone produced nearly four-fifths of the total, exporting by sea to Bombay, Madras, Burma, Ceylon, and the Straits, as well as inland by rail and river. A revised Act for the regulation of coal mines was passed by the Viceroy's Council in March 1901.

Gold.—Gold is known to exist in various parts, and gold-washing is practised in many of the hill streams ; but the extraction of the precious metal by quartz-crushing has been successfully pursued only in the Kolar gold-field of Mysore. Here there are two companies, the Mysore and the Champion, which produce each about 150,000 oz. in the year ; while the total production steadily rose from 163,000 oz. in 1892 to 510,000 oz. in 1900. A royalty of 5 per cent. is paid to the Mysore State.

Petroleum.—The most important source of petroleum is in Upper Burma, where the output increased from 8,000,000 gallons in 1893 to 37,000,000 gallons in 1900. The petroleum is refined at Rangoon. Petroleum is also produced in the extreme north-east of Assam, in the neighbourhood of a coal-field. The output here rose from 42,000 gallons in 1893 to 753,000 gallons in 1900. In addition, there are petroleum wells on the north-west frontier; but those in British Baluchistan, which in one year yielded 70,000 gallons, have not been worked since 1894, and the total output in the Punjab is only 2000 gallons a year. Compared with these figures, the total import of mineral oils amounted to more than 80,000,000 gallons.

Salt.—Salt is produced by evaporation almost everywhere along the sea-coast, and at certain inland lakes, of which the Sambhar Lake in Rajputana is the most important. It is also obtained by mining at two places in the Punjab. Its manufacture is a government monopoly. The annual production amounts to about 1,000,000 tons, compared with an importation of about 400,000 tons.

For the statistics concerning railways, see the section *History* below. The following table shows the general course of the foreign sea-borne trade since 1870. To avoid accidental fluctuations, quinquennial averages have been taken. First are given the value of the imports and exports of merchandise only, and the excess value of the exports of merchandise ; then the net imports of treasure, the exports having been deducted ; and finally, the excess value of the exports of both merchandise and treasure which may be regarded as the payment by India to foreign countries for interest on capital invested and for services rendered.

Foreign trade.

Table of Foreign Trade (Sea-borne) since 1870.

Five Years' Average.	Merchandise. Imports.	Merchandise. Exports.	Merchandise. Excess Exports.	Treasure. Net Imports.	Excess Exports, Merchandise and Treasure.
	Rx.	Rx.	Rx.	Rx.	Rx.
1869–70 to 1873–74	33,036,588	56,252,723	23,216,135	6,674,240	16,541,895
1874–75 to 1878–79	38,363,836	60,324,893	21,961,057	7,048,286	14,912,771
1879–80 to 1883–84	50,154,241	79,084,526	28,930,285	10,333,962	18,596,323
1884–85 to 1888–89	61,516,273	88,639,972	27,123,699	11,980,356	15,143,343
1889–90 to 1893–94	70,778,390	104,992,036	34,213,646	14,242,482	19,971,164
1894–95 to 1898–99	73,666,336	107,533,024	33,866,688	8,495,308	25,371,380

The following table analyses the total foreign sea-borne trade of India for two recent years, 1891–92 and 1897–98 :—

Analysis of Foreign Sea-borne Trade.

	1891–92.	1897–98.
	Rx.	Rx.
Imports—		
Private merchandise . .	66,587,457	69,420,120
Government stores . .	2,844,926	4,240,340
Total merchandise .	69,432,383	73,660,460
Treasure—		
Private	14,722,662	20,476,286
Government . . .	...	54,331
Total treasure . .	14,722,662	20,530,617
Total imports . .	84,155,045	94,191,077
Exports—		
Indian produce and manufactures . . .	103,550,831	93,786,101
Foreign produce and manufactures . . .	4,485,179	3,751,172
Government stores . .	137,582	95,508
Total merchandise .	108,173,592	97,632,781
Treasure—		
Private	3,143,186	7,134,169
Government . . .	143,500	14,478
Total treasure . .	3,286,686	7,148,647
Total exports . .	111,460,278	104,781,428
Total sea-borne trade	195,615,323	198,972,505

Under imports, the most notable feature is the increase in Government stores, representing larger railway construction by the State. Under exports, the decrease in Indian produce and manufactures is probably temporary, being due to famine and plague ; but the decrease in foreign produce and manufactures shows a permanent change in the character of the re-export trade, Bombay having lost much of its *entrepôt* business with the east coast of Africa and the Persian Gulf.

The re-exports of foreign produce and manufactures reached their maximum of Rx.5,057,414 in 1894–95, and then fell year by year to only Rx.3,292,491 in 1899–1900.

The following table gives the value (in tens of thousands of rupees) of the chief articles of import for the years named :—

Values of Principal Imported Articles.

Articles.	1889-90.	1894-95.	1899-1900.
	Rs.10,000.	Rs.10,000.	Rs.10,000.
Apparel	1,296	1,435	1,464
Books, &c.	855	869	933
Coal	1,309	1,474	810
Cotton twist, &c.	3,483	2,851	2,460
Cotton piece-goods	26,391	29,822	27,002
Hardware, &c.	1,096	1,333	1,590
Liquors	1,465	1,458	1,597
Machinery, &c.	2,435	2,442	2,542
Iron	2,414	2,245	2,420
Steel	328	586	1,000
Copper	2,222	1,512	629
Mineral oils	2,479	2,123	3,180
Provisions	1,597	1,576	1,689
Railway materials	1,821	1,557	2,776
Silk manufactures	1,778	1,277	1,129
Raw silk	1,067	1,037	576
Sugar	2,200	2,875	3,376
Woollen manufactures	1,455	1,542	1,758

Cotton manufactures of all kinds still form 42 per cent. of the total imports, but ten years earlier the proportion was as high as 45 per cent. The value of piece-goods reached its maximum in 1894–95, and has since fluctuated considerably. The value of twist and yarn first fell under competition with the product of local spinning mills, and then rose again when local weaving mills began to use the finer counts of English yarn. At a long distance after cotton manufactures, the next most important article of import is metals of all kinds, which now form normally 7 per cent. of the total. Here the largest increase is under the head of steel. Hardware and cutlery, machinery and mill-work, each show fair increases, while railway plant and rolling stock are subject to fluctuations. Mineral oils have considerably increased, despite a heavier import duty; and sugar increased yet more considerably, partly under the stimulus of Continental bounties, which are now met by a countervailing duty. Both raw silk and silk manufactures show a heavy decrease. But the most significant decrease is in coal, which is little more than half of what it was in some earlier years. The mines of Bengal are now almost entirely able to supply the railways and mills of all India.

The following table gives the value (in tens of thousands of rupees) of the chief articles of export for the same years :—

Values of Principal Exported Articles.

Articles.	1889-90.	1894-95.	1899-1900.
	Rs.10,000.	Rs.10,000.	Rs.10,000.
Coffee	1,500	2,209	1,506
Raw cotton	18,671	8,708	9,925
Cotton twist	5,840	5,784	7,008
Cotton manufactures	2,733	3,600	2,611
Indigo	3,863	4,746	2,692
Rice	10,110	13,815	13,101
Wheat	5,793	2,566	3,909
Hides	4,524	6,560	10,464
Raw jute	8,640	10,576	8,071
Jute manufactures	2,791	4,211	6,265
Lac	489	1,406	1,137
Opium	10,116	9,065	8,203
Oil-seeds	10,631	14,206	10,110
Tea	5,445	7,989	9,177
Wood	875	665	1,096
Raw wool	1,779	2,016	1,801

Here rice takes the first place, with a steady average of about 12 per cent. of the total value. It should be borne in mind that rice is the only article subject to an export duty. Even the famine of 1896–97 hardly checked the export of rice from Burma to foreign countries. The quantity of rice exported reached its maximum (38,000,000 cwts.) in 1898–99. Raw cotton falls to the second place, owing to its wide fluctuations. The maximum quantity was over 6,000,000 cwts. in 1889–90, which fell to only 3,000,000 cwts. in 1894–95 and again in 1897–98. The next place is held by oil-seeds, which similarly fluctuated from a maximum of 24,000,000 cwts. in 1893–94 to a minimum of 11,000,000 cwts. in 1896–97. Raw jute shows a steady increase, the quantity having reached its maximum (15,000,000 cwts.) in 1897–98. Tea also shows a steady increase, the quantity having risen almost year by year from 105,000,000 ℔ in 1889–90 to 176,000,000 ℔ in 1899–1900. Hides increased considerably, but the very high figure for 1899–1900, explained by the mortality of cattle from drought, is by no means a sign of prosperity. Wheat is liable to excessive fluctuations; from a maximum quantity of 30,000,000 cwts. in 1891–92 to only 2,000,000 cwts. in each of the two years 1896–97 and 1897–98. Opium shows a decrease, from 118,598 cwts. in the first year to 93,378 cwts. in the last. Indigo shows wide fluctuations, from a maximum quantity of 187,337 cwts. in 1895–96 to a minimum of 111,420 cwts. in 1899–1900. The most remarkable increase of all is in manufactures of jute, the produce of the mills near Calcutta, which more than doubled in value. The export of jute cloth (as opposed to bags) increased in ten years from 37 to 307 million yards. Cotton piece-goods show a decrease in value, which was very marked during the last five years. The decrease in quantity was from a maximum of 193 to a minimum of 130 million yards. Cotton twist and yarn, on the other hand, show a fair increase, the quantity having risen from 143 to 243 million ℔. Coffee fluctuated, with a tendency to decrease. The maximum quantity was 367,480 cwts. in 1888–89; the minimum was 215,896 cwts. in 1896–97. Raw wool, lac, and timber each show an increase. In quantity, lac of all kinds rose in ten years from 90,240 to 238,450 cwts., and teak timber from 71,402 to 77,822 cubic tons. Among minor articles, not specified in the above table, sugar, spices, dyes (other than indigo), raw silk, and silk manufactures all show decreases. Manures (chiefly animal bones), oils, and tobacco each show an increase; but the total export of tobacco in 1899–1900 was only 10,000,000 ℔, valued at Rx.184,465. In the same year the export of coal was 218,877 tons, valued at Rx.328,315.

The proportion of trade that passes through the Suez Canal remains fairly constant at about 80 per cent. for imports and 57 per cent. for exports. The following table distributes the imports according to the countries from which they were received in each of the three years 1877–78, 1887–88, and 1897–98 :—

Country.	1877-78. Value.	Percentage of Total	1887-88 Value.	Percentage of Total.	1897-98. Value.	Percentage of Total
	Rx.		Rx.		Rx.	
United Kingdom	34,278,708	83	51,650,627	80	50,796,218	69
Austria-Hungary	113,188	..	771,075	1	2,146,926	3
Belgium	120	..	308,841	..	2,285,298	3
France	451,129	1	849,091	1	882,802	1
Germany	25,483	..	194,493	..	2,434,519	3
Italy	349,480	1	371,073	1	509,094	1
Russia	..	..	227,300	..	2,080,756	3
East Coast of Africa	217,964	1	670,275	1	190,885	..
Mauritius	643,274	2	1,550,573	2	1,684,765	2
United States	279,717	1	1,030,279	2	1,444,382	2
Arabia and Persia	860,824	2	1,080,255	2	1,272,235	2
Ceylon	599,759	1	633,663	1	1,095,772	2
China	1,423,672	3	2,415,321	4	1,691,142	2
Straits Settlements	1,079,702	2	2,119,772	3	2,410,200	3
Turkey in Asia	512,159	1	275,903	..	291,286	..
Australia	298,309	1	484,885	1	334,450	1
Other Countries	330,285	1	371,686	1	2,109,730	3
Total	41,464,182		65,004,612		73,660,460	

During the first period of ten years the increase in the imports from the United Kingdom almost kept pace with the increase in the total imports, but during the second period of ten years the imports from the United Kingdom decreased absolutely, while their proportion to the total fell from 80 to 69 per cent. What the United Kingdom lost was gained by Germany, Belgium, Austria-Hungary, Russia, and unnamed countries (including Japan). The imports from other countries show little variation.

The following table distributes the exports according to countries for the same years :—

Country.	1877-78. Value.	Percentage of Total.	1887-88. Value.	Percentage of Total.	1897-98. Value.	Percentage of Total.
	Rx.		Rx.		Rx.	
United Kingdom	29,614,849	46	35,058,574	39	30,236,459	31
Austria-Hungary	1,465,892	2	2,734,509	3	2,105,885	2
Belgium	218,706	..	3,171,350	4	3,039,239	3
France	5,967,608	9	7,209,826	8	5,642,778	6
Germany	330,794	..	1,032,347	1	7,188,445	7
Italy	1,870,007	3	4,527,546	5	2,698,744	3
Russia	58,438	..	471,066	..	209,707	..
Egypt	577,955	1	3,238,839	4	3,971,339	4
Mauritius	1,198,609	2	1,233,170	1	1,304,405	1
United States	1,932,727	3	3,782,737	4	5,876,095	6
Arabia and Persia	1,602,428	2	2,477,201	3	2,661,460	3
Ceylon	2,545,694	4	2,081,663	2	4,098,875	4
China	12,743,153	20	13,092,100	14	12,227,882	13
Straits Settlements	2,601,691	4	4,199,595	5	4,605,641	5
Other Countries	2,493,777	4	6,233,132	7	11,765,827	12
Total	65,222,328		90,543,655		97,632,781	

Here the decline of trade with the United Kingdom is still more marked, its proportion to the total having steadily fallen from 46 to 31 per cent. The shares of China and of France also decreased. Germany and Belgium again gained most; while the United States also show a large increase. The exports to Egypt are probably for distribution to Mediterranean ports. The growing trade with Japan is concealed under "other countries." In 1899–1900 the exports to Japan were valued at Rx.6,336,664, almost entirely raw cotton, with some indigo and rice. In 1890–1891 the total value was only Rx.1,210,276.

Turning to the more important articles of *import*. In 1897–98 the United Kingdom sent 97 per cent. of the cotton piece-goods, the remainder coming chiefly from the United States and Austria-Hungary; and likewise 97 per cent. of the cotton twist and yarn. Of railway material, and also of machinery and millwork, the share of the United Kingdom was as large as 99 per cent.; but in the case of hardware and cutlery it dropped to 78 per cent., in iron to 75 per cent., in copper to 70 per cent., and in steel to 50 per cent. In iron, steel, and copper the most formidable competitor of the United Kingdom was Belgium. The imports from Germany consisted mainly of sugar and miscellaneous articles. The importation of sugar from Austria-Hungary suddenly rose from Rx.131,379 in 1896–97 to Rx.1,044,504 in 1897–98, or eightfold in a single year. Russia now sends nearly three times as much mineral oil as the United States.

As regards the *exports*, cotton twist and yarn were sent almost entirely to China; cotton piece-goods to the neighbouring countries of Asia and Africa; raw cotton to Japan and the Continent. Of raw jute, the United Kingdom took more than one half, and Germany nearly one-fifth; gunny cloth went mainly to the United States, while Australia was the chief market for gunny bags. Rice went to Egypt (for transhipment), Ceylon, the Straits, the United Kingdom, Brazil, Mauritius, and Arabia. Of the exports of tea, no less than 92 per cent. went to the United Kingdom, and 3 per cent. to Australia; but some success attended the efforts to open up a market in the United States and Canada. Of oil-seeds, the United Kingdom took the largest proportion of linseed; but rape, sesamum, castor, and poppy went mainly to France and Belgium. The export of dressed hides was mainly to the United Kingdom, and to the United States in the second place; while Germany took the largest amount of raw hides, with the United States again in the second place. Wheat went mainly to the United Kingdom and other countries in Europe.

The following table distributes the total foreign trade (in merchandise only) among the 16 principal seaports for the two years 1887–88 and 1897–98:—

Port.	1887–88.		1897–98.	
	Value.	Percentage of Total.	Value.	Percentage of Total.
	Rx.		Rx.	
Calcutta	58,955,852	38·6	71,994,608	43·1
Bombay	59,654,586	39·0	52,063,062	31·2
Rangoon	9,897,716	6·5	12,346,725	7·4
Madras	8,800,123	5·7	10,161,018	6·1
Karachi	5,186,785	3·4	9,228,432	5·5
Tuticorin	1,613,897	1·1	2,185,426	1·3
Moulmein	787,629	·5	910,307	·6
Bassein	631,533	·4	884,858	·5
Negapatam	863,540	·6	839,837	·5
Chittagong	1,256,999	·8	815,035	·5
Coconada	703,786	·5	777,933	·5
Cochin	379,052	·2	645,197	·4
Calicut	439,278	·3	640,526	·4
Mangalore	319,171	·2	549,060	·3
Tellicherri	737,557	·5	542,183	·3
Akyab	939,065	·6	374,624	·2
Total	151,166,569	98·9	164,958,831	98·8
Grand Total for British India	152,856,275		166,957,393	

The two great rivals, Calcutta and Bombay, control between them three-fourths of the total trade of India. But while the share of Calcutta has steadily increased, Bombay suffered severely from the combined effects of famine and plague. Rangoon has gained upon Madras, and Karachi comes close behind. Of the minor ports, Tuticorin and Cochin (both in the Madras Presidency) show the largest increase; while Chittagong, Akyab, and Tellicherri conspicuously declined.

Shipping.—The following table distributes according to national flags the vessels (both steam and sailing) that cleared for foreign countries from British India in each of the three years 1877–78, 1887–88, and 1897–98:—

National Flag.	1877–78.		1887–88.		1897–98.	
	Number of Vessels.	Tonnage.	Number of Vessels.	Tonnage.	Number of Vessels.	Tonnage.
British	3,417	2,394,213	3,049	3,089,264	2,887	3,226,027
Austro-Hungarian	18	22,651	59	102,214	64	138,203
Danish	4	3,358	...	...	1	842
Dutch	4	2,398	14	12,511	10	7,854
French	132	70,961	47	37,735	47	59,672
German	42	33,981	86	95,633	121	192,678
Italian	87	73,291	71	108,134	28	55,604
Norwegian	37	31,944	34	31,699	61	56,243
Portuguese	9	768	12	1,069	1	28
Russian	7	5,195	1	1,148	2	2,039
Spanish	2	1,207	1	333	..	...
Swedish	25	15,005	9	3,746	5	3,673
American	65	75,864	37	53,463	1	1,858
Arab	290	33,789	304	41,865	210	25,716
Japanese	...	...	...	...	9	18,443
Mekran	7	362	24	865	1	78
Persian	...	...	3	205	2	1,233
Siamese	2	455	2	796	...	...
Turkish	7	5,275	25	7,138	2	1,759
British Indian	1,950	97,278	1,647	72,660	1,201	61,071
Foreign Indian	77	7,158	158	14,547	131	13,848
Others	2	1,577	2	226	...	...
Total	6,184	2,876,730	5,585	3,675,251	4,784	3,866,869

In this case the United Kingdom holds its own. Though the number of British-owned vessels (including those registered in British India) decreased, the aggregate tonnage rose, and the proportion which this bore to the total remained pretty constant. Here again the most notable increase is shown by Germany, closely followed by Austria-Hungary. France, Italy, and Sweden each declined, while American ships dropped from 65 to 1. The fall under British Indian is probably a result of re-classification.

Treasure.—The following table gives the imports and exports of treasure, distinguishing gold and silver, for each of the ten years ending 1899–1900. During the 50 years ending 1898–99, India imported treasure to the aggregate value of Rx.524,000,000. In no year of that period did the imports of treasure fail to exceed the exports; but in 1894–95, the year after the mints were closed, the net imports dropped to Rx.1,355,135. The net imports first rose above Rx.10,000,000 just before the Mutiny, when railway construction was beginning; and first rose above Rx.20,000,000 at the time of the American Civil War. During the decade ending 1868–69, the net imports of gold averaged nearly Rx.6,000,000 a year, and the net imports of silver averaged more than Rx.10,000,000 a year. The closing of the Indian mints to the free coinage of rupees in June 1893 has had the effect of reducing the net imports of silver, which now possesses only a bullion value, and of increasing the net imports of gold.

Year.	Imports. Gold.	Imports. Silver.	Exports. Gold.	Exports. Silver.	Net Imports. Gold.	Net Imports. Silver.
	Rx.	Rx.	Rx.	Rx.	Rx.	Rx.
1890–91 . .	6,500,832	15,433,654	864,660	1,258,518	5,636,172	14,175,136
1891–92 . .	4,118,929	10,603,733	1,705,137	1,581,549	2,413,792	9,022,184
1892–93 . .	1,781,789	15,228,021	4,594,472	2,364,452	−2,812,683	12,863,569
1893–94 . .	3,146,530	15,314,726	2,505,284	1,594,908	641,246	13,719,818
1894–95 . .	1,756,280	7,824,927	6,730,374	1,495,698	−4,974,094	6,329,229
1895–96 . .	5,029,269	8,338,716	2,503,317	1,756,494	2,525,952	6,582,222
1896–97 . .	4,491,179	8,593,384	2,200,140	2,737,355	2,291,039	5,856,029
1897–98 . .	7,281,222	13,249,395	2,372,733	4,775,914	4,908,489	8,473,481
1898–99 . .	8,840,054	9,055,559	2,336,646	5,074,775	6,503,408	3,980,784
1899–1900 . .	7,632,531	6,349,926	1,338,797	3,965,461	6,293,734	2,384,465

Coasting Trade.—The following table analyses the total coasting trade of India for the two years 1888–89 and 1897–98. During ten years the aggregate coasting trade increased by 19 per cent. Taking country produce only, imports increased at the rate of 30 per cent., and exports at the rate of 39 per cent. In foreign products, imports showed a slight decrease, and exports a somewhat larger increase. Government transactions increased considerably. The heavy fall in treasure was probably due to the closing of the mints.

		1888–89.	1897–98.
Imports—		Rx.	Rx.
Private Merchandise	Country .	23,136,488	30,015,652
	Foreign .	5,475,424	5,372,080
Government Stores	Country .	178,971	404,226
	Foreign .	193,151	331,996
Total Merchandise . . .		28,984,034	36,123,954
Treasure		4,055,901	2,237,461
Total Imports . . .		33,039,935	38,361,415

		1888–89.	1897–98.
Exports—		Rx.	Rx.
Private Merchandise	Country .	20,954,551	29,150,764
	Foreign .	6,757,845	7,113,212
Government Stores	Country .	373,197	416,241
	Foreign .	176,074	398,961
Total Merchandise . . .		28,261,667	37,079,178
Treasure		4,538,127	2,418,652
Total Exports . . .		32,799,794	39,497,830
Grand Total		65,839,729	77,859,245

The following table distributes among provinces the coasting trade for 1897–98, excluding Government transactions:—

Province.	Imports. Merchandise. Country.	Imports. Merchandise. Foreign.	Imports. Merchandise. Total.	Imports. Treasure.	Exports. Merchandise. Country.	Exports. Merchandise. Foreign.	Exports. Merchandise. Total.	Exports. Treasure.
	Rx.	Rx.	Rx.	Rx.	Rx.	Rx.	Rx.	Rx.
Bengal . .	7,292,856	831,412	8,124,268	538,347	6,631,623	1,409,167	8,040,790	1,270,963
Bombay .	12,131,453	630,633	12,762,086	259,278	8,473,451	4,610,375	13,083,826	431,616
Sind . .	1,139,744	1,620,996	2,760,740	78,827	2,491,478	165,118	2,656,596	7,973
Madras .	4,835,330	1,183,163	6,018,493	91,571	4,817,536	250,743	5,068,279	61,717
Burma . .	4,616,269	1,105,876	5,722,145	1,025,249	6,736,676	677,808	7,414,484	441,990
Total .	30,015,652	5,372,080	35,387,732	1,993,272	29,150,764	7,113,211	36,263,975	2,214,259

This table brings out the varying character of the coasting trade in the several provinces. Bombay, with its line of active little ports all along the western coast, from Kathiawar to Kanara, possesses more than one-third of the whole; but owing to the prevalence of plague, its share of the total imports fell from 44 to 36 per cent. Trade is also active along both coasts of Madras, but no increase was shown during 1894–98. In Bengal (where the only ports besides Calcutta are Chittagong and the Orissa roadsteads), the imports of country produce increased between 1894 and 1898 by 50 per cent., and the exports by 40 per cent. Sind (which means Karachi) imports a larger amount of foreign than of country merchandise, standing alone in this respect; while its exports, which more than doubled in 1894–98, are almost entirely confined to country produce. In both cases the trade is carried on with Bombay. In Burma the coasting trade in foreign produce remained stationary, the imports being approximately double the exports. The exports of country produce mainly depend upon the demand in India for Burmese rice, and fluctuated within three years from under Rx.3,000,000 to nearly Rx.7,000,000. The imports showed a steady increase, at the rate of 31 per cent. in 1894–98. The coasting trade in treasure consists almost entirely of an export from Bengal to Burma, to move the rice crop.

Trans-frontier Trade.—The following table gives the registered imports and exports by land along the northern frontier of British India, from Sind to Burma, for the two years 1891–92 and 1897–98. The largest portion of this land trade is conducted with Nepal, which sends to Bengal and the North-Western Provinces rice, timber, cattle, oil-seeds, *ghi*, &c., and receives in exchange cotton, silver, salt, metals, sugar, spices, and tobacco. The trade with independent Afghanistan shows a steady decline, due to the restrictions imposed by the Amir. On the other hand, the trade with Tirah and Bajaur (Afghan territory under British influence) shows satisfactory improvement. The trade with Tibet and Sikkim increased; but that with Bhutan and along the frontier of Assam is insignificant. Along the frontier of Burma trade is comparatively active, especially with the Shan States; but it should be remembered that the Shan States are not foreign territory. Of the total exports of merchandise, nearly one-half consist of cotton goods. The imports and exports of treasure appear to be almost equally balanced.

Country.	Imports from. 1891–92.	Imports from. 1897–98.	Exports to. 1891–92.	Exports to. 1897–98.
	Rx.	Rx.	Rx.	Rx.
Lus Bela . .	43,785	96,713	23,643	41,241
Khelat, Kandahar, &c. .	600,317	413,812	682,224	277,921
Kabul . .	218,120	129,109	653,639	253,979
Tirah and Bajaur	90,743	258,016	114,744	336,516
Kashmir . .	650,509	810,510	661,614	631,022
Ladakh . .	30,779	52,662	22,238	45,635
Nepal . .	1,645,066	2,056,529	1,358,554	1,828,810
Sikkim . .	22,016	49,404	12,699	36,496
Bhutan . .	33,053	14,685	22,759	15,883
Tibet . .	130,671	124,388	49,566	100,858
Tawang . .	2,685	2,261	1,067	2,984
Mishmi Hills, &c.	8,825	8,227	1,594	2,088
Manipur . .	...	7,146	...	11,453
Hill Tipperah .	46,833	45,560	2,847	11,662
Karennee . .	177,333	158,272	51,433	109,921
Shan States .	260,165	839,320	174,363	739,616
Zimme . .	182,843	288,802	44,550	150,304
Siam . .	48,871	131,832	70,944	112,757
Western China .	46,336	147,856	104,539	209,085
Total . .	4,238,950	5,634,604	4,053,017	4,918,231

Revenue and Expenditure.—The following table shows the gross revenue and expenditure in India and in Great Britain for each of the ten years ending 1898–99:—

Year.	Gross Revenue.			Gross Expenditure.			Surplus or Deficit.
	In India.	In Great Britain.	Total.	In India.	In Great Britain.	Total.	
	Rx.	Rx.	Rx.	Rx.	Rx.	Rx.	Rx.
1889-90	84,598,760	486,443	85,085,203	60,960,805	21,512,365	82,473,170	+2,612,033
1890-91	85,221,551	520,098	85,741,649	61,397,459	20,656,019	82,053,478	+3,688,171
1891-92	88,773,360	369,923	89,143,283	65,763,836	22,911,912	88,675,748	+467,535
1892-93	89,819,707	352,731	90,172,438	64,844,035	26,161,815	91,005,850	-833,412
1893-94	90,246,041	319,173	90,565,214	66,000,101	26,112,111	92,112,212	-1,546,998
1894-95	94,814,831	372,598	95,187,429	65,718,671	28,775,648	94,494,319	+693,110
1895-96	97,977,005	393,162	98,370,167	69,377,831	27,458,338	96,836,169	+1,533,998
1896-97	93,586,471	543,270	94,129,741	69,600,508	26,234,255	95,834,763	-1,705,022
1897-98	96,139,287	302,717	96,442,004	76,481,391	25,319,824	101,801,215	-5,359,211
1898-99	101,062,361	364,332	101,426,693	72,977,618	24,487,765	97,465,383	+3,961,310

Finance. Between 1880 and 1899 the gross revenue increased at the rate of 48 per cent., while the expenditure increased at the rate of 61 per cent. Of these twenty years eleven were years of surplus and nine were years of deficit, the net deficit being Rx.2,026,549. If we go back for a further period of thirty years, *i.e.*, to 1849–50, the net deficit has amounted to Rx.4,000,000; but it has to be remembered that a deficit of no less than Rx.32,000,000 was incurred in the three years following the outbreak of the Mutiny.

As the gross revenue and expenditure of India include large sums on both sides of the account for railways and other commercial services, it will be convenient to consider the chief items separately. The following table gives the principal heads of both revenue and expenditure for the five years named :—

Head.	1877–78.	1882–83.	1887–88.	1892–93.	1897–98.
Revenue—	Rx.	Rx.	Rx.	Rx.	Rx.
Land	19,563,699	21,876,047	23,189,292	24,905,328	25,683,642
Forests	680,772	938,855	1,124,125	1,591,332	1,739,514
Tributes	675,120	689,945	743,597	790,112	884,029
Opium	9,182,722	9,499,594	8,515,462	7,993,180	5,179,772
Salt	6,461,225	6,177,781	6,670,728	8,656,104	8,594,225
Stamps	2,993,483	3,379,681	3,876,298	4,448,540	4,837,043
Excise	2,458,029	3,609,561	4,534,655	5,242,443	5,489,454
Customs	2,624,123	1,296,119	1,348,837	1,617,633	4,641,295
Provincial rates	2,255,937	2,683,015	3,035,323	3,706,498	3,723,290
Assessed taxes	101,682	517,811	1,431,436	1,686,141	1,895,465
Registration	234,160	285,829	311,253	430,064	486,544
Expenditure—					
Charges of collection, &c.	8,321,008	8,488,957	9,438,163	9,461,694	10,816,813
Debt	5,158,313	4,770,184	5,441,754	4,374,263	3,472,260
Civil services	17,205,098	19,435,241	21,593,591	24,214,358	25,471,965
Military services	18,454,417	19,324,157	22,106,011	25,073,970	28,188,867

Between 1878 and 1898 the land revenue increased by just Rx.6,000,000, but the proportion which it bore to the total gross revenue fell from 34 to 27 per cent. Forests largely increased, especially since 1890. The small increase in tributes is mainly due to the recent levy of the full assessment upon Mysore. Opium decreased very heavily, especially in the last five years, and the proportion which it bore to the total revenue fell from 14 to 5 per cent. The fluctuations in salt were partly due to changes in the rate of duty, which is now levied uniformly (except in Burma) at Rs.2 : 8 : 0 per maund. Stamps steadily increased, the rate of increase during the period being no less than 62 per cent. Nearly two-thirds of the

Commercial Services.	1877–78.	1882–83.	1887–88.	1892–93.	1897–98.
Post Office—	Rx.	Rx.	Rx.	Rx.	Rx.
Revenue	850,431	977,797	1,214,196	1,488,875	1,879,163
Expenditure	979,004	1,217,287	1,375,201	1,518,545	1,729,474
Net expenditure	128,573	239,490	161,005	29,670	-149,689
Telegraphs—					
Revenue	344,971	524,858	763,886	937,743	1,309,330
Expenditure	479,569	621,257	786,627	875,073	1,051,494
Net expenditure	134,598	96,399	22,741	-62,670	-257,836
Railways—					
Revenue	7,243,730	10,973,030	14,533,360	19,077,103	21,260,886
Expenditure	7,393,877	12,279,224	16,655,746	20,924,155	22,693,502
Net expenditure	150,147	1,306,194	2,122,386	1,847,052	1,432,616
Irrigation—					
Revenue	1,144,268	1,533,828	1,714,274	2,418,902	3,569,864
Expenditure	1,808,496	2,249,683	2,461,646	2,940,479	3,144,085
Net expenditure	664,228	715,855	747,372	521,577	-425,779
Total—					
Revenue	9,583,400	14,009,513	18,225,716	23,922,623	28,019,243
Expenditure	10,660,946	16,367,451	21,279,220	26,258,252	28,618,555
Net expenditure	1,077,546	2,357,938	3,053,504	2,335,629	599,312

whole is derived from judicial or court-fee stamps. Excise more than doubled in the twenty years, but the recent famine caused an actual decline. It is levied on liquors, opium (for local consumption), and other intoxicating drugs. The increase is attributed to more effective control of the administration, thus checking illicit manufacture, rather than to increased consumption. The policy of the State is to increase progressively the rates of duty, according as the articles will admit. The fluctuations under customs are due to changes of financial policy. From 1875 to 1882 there was a general import duty of 5 per cent. In 1882 all articles were admitted free, except liquors, arms, opium, and salt, and all exports were freed from duty, except rice. In 1894 the former tariff of 5 per cent. was reimposed, subject to certain exceptions. In 1896 cotton yarn was exempted from duty, and the rate on all other cotton goods was reduced to 3½ per cent. In 1899 (subsequent to the period covered by this table) sugar imported from countries which grant a bounty on exportation was charged with an additional duty equivalent to the bounty, which is estimated to yield about Rx.170,000 a year. In 1897–98, out of a total customs revenue of Rx.4,641,295, the export duty on rice yielded Rx.723,731. Of the import duties, cotton manufactures yielded Rx.795,721; liquors, Rx.661,317; metals, Rx.577,553; petroleum, Rx.531,778; and sugar, Rx.246,045. The present income tax was first imposed in 1886, in substitution for various licenses on trades. It is levied at the rate of 5 pies in the rupee (say 6d. in the £) on incomes exceeding Rs.2000, and at the rate of 4 pies in the rupee (say 5d. in the £) on incomes exceeding Rs.500, below which there is total exemption. In 1897–98 the total number of persons assessed under the tax was only 462,383, and the average incidence of the demand was Rs.36 per person assessed.

The table at the bottom of the previous page shows the revenue and expenditure of the commercial services which are included in the Indian budget for the same five years. It will be observed that post-office, telegraphs, and irrigation each yielded a net profit in 1897–98, and that the loss on railways has steadily diminished. Within the period the gross revenue from the post-office more than doubled; from telegraphs it multiplied nearly fourfold; from railways nearly threefold; and from irrigation more than threefold. These figures are, of course, exclusive of capital expenditure.

The two following tables show the net revenue and net expenditure for 1899–1900, according to the form in which the accounts are now laid before Parliament, 15 rupees being taken as the equivalent of £1:—

Net Revenue, 1899–1900.

Land Revenue, &c.—		
Land	£16,444,825	
Forests	1,232,685	
Tributes	586,603	
Total		£18,264,113
Opium		2,670,589
Taxation—		
Salt	£5,373,775	
Stamps	3,225,920	
Excise	3,810,539	
Provincial rates	2,495,458	
Customs	3,058,795	
Assessed taxes	1,292,729	
Registration	287,164	
Total		19,544,380
Miscellaneous—		
Mint	£289,183	
Miscellaneous	99,382	
Total		388,565
Exchange		−80,949
Grand Total		£40,786,698

Net Expenditure, 1899–1900.

Debt		£1,342,283
Military		14,968,399
Collection of revenue		4,448,839
Commercial—		
Post office	−£126,068	
Telegraphs	−105,891	
Railways	−76,756	
Irrigation	−136,387	
Total		−445,102
Famine relief		2,098,848
Civil Services—		
Civil departments	£9,597,544	
Miscellaneous	3,513,138	
Construction of railways	2,356	
Buildings and roads	2,891,990	
Total		16,005,028
Provincial and Local balances		−206,220
Grand Total		£38,212,075
Surplus		2,574,623

As compared with the preceding year (1898–99) the total net revenue shows a decrease of £892,919, due mainly to a heavy fall under land, against which may be partly set off improvements under opium and mint. The total net expenditure shows a decrease of £1,026,669, of which £1,189,110 was under army and £723,473 under commercial services, while £1,307,305 more was spent on famine relief.

Debt.—The total debt consisted in 1898 of Rx.111,695,634 in India and £123,274,680 in Great Britain, of which Rx.131,030,304 was appropriated to railways and Rx.32,639,803 to irrigation, leaving Rx.65,300,207 for other purposes. During the ten years 1889–98 the debt in India increased by about Rx.11,000,000, and the debt in England by more than £28,000,000. Almost all the debt in India bears 3½ per cent. interest, the rate having been reduced from 4 per cent. in 1894. The debt in England bears interest at rates varying from 3½ to 2½ per cent. In 1897–1898 the total payments on account of interest amounted to Rx.10,695,520, of which Rx.5,939,011 was debited against railways and Rx.1,284,249 against irrigation, leaving Rx.2,957,024 for interest on ordinary debt and Rx.515,236 for interest on other obligations. Since 1887–88, owing to the reduction in the rate of interest, the charge for ordinary debt has fallen by more than Rx.2,000,000. Of the total debt in India, Rx.21,780,893 was in 1898 enfaced for payment of interest in London, and of the remainder it is estimated that Rx.47,804,990 is held by natives, while about Rx.10,000,000 is held in reserve by the Government against paper currency.

The expenditure of the Indian Government in England is for the most part met by means of bills (or telegraphic transfers) drawn on India by the Secretary of State, and sold by him in London for sterling. During the 25 years ending 1897–98 the total amount of such bills was Rs.482,91,57,513, and the total amount of sterling received for them was £353,271,946. The difference between these two figures (Rs.12,96,43,805) represents the "loss by exchange" on the conventional value of the rupee at 2s. During the 25 years the average annual rate obtained per rupee ranged from 1s. 10·351d. in 1873–74 to 1s. 1·100d. in 1894–95. Since the closing of the Indian mints to the free coining of rupees in June 1893 the exchange value of the rupee has been gradually dissociated from the market price of silver, and during 1900 stood pretty steadily at 1s. 4d. This is the rate at which, by Indian legislation, sovereigns were made legal tender, £1 being the equivalent of Rs.15; and the accounts of the Indian Government, as laid before Parliament, are now expressed in pounds sterling on this basis.

Savings Banks.—In 1897–98 there were 6484 Government savings banks in India, mostly connected with the Post Office. The total number of depositors or accounts was 755,426, and the balance at the end of the year was Rx.10,556,733, being an average of Rs.139 for each depositor. About 90 per cent. of the depositors, with 82 per cent. of the deposits, are natives of India. The rate of interest allowed is 3⅛ per cent., and the maximum amount receivable from any one depositor is Rx.200.

Notation.—In India the method of pointing a statement of rupees differs from the English system. Up to 99,999 the figures are named and pointed as in English, but 100,000 rupees is termed a *lakh* (or *lac*) and written 1,00,000. Millions are not named in the Indian notation. Thus 1234567 would not be punctuated 1,234,567, but Rs.12,34,567, reading "Twelve lakhs, thirty-four thousand, five hundred and sixty-seven" rupees. The *crore* (Indian *karōr*) is equal to 100 lakhs. Thus Rs.1,23,45,678 would read "One crore, twenty-three lakhs, forty-five thousand, six hundred and seventy-eight" rupees (English notation 12,345,678). In the case of very large numbers, such as Rs.28332415000, a change is introduced. This would be written Rs.2,833,24,15,000, and read "Two thousand eight hundred and thirty-three crores, twenty-four lakhs, fifteen thousand." This system is also sometimes used in enumerating bales of goods, such as jute or cotton, but is never applied to populations.

Army.—The net expenditure on the army was, during 1899–1900, £14,166,617, of which £4,061,817 was spent in Great Britain and £10,824,283 in India. In 1897 the death-rate was 12·75 per thousand for the European army, and 10·70 per thousand for the native army. (For full details see article on Armies.)

Police and Prisons.—The total police force of all kinds (excluding village watchmen) consisted in 1899 of 150,016 officers and men, of whom 47,354 were armed with firearms and 38,487 with swords. The total cost was £2,093,968. Compared with 1889, the numbers increased in ten years by 3 per cent., while the cost increased by 17 per cent. The total daily average number of prisoners in all the gaols in 1899 was 104,119, of whom 2770 were females. The death-rate was 22 per thousand, being lower than in any year of the previous decade. The total expenditure was Rs.61,79,357, being Rs.59·10 per head of average strength. Compared with 1889, the numbers increased by 25 per cent. and the cost by 27 per cent.

Posts and Telegraphs.—The following is a comparison of the general statistics of the Imperial Post Office in British India in 1899–1900 compared with 1890–91. The number of post-offices increased in ten years from 8394 to 10,823, or 29 per cent.; of letter-boxes from 11,999 to 19,822, or 65 per cent.; the strength of the establishment increased from 44,979 to 55,073, or 22 per cent. The length of railways, roads, &c., over which the mails were conveyed increased from 74,393 to 91,534 miles, or 23 per cent.; the total number of letters, &c., received for delivery from 325,000,000 to 521,000,000, or 60 per cent.; the gross revenue from Rx.1,396,385 to £1,299,609, or approximately 40 per cent.; and the gross expenditure from Rx.1,177,694 to £999,113, or approximately 27 per cent. The surplus thus grew from Rx.218,691 to £300,496. The rate of postage, extending over the whole of British India, is half an anna (say ½d.) for a weight not exceeding half a tola, and one anna (say 1d.) for every one and a half tolas; while a postcard, including the cost of the card, costs only 3 pies (say ¼d.).

The following are the corresponding statistics for government telegraphs:—During the ten years from 1890–91 to 1899–1900 the length of lines increased from 37,070 to 52,909 miles, or 43 per cent.; the length of wires from 113,512 to 170,766 miles, or 50 per cent.; the length of cable from 251 to 283 miles, or 13 per cent.; the number of signal offices open from 949 to 1851, or nearly twofold; the number of messages from 3,403,769 to 6,237,301, or 83 per cent.; the revenue from Rx.569,081 to £565,676, approximately 50 per cent.; and the working expenses from Rx.468,880 to £447,758, or 43 per cent. The surplus thus rose from Rx.100,201 to £117,918, while, as the capital expenditure increased from Rx.5,024,168 to £4,510,939, the interest on capital outlay advanced from 1·99 to 2·61 per cent. The ordinary rate of charge for telegraphing throughout the whole of British India (including Burma) is one rupee for eight words, the address being free, with two annas for each additional word. The "urgent" rate is double this, and the "deferred" rate one half.

Municipalities.—The following table gives the chief statistics of municipalities in India, according to provinces, for 1899–1900:—

Province.	Number of Municipalities.	Population.	Income. From Taxation.	Income. From other Sources.	Income. Total.	Incidence of Taxation per Head.
			Rx.	Rx.	Rx.	Rx.
Bengal	152	3,379,749	759,729	512,372	1,272,101	2·25
N.W. Provinces and Oudh	104	3,235,685	372,763	110,617	483,380	1·25
Punjab	148	2,086,327	325,967	165,529	491,496	1·56
Burma	42	865,822	194,006	328,168	522,174	2·24
Central Provinces	52	683,739	112,247	37,947	150,194	1·64
Assam	14	84,727	11,164	14,312	25,476	1·32
Madras	59	2,154,920	275,496	420,651	696,147	1·28
Bombay	166	3,058,311	1,204,880	2,941,180	4,146,060	3·94
India, General	20	283,344	34,207	13,335	47,542	1·21
Total	757	15,832,624	3,290,459	4,544,111	7,834,570	2·08

Since 1890–91 the population within municipal limits has increased by 6 per cent., while the income from taxation has increased by 42 per cent., and the total income by 158 per cent. In 1899–1900 the chief items of expenditure were: conservancy, Rx. 896,139; roads, Rx. 396,886; water-supply, Rx. 332,716; drainage, Rx. 319,525; hospitals, Rx. 300,776; education, Rx. 255,478; lighting, Rx. 175,354; police, Rx. 166,507.

Education.—The following table gives the chief educational statistics for the three quinquennial years 1886-87, 1891–92, and 1896–97:—

Public Institutions.	1886–87. Institutions.	1886–87. Pupils.	1891–92. Institutions.	1891–92. Pupils	1896–97. Institutions.	1896–97. Pupils.
Colleges	114	11,501	141	16,277	160	18,783
Secondary schools	4,517	429,093	4,872	473,294	5,267	535,155
Primary schools	89,187	2,513,934	97,109	2,837,607	103,920	3,209,825
Training schools	141	5,123	152	5,146	184	5,667
Special schools	329	11,208	402	16,586	355	18,952
Total	94,288	2,970,859	102,676	3,348,910	109,886	3,788,382
Private institutions	32,828	372,685	39,117	507,911	42,139	568,488
Grand Total	127,116	3,343,544	141,793	3,856,821	152,025	4,356,870

During the whole period of ten years the total number of pupils at school increased by just over one million, or at the rate of 30 per cent. Schools did not increase quite so fast, but show a steady improvement in the average strength of each institution. The average attendance at colleges rose from 101 to 117; in secondary schools, from 95 to 102; and in primary schools, from 28 to 31. Assuming the number of persons of school-going age to be 15 per cent. of the total population, the proportion of these actually attending school rose from 10·7 to 12·5 per cent. The total number of girls attending school increased during the ten years from 266,287 to 402,158, or 51 per cent., while their proportion to the estimated female population of school-going age rose from 1·7 to 2·3 per cent. Mahommedans are specially numerous in private institutions, and hold their own in primary schools, but in secondary schools and colleges their proportion steadily falls. Native Christians are well represented throughout. In 1896-97 the total number of pupils learning English was 438,846 (chiefly in Madras and Bengal), being 1 in 79 of the total population of school-going age. There are now five universities in India, which are purely examining bodies, modelled on the pattern of the London University. During the ten years ending 1896–97, the total number of candidates who passed the matriculation was 57,919; of those who passed an intermediate examination, 21,240; of those who graduated B.A., 10,884; of those who proceeded to the degree of M.A., 917. Colleges and schools are classified according to their management. In 1896–97 only 2 per cent. of the total number of pupils were in institutions under the direct management of the State; 22 per cent. were in institutions under district boards or municipalities; 47 per cent. were in "aided" institutions; 12 per cent. in institutions that receive no assistance from the State but submit to public inspection; 13 per cent. in private institutions; and 4 per cent. in native States. It has long been the policy of the Government to withdraw from active management. The institutions which it still maintains belong to three classes: (1) a few arts colleges and English secondary schools, which are necessary in order to preserve a high standard of instruction; (2) primary schools in backward tracts or for backward sections of the population; and (3) special institutions, such as medical and engineering colleges and training schools.

The following table classifies the expenditure on education for the three quinquennial years 1886–87, 1891-92, and 1896–97. During the whole period of ten years the total expenditure increased by just a crore of rupees, or at the rate of 40 per cent. As the rate of increase in pupils was only 30 per cent., it is evident that education is tending to become more expensive,

as must inevitably be the case as it becomes more efficient. Nevertheless, the average cost per head of population in 1896–97 was only Rs.0:2:5 (say 2½d.). It will be observed that the rate of increase has been much the highest under the two last headings, fees and "other sources," the latter of which includes subscriptions and endowments, missionary contributions, and grants from the revenues of native States. These two headings now contribute more than half of the total expenditure, the actual proportion having

Source.	1886–87.	1891–92.	1896–97.
	Rs.	Rs.	Rs.
Provincial revenues .	85,61,249	88,13,549	95,22,985
Local funds . .	37,14,579	53,94,808	57,45,944
Municipal funds .	12,05,984	14,09,827	14,96,721
Fees	65,29,958	88,54,750	1,06,10,933
Other sources . .	52,30,644	60,46,698	78,68,317
Total . .	2,52,42,414	3,05,19,632	3,52,44,900

risen in ten years from 46·6 to 52·4 per cent. Of the total expenditure in 1896–97, 7 per cent. was devoted to arts colleges, 32 per cent. to secondary schools, 31 per cent. to primary schools, and 5 per cent. to special schools. Examined from another point of view, public funds provided 51 per cent. of the cost of colleges, 28 per cent. of the cost of secondary schools, and 52 per cent. of the cost of primary schools. The universities are almost all self-supporting, the total cost being more than balanced by fees.

The following table distributes the pupils for 1896–97 according to provinces, separating the boys from the girls, and giving the percentage of each to the estimated population of school-going age (15 per cent. of the total population):—

Province.	Boys.	Girls.	Total.	Percentage to estimated Population of School-going Age.		
				Boys.	Girls.	Total.
Madras	706,106	116,747	822,853	26·7	4·3	15·4
Bombay . . .	590,542	82,163	672,705	28·3	4·2	16·6
Bengal	1,561,008	113,767	1,674,775	28·5	2·0	15·2
N.W. Provinces and Oudh . . .	337,511	15,461	352,972	9·3	·5	5·0
Punjab	244,680	21,242	265,922	14·5	1·5	8·5
Central Provinces .	138,710	10,797	149,507	14·2	1·1	7·7
Burma	226,072	29,065	255,137	38·8	5·2	22·3
Assam	95,148	8,393	103,541	22·7	2·1	12·7
Coorg	4,314	801	5,115	30·0	7·0	19·7
Berar	50,621	3,722	54,343	22·6	1·8	12·5
Total . .	3,954,712	402,158	4,356,870	22·3	2·3	12·5

The high position taken by Burma is due to the prevalence of Buddhism, which demands that all young boys shall pass a period of literary training in a monastery, where they are taught Pali, the sacred language, as well as the vernacular. In respect of secondary education Burma takes a very low place. In justice to Bombay it should be stated that the outbreak of the plague closed nearly all the schools in Bombay city and Poona, the centres of higher instruction. Excluding Burma and Coorg, where the circumstances are peculiar, Madras and Bombay contest the lead in the matter of female education. Each of them has twice the proportion of girls at school that Bengal has, and eight times the proportion of the North-Western Provinces. During the last few years the Punjab has shown the most rapid progress, especially in the local support given to English-speaking schools.

Plague and Famine.—During recent years India has suffered severely from both plague and famine. Bubonic plague first declared itself in an epidemic form at Bombay city in September 1896, having probably been introduced from Hong Kong. Since that time the western presidency has never been entirely free from the disease, which has now also extended to other parts of India. From September 1896 to April 1901, or for just four and a half years, the total number of recorded deaths from plague was 480,000, of which no fewer than 336,000 were in the presidency of Bombay. Elsewhere epidemic outbreaks have been confined to Bangalore, parts of Mysore State, and (at a later date) Calcutta and separate tracts in North and South Behar. In the western presidency the city of Bombay itself and the towns of Karachi and Poona have suffered most severely, together with the districts of Satara and Belgaum and the native State of Cutch. In 1902 plague extended to the Punjab in a severe form.

The effects of famine, which are far more widespread than those of plague, have made themselves felt twice within three years. The two famines of 1896–97 and 1899–1900 were both directly caused by drought. On the former occasion the region of extreme distress was confined to the Central Provinces, the North-Western Provinces, and the native States of Bundelkhand that lie between. Elsewhere, as in the Bombay Deccan, the Northern Circars of Madras, and some districts of Bengal and the Punjab, the drought was more or less severe. But the total area in which famine was officially recognized extended over nearly 400,000 square miles, being considerably larger than on any former occasion known to history. The total expenditure by the Government on famine relief during the two financial years 1896–97 and 1897–98 amounted to no less than Rx.7,405,133 (nearly £5,000,000 sterling). In the Central Provinces alone the total cost of the famine is calculated at 2½ crores of rupees. Here, mainly owing to the difficult nature of the country and the shyness of the aboriginal tribes, the efforts of the Government to save life failed of complete success. In 1896 the death-rate rose to 49·3 per 1000, and in 1897 there was a further rise to 69·3 per 1000 for the whole province, the rate in two districts being above 90 and in three districts above 80. These figures speak for themselves, especially when it is stated that in the worst district of the North-Western Provinces the death-rate for 1897 was only 61·8, and for the whole province only 40·5 per 1000. The famine of 1899–1900 is estimated to have extended over a total area of nearly 700,000 square miles. The Central Provinces were again included within the region of distress, though the North-Western Provinces altogether escaped. Almost the whole of Bombay suffered, more or less severely; also Berar, Haidarabad, and part of the Punjab. But the zone of extreme distress ran from Kathiawar on the western coast, through Northern Gujarat, into the native States of Rajputana and Central India. Here the deficiency of rainfall not only caused the harvest to fail and the cattle to perish of starvation, but also reduced the water-supply to such an extent as to expose the unhappy people to the ravages of cholera. During the financial year 1900–1901, the direct expenditure on famine relief was Rx.6,337,600, besides Rx.1,471,600 for remissions and suspensions of revenue, and Rx.660,300 for compensation charges: total, Rx.8,469,500. In addition, Rx.4,110,000 was advanced in loans to native States, and Rx.1,420,000 to agriculturists. Altogether, the drain on the balances caused by famine is estimated to have amounted for two years to nearly £14,000,000 sterling. The total number of deaths due to famine, directly or indirectly, is believed to have been about 1,000,000. The following table shows the distribution of persons in receipt of relief in July 1900, when distress was at its height:—

Province.	Relief Works.	Gratuitous Relief.	Total.
BRITISH PROVINCES—			
Madras . . .	8,633	3,060	11,693
Bombay . . .	1,168,995	456,644	1,625,639
Bengal . . .	11,749	7,807	19,556
N.W. Provinces .	...	1,397	1,397
Punjab . . .	136,129	42,917	179,046
Central Provinces .	473,866	1,760,058	2,233,924
Berar. . . .	373,235	143,962	517,197
Ajmer-Merwara .	75,282	31,239	106,521
Total . . .	2,247,889	2,447,084	4,694,973
NATIVE STATES—			
Rajputana . . .	251,018	133,241	384,259
Central India . .	85,733	36,117	121,850
Haidarabad . .	369,236	106,893	476,129
Baroda . . .	76,726	35,356	112,082
Bombay . . .	403,443	66,284	469,727
Punjab . . .	28,740	16,881	45,621
Central Provinces .	12,801	39,026	51,827
Kashmir (Jammu) .	531	...	531
Total . .	1,228,228	433,798	1,662,026
Grand Total .	3,476,117	2,880,882	6,356,999

Vital Statistics.—For several years past vital statistics have been collected throughout British India, through the agency of the police. Though considerable improvement in accuracy has been attained, the returns cannot be considered as trustworthy, especially as regards the number of births and the causes of death. For comparative purposes, however, the number of registered deaths is worthy of attention. This is shown in the following table for each of the ten years ending 1899. During these ten years the total population under registration has increased from 194,000,000 to 214,000,000, mainly by adopting the results of the census of 1891. Registration has not yet been extended to Upper Burma, or to some small tracts in other provinces.

Year.	Deaths from Different Causes.							Ratio of Total Deaths per 1000 of Population.
	Cholera.	Smallpox.	Fevers.	Dysentery and Diarrhœa.	Injuries.	All other Causes.	Total Deaths.	
1890	292,528	120,554	4,110,044	230,899	87,495	1,091,609	5,933,129	29·99
1891	583,634	98,844	3,822,358	244,889	89,184	1,114,620	5,953,529	28·09
1892	729,512	101,142	4,629,201	236,734	86,318	1,216,058	6,998,965	32·12
1893	217,507	68,819	3,761,724	201,127	89,498	1,223,932	5,562,607	25·52
1894	521,975	43,623	4,987,304	261,996	93,110	1,393,162	7,301,170	33·49
1895	313,131	44,979	4,255,030	242,020	94,147	1,280,758	6,230,065	28·60
1896	471,767	137,622	4,569,541	239,810	92,251	1,356,834	6,867,825	31·65
1897	555,016	167,160	5,015,842	403,394	115,691	1,475,042	7,732,145	36·03
1898	150,817	55,713	3,817,456	209,035	91,604	1,344,927	5,669,552	26·44
1899	169,237	49,560	4,085,455	244,920	95,524	1,792,726	6,437,422	30·01

It will be observed that the death-rate rose to its maximum in 1897, which was a year of famine, and that the deaths from every cause showed an increase in that year. The largest number of deaths from cholera (729,512) was in 1892, when there was a severe epidemic throughout Northern India; the smallest number (150,817) was in 1898. The number of deaths from smallpox ranged from 43,623 in 1894 to 167,160 in 1897, when there was a very severe outbreak in the North-Western Provinces, causing more than half the total number of deaths.

The following table gives the death-rate per 1000, according to causes, for each of the different provinces in 1897. The variations from the average may fairly be taken as evidence of the greater or less extent to which famine prevailed in that year. This does not apply, however, to either Assam or Coorg, in both of which cases the high mortality was caused by the exceptional prevalence of fever. The low fever-rate in Madras is undoubtedly due to a difference of classification:—

Province.	Ratio of Deaths per 1000 of Population, 1897.						
	Cholera.	Smallpox.	Fever.	Dysentery.	Injuries.	All other Causes.	Total.
Bengal	2·76	0·27	23·62	0·75	0·59	4·92	32·91
N.W. Provinces	0·94	1·86	31·21	1·25	0·71	4·48	40·45
Punjab	0·03	0·78	20·57	0·77	0·35	8·54	31·04
Lower Burma	1·89	0·43	11·46	1·95	0·25	10·28	26·26
Central Provinces	6·01	0·38	40·98	8·53	0·79	12 64	69·33
Assam	6·62	1·08	28·74	4·61	0·53	9·03	50·61
Coorg	0·61	0·34	41·50	3·11	0·35	4·12	50·03
Madras	4·40	0·70	9·00	1·20	0·30	9·80	25·40
Bombay	3·03	0·20	24·59	4·57	0·37	7·08	39·84
Berar	3·50	0·20	23·00	10·30	0·50	15·10	52·60
All India	2·59	0·75	23·48	1·87	0·54	6·80	36·03

(J. S. Co.)

Recent History.

The period dealt with in this article is mainly comprised in the interval between the years 1880 and 1900. Roughly speaking, of the years from the close of 1858, when the government of British India was transferred from the East India Company to the Crown, to the commencement of 1900, half were occupied in preparing, in plotting out, and in making a vigorous commencement in the execution of the great projects for the moral and material development of India, of which the latter half saw the application and extension. The schemes which were then put into force, more particularly for the material development of India, for increasing the system of railway communications, for fiscal reform, or for the prosecution of irrigation works, had their inception in the preceding period, and more particularly in its second decade. The work of reorganization, of progress, and of financial reform, which was commenced in 1859 by Lord Canning, though from time to time hindered under his successors by war, was on the whole continuously carried on. In spite of discouragement from famines and plague, from a succession of wars on the north-western and eastern frontiers, and from the ruinous effect on Indian finance of the continuous fall in the value of silver relatively to gold, the work begun in the first half of the forty-one years under review, and vigorously resumed after 1880, was more or less consistently carried on up to 1900. Thus the whole period forms, as it were, one growth. The first half is inextricably bound up with the second; and while much of the progress of the last twenty years has been in directions previously but little pursued, more has been but the sequence and necessary outcome of the foregoing period. It is therefore desirable to review the position in which the Government, in some at least of its more important branches, found itself at the close of 1879. With the military and political departments of the Government this article is only so far concerned as may be necessary to show their bearing on finance or polity.

The Position in 1880.

The finances of the country, which, during the years immediately preceding 1876 and 1877, had been very carefully husbanded by the Indian Government, were in those two years made the subject of a fresh and exhaustive study. Sir John Strachey took charge of the finances in 1876, and his administration marks a new era in Indian finance. He was not destined to reap the fruit of all his labours; but great changes had already been effected by him, and more were in contemplation, when the stress and strain of the Afghan war deferred their execution. The obstructive old internal salt customs frontier line, stretching at one time from the Indus to the Mahanadi in Madras, a distance of 2300 miles, and guarded by nearly 2000 men, had been finally abolished. The inland salt duties throughout India were at the same time in great measure equalized. In Bengal and in Northern India the duty had been reduced; in Bombay and Madras it had been raised. Arrangements had been concluded with certain native states by which, subject to compensation allotted to them, the great Indian sources of salt supply, which lie for the most part within their territories, were made over to the control of the Government of India. The consumption of salt at once considerably increased as a consequence of this measure, and the revenue corresponded. For the whole of India the average annual consumption rose from 24,424,000 maunds in 1875–77 to 27,550,000 maunds in 1879–81, the revenue increasing at the same time from £5,996,000 to £6,834,000.[1] Similar reforms had been contemplated, and in a small measure had been commenced, with regard to the customs revenue from import duties levied in India on cotton goods. In July 1877 the House of Commons resolved that the import duties levied in India on cotton goods were protective in their nature, and should be repealed as soon as the condition of India should permit. In 1878 the cotton duties were slightly diminished, and some other reductions were made at a cost to the revenue of £77,000. In 1879 the cotton

Finance.

[1] Throughout this article, unless otherwise indicated, the pound sterling is taken to represent ten rupees, being the "conventional sterling," or "Rx," of Indian accounts, till a recent date.

duties were further reduced at a cost of £200,000, but larger remissions were prevented owing to the effect on the finances of military operations in Afghanistan.

During Lord Mayo's rule administrative measures had been initiated, having for their object the decentralization of the finances; the transfer, that is to say, to the several provincial governments of the direct control of a portion of the public receipts and expenditure within their limits, with corresponding relief and advantage to the central administration. In 1877–79 these measures were further developed. Certain important local sources of revenue were definitely placed in the hands of the provincial governments, which were left to cultivate and improve them, to augment their produce, and to spend all or a definite part of them, at their discretion. On the other hand, the expenditure in certain branches of administration was transferred to provincial governments, of which the cost would be defrayed from the funds assigned them. Economy and good administration resulted, so far as the finances and the provincial governments were concerned, while the central government was relieved from provincial importunities, of which it could not always measure the relative importance, and from the control of details of provincial administration of which, in truth, it was not a competent judge.

Decentralization.

During the twenty-one years preceding 1880 both Upper and Southern India had been visited at times by devastating famines. The Madras famine of 1877–78 greatly exceeded in severity any which had of late years preceded it, and led to the appointment in January 1878 of a very carefully selected commission, presided over by General Strachey, R.E., to advise and report on measures which might palliate the effects of such calamities in future. In 1880 they presented their report, dealing exhaustively with all aspects of the question. Chief among the subjects handled by them was the extension of railway construction. In 1878 the length of guaranteed broad gauge lines was about 6000 miles, being the fruit of twenty-eight years' construction. On the state railways, at the same date in the nine previous years, 1050 miles of broad gauge and 1200 miles of narrow gauge had been completed; in all, say, 8250 miles. The Government of Lord Mayo had, not long before, inaugurated, in lieu of the costly method of guaranteed railways heretofore in force, the system of construction of state railways by loans, supplemented by such funds as could be annually spared from revenue. The famine commission estimated the length of railway which would be needful to ensure the ends they proposed at 20,000 miles. "Until the whole country," they wrote, "is more completely supplied with railways or canals by which food can be transported cheaply and in large quantities to every part where severe want may exist, the possibility of some unusual demand for Government interference in particular localities, or for special classes of people, cannot be shut out, nor the danger of the occurrence of a great calamity altogether removed. It is therefore to the improvement of the internal communications, and the removal of all obstructions to the free course of trade, accompanied by the extension of irrigation in suitable localities, and an improved agriculture, that we look for obtaining security against disastrous failures of the food supply in tracts visited by droughts." Though the scheme then put forward has been modified and added to in course of time, the views and estimate of railway requirements thus enunciated by the famine commission have formed a standard which has uniformly guided the Government of India from 1880 to the present day. Similarly, after an elaborate review of the extent of irrigation from public works, the commission had advocated for the needs of each province a large extension of the then existing system. The area under artificial irrigation in 1878 is given in the Report of the Indian Famine Commission of 1898 at 5,171,497 acres from productive works (p. 338).

Famine and railway policy.

After the famine of 1874 in Bengal Lord Northbrook had declared that to enable the state to meet the obligation of preventing and relieving famine, it was necessary to secure, in prosperous times, a substantial surplus of revenue over expenditure, in addition to that needful margin which a prudent Administration always requires for the ordinary service of the state. Due provision would thus be made for meeting occasional expenditure on famine. Taking an average of years, it was subsequently estimated that the annual cost of relieving famine, including loss of revenue and actual expenditure, would not be likely to exceed £1,500,000. As in 1877 the Government believed that the ordinary income and expenditure of the state might be considered to be for practical purposes in a state of equilibrium, it was believed necessary to improve the financial position by £1,500,000 a year on account of famine liabilities alone, and in addition to this to provide a margin on the annual estimates of at least £500,000, to meet unforeseen contingencies. A considerable portion of this £2,000,000 was supplied by a transfer of charges to provincial governments under the decentralization scheme above referred to; the rest was provided by fresh taxation. New taxation on land by means of rates imposed in Bengal, the North-West Provinces, Oudh, and the Central Provinces, provided about £525,000. Imposition of a license tax on trades and professions throughout India yielded about £820,000—in all £1,345,000. This was the total amount of famine insurance taxation then imposed. The money thus obtained, or so much of the one and a half million as remained after meeting charges for famine during any current year, was to be applied to the discharge of debt, or the prosecution of remunerative public works of a character likely to give protection to the country against the effects of drought, that is to say, to construction of railways or irrigation works. But in years of deficit the grant was necessarily suspended, and the fiscal sources from which it was drawn were in part or in whole diverted to meet the requirements of ordinary expenditure.

Famine insurance.

Education had advanced during the twenty years under review, though relatively to area and population it was still in an extremely backward state. A despatch from England in 1854 had laid down with fulness and precision the principles which were to guide the Government in state education, and its provisions were continued and enlarged by a subsequent despatch of 1859. These two despatches still form the charter of education in India. In 1859 there are believed to have been but little over 50,000 schools, including indigenous schools, and 925,000 scholars for all India, of whom more than 500,000 were pupils of indigenous schools. In 1881–82 there were 112,632 schools, including those for Europeans and Eurasians and for special instruction, with 2,665,636 pupils. The average throughout British India (exclusive of British Burma), according to the census of 1881, was one male under instruction to 42 of the whole male population, and one female to 858 of the whole female population. This may be contrasted with the rule in European countries, where it is usual to take the children of school-going age as one-sixth of the entire population, so that, in round numbers, one child would be at school for every six persons of the population. A large extension of primary education was therefore urgent, and in all

Education.

respects progress had been extremely slow. The three universities of Calcutta, Madras, and Bombay had been incorporated in 1857 by Acts of the Indian legislature. Among the several presidencies and provinces Bengal and Madras had on the whole shown the greatest advance; but Bombay, with its large and highly intelligent Parsee population, has always been prominent in respect of education.

The three great codes which pre-eminently do honour to the Indian legislature—the Penal Code, the Code of Criminal Procedure, and the Civil Procedure Code—were passed during the earlier part of the sixth decade of the 19th century. The labours of Sir Henry Sumner Maine and Sir FitzJames Stephen had enriched the Indian statute-book with other important Acts, such as the Evidence Act, various forest laws, the Criminal Tribes Act, the Christian Marriage Act, the Mahommedan and Parsee Marriage Act, and an Act for the Prevention of the Murder of Female Infants. The relations of landlord and tenant in Upper India and in Oudh had occupied the attention of the legislature. A high court of judicature, similar to those already existing in Calcutta, Bombay, and Madras, had been established for the North-West Provinces. The police system throughout India had been reorganized; sanitation had been especially recognized as claiming attention; the trade of India had developed from a total in round figures of 41 millions of imports and 43 millions of exports in 1859–64 to a total of 62 millions of imports and 76 millions of exports in 1880–81. Notably the great tea industry had taken firm root, and was assuming ever-increasing proportions. In 1879 there were 58 mills in India for the manufacture of cotton yarn and cloth by steam machinery. They worked 1½ million spindles and 1200 looms, giving employment to upwards of 40,000 persons. Of this total 44 mills were in the island or province of Bombay, 6 in Calcutta, 3 in Madras, the rest in various localities. There existed at that date 21 jute mills, mostly in Bengal. Brewing had been introduced, and was becoming more and more extended. Steam paper mills and some minor industries had also taken root.

Social progress.

During little less than half of the twenty-one years of the period with which we are dealing the Government of India had been in the hands of Lord Lawrence and Lord Northbrook. Both were pre-eminently men of caution, and in questions of Indian administration both were highly conservative. Their policy in home matters was to exercise extreme reserve in increasing fiscal burdens, and in foreign matters to abstain rigorously from interference beyond their borders. During their tenure of office, Lord Canning, Lord Elgin, and, on the whole, Lord Mayo, shared these characteristics. The administrative note, therefore, of the seventeen years from 1859, after the close of the Mutiny, to 1876 was one of moderation and cautious advance. They were years but little removed from the rule of the late East India Company and the great catastrophe of 1857. The whole machinery of Government, more especially during the earlier part of that period, was successively brought under review, and in almost every department reorganization more or less complete was projected. It was a time mainly of study and deliberation, preliminary to action; of prudent but thorough overhauling of the administration which had been but recently handed over to the Crown. The educational and other civilizing influences which had been established for the first time in years little anterior to 1859 had scarcely begun to make themselves felt. The population in almost every grade and class was still intimidated, inert, and irresponsive. In the latter half of the seventh decade of the century, however, the confidence and experience gained in previous years were beginning to bear fruit.

Administrative policy.

Such was the position on the eve of the period about to be dealt with. The revenues were in a sound condition; the country was quiet and content; time and scrutiny had suggested reform, for which the moment was now ripe; a generation had grown up in tranquillity since the horrors of 1857. Suddenly the Afghan war of 1878 broke out. For two years the whole resources of the Administration were strained to bring the struggle to a successful issue. The progress of the country was paralysed and the reform of its finances arrested. Nor was it till the close of that war, and the departure of Lord Lytton from the scene in 1880, that work was resumed and effect was given to financial and other reforms, for which the labours of the administration and the lapse of time had now prepared the country.

Summary 1860-1880.

Many eminent men had taken part in the government of India during the period from 1859 to 1880. But in any sketch of that period it should be recorded that among those who assisted successive Viceroys with their advice and experience India owes unquestionably the most to Sir Richard and Sir John Strachey. Each of these distinguished brothers, in one or other capacity, successively held high and important offices in the state from 1864 to 1880. The former belonged to that illustrious corps of Bengal (now Royal) Engineers, which has given so many brilliant men to civil and political administration in India; the latter to the Indian Civil Service. In their joint volume, *The Finances and Public Works of India, from 1869 to 1881*, they have left an invaluable record of the principal administrative measures which they initiated or in which they actively participated.

From 1880 *to* 1901.

With the advent in 1880 of Lord Ripon as Viceroy the portals of war were closed, and India entered once more upon the pleasant paths of peace. Remission of taxation, encouragement of primary and secondary education, the promotion of local self-government, the amelioration of the status of the agricultural tenant, the recognition and promotion of native claims to a share in directing the internal affairs of India—these were the cardinal points of the policy of 1880 and the years immediately ensuing. During the preceding period the attention of the central government, and the genius of those who inspired it, had been more immediately devoted to the material progress of India. Of that sympathetic and indulgent handling of the native population which characterized the East India Company, the traces become less and less apparent as we pass from the sixth towards the close of the seventh decade. The greatest benefits had been conferred on the people by the fiscal and public works measures introduced during those years. But of any seeking or strengthening of personal touch with them on the part of the Administration there is comparatively little trace. Much was done for the people, but in concert with them little was attempted. The steps taken in this direction during the eighth decade mark a return to the more personal and human aspects of administration which before 1857 had been perhaps exclusively prominent, but which of later years might be judged to have fallen too greatly into abeyance. In short, after 1880, and for a brief term of subsequent years, the moral development of India again took an equal place in the foreground, and the characteristic note of the decade which succeeded 1880 is to be found in the greater effort made during that period to combine moral with material progress.

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After the famine of 1874 in Bengal Lord Northbrook had declared that to enable the state to meet the obligation of preventing and relieving famine, it was necessary to secure, in prosperous times, a substantial surplus of revenue over expenditure, in addition to that needful margin which a prudent Administration always requires for the ordinary service of the state. Due provision would thus be made for meeting occasional expenditure on famine. Taking an average of years, it was subsequently estimated that the annual cost of relieving famine, including loss of revenue and actual expenditure, would not be likely to exceed £1,500,000. As in 1877 the Government believed that the ordinary income and expenditure of the state might be considered to be for practical purposes in a state of equilibrium, it was believed necessary to improve the financial position by £1,500,000 a year on account of famine liabilities alone, and in addition to this to provide a margin on the annual estimates of at least £500,000, to meet unforeseen contingencies. A considerable portion of this £2,000,000 was supplied by a transfer of charges to provincial governments under the decentralization scheme above referred to; the rest was provided by fresh taxation. New taxation on land by means of rates imposed in Bengal, the North-West Provinces, Oudh, and the Central Provinces, provided about £525,000. Imposition of a license tax on trades and professions throughout India yielded about £820,000—in all £1,345,000. This was the total amount of famine insurance taxation then imposed. The money thus obtained, or so much of the one and a half million as remained after meeting charges for famine during any current year, was to be applied to the discharge of debt, or the prosecution of remunerative public works of a character likely to give protection to the country against the effects of drought, that is to say, to construction of railways or irrigation works. But in years of deficit the grant was necessarily suspended, and the fiscal sources from which it was drawn were in part or in whole diverted to meet the requirements of ordinary expenditure.

Famine insurance.

Education had advanced during the twenty years under review, though relatively to area and population it was still in an extremely backward state. A despatch from England in 1854 had laid down with fulness and precision the principles which were to guide the Government in state education, and its provisions were continued and enlarged by a subsequent despatch of 1859. These two despatches still form the charter of education in India. In 1859 there are believed to have been but little over 50,000 schools, including indigenous schools, and 925,000 scholars for all India, of whom more than 500,000 were pupils of indigenous schools. In 1881–82 there were 112,632 schools, including those for Europeans and Eurasians and for special instruction, with 2,665,636 pupils. The average throughout British India (exclusive of British Burma), according to the census of 1881, was one male under instruction to 42 of the whole male population, and one female to 858 of the whole female population. This may be contrasted with the rule in European countries, where it is usual to take the children of school-going age as one-sixth of the entire population, so that, in round numbers, one child would be at school for every six persons of the population. A large extension of primary education was therefore urgent, and in all

Education.

respects progress had been extremely slow. The three universities of Calcutta, Madras, and Bombay had been incorporated in 1857 by Acts of the Indian legislature. Among the several presidencies and provinces Bengal and Madras had on the whole shown the greatest advance; but Bombay, with its large and highly intelligent Parsee population, has always been prominent in respect of education.

The three great codes which pre-eminently do honour to the Indian legislature—the Penal Code, the Code of Criminal Procedure, and the Civil Procedure Code—were passed during the earlier part of the sixth decade of the 19th century. The labours of Sir Henry Sumner Maine and Sir FitzJames Stephen had enriched the Indian statute-book with other important Acts, such as the Evidence Act, various forest laws, the Criminal Tribes Act, the Christian Marriage Act, the Mahommedan and Parsee Marriage Act, and an Act for the Prevention of the Murder of Female Infants. The relations of landlord and tenant in Upper India and in Oudh had occupied the attention of the legislature. A high court of judicature, similar to those already existing in Calcutta, Bombay, and Madras, had been established for the North-West Provinces. The police system throughout India had been reorganized; sanitation had been especially recognized as claiming attention; the trade of India had developed from a total in round figures of 41 millions of imports and 43 millions of exports in 1859–64 to a total of 62 millions of imports and 76 millions of exports in 1880–81. Notably the great tea industry had taken firm root, and was assuming ever-increasing proportions. In 1879 there were 58 mills in India for the manufacture of cotton yarn and cloth by steam machinery. They worked $1\frac{1}{2}$ million spindles and 1200 looms, giving employment to upwards of 40,000 persons. Of this total 44 mills were in the island or province of Bombay, 6 in Calcutta, 3 in Madras, the rest in various localities. There existed at that date 21 jute mills, mostly in Bengal. Brewing had been introduced, and was becoming more and more extended. Steam paper mills and some minor industries had also taken root.

Social progress.

During little less than half of the twenty-one years of the period with which we are dealing the Government of India had been in the hands of Lord Lawrence and Lord Northbrook. Both were pre-eminently men of caution, and in questions of Indian administration both were highly conservative. Their policy in home matters was to exercise extreme reserve in increasing fiscal burdens, and in foreign matters to abstain rigorously from interference beyond their borders. During their tenure of office, Lord Canning, Lord Elgin, and, on the whole, Lord Mayo, shared these characteristics. The administrative note, therefore, of the seventeen years from 1859, after the close of the Mutiny, to 1876 was one of moderation and cautious advance. They were years but little removed from the rule of the late East India Company and the great catastrophe of 1857. The whole machinery of Government, more especially during the earlier part of that period, was successively brought under review, and in almost every department reorganization more or less complete was projected. It was a time mainly of study and deliberation, preliminary to action; of prudent but thorough overhauling of the administration which had been but recently handed over to the Crown. The educational and other civilizing influences which had been established for the first time in years little anterior to 1859 had scarcely begun to make themselves felt. The population in almost every grade and class was still intimidated, inert, and irresponsive. In the latter half of the seventh decade of the century, however, the confidence and experience gained in previous years were beginning to bear fruit.

Administrative policy.

Such was the position on the eve of the period about to be dealt with. The revenues were in a sound condition; the country was quiet and content; time and scrutiny had suggested reform, for which the moment was now ripe; a generation had grown up in tranquillity since the horrors of 1857. Suddenly the Afghan war of 1878 broke out. For two years the whole resources of the Administration were strained to bring the struggle to a successful issue. The progress of the country was paralysed and the reform of its finances arrested. Nor was it till the close of that war, and the departure of Lord Lytton from the scene in 1880, that work was resumed and effect was given to financial and other reforms, for which the labours of the administration and the lapse of time had now prepared the country.

Summary 1860-1880.

Many eminent men had taken part in the government of India during the period from 1859 to 1880. But in any sketch of that period it should be recorded that among those who assisted successive Viceroys with their advice and experience India owes unquestionably the most to Sir Richard and Sir John Strachey. Each of these distinguished brothers, in one or other capacity, successively held high and important offices in the state from 1864 to 1880. The former belonged to that illustrious corps of Bengal (now Royal) Engineers, which has given so many brilliant men to civil and political administration in India; the latter to the Indian Civil Service. In their joint volume, *The Finances and Public Works of India, from 1869 to 1881*, they have left an invaluable record of the principal administrative measures which they initiated or in which they actively participated.

From 1880 *to* 1901.

With the advent in 1880 of Lord Ripon as Viceroy the portals of war were closed, and India entered once more upon the pleasant paths of peace. Remission of taxation, encouragement of primary and secondary education, the promotion of local self-government, the amelioration of the status of the agricultural tenant, the recognition and promotion of native claims to a share in directing the internal affairs of India—these were the cardinal points of the policy of 1880 and the years immediately ensuing. During the preceding period the attention of the central government, and the genius of those who inspired it, had been more immediately devoted to the material progress of India. Of that sympathetic and indulgent handling of the native population which characterized the East India Company, the traces become less and less apparent as we pass from the sixth towards the close of the seventh decade. The greatest benefits had been conferred on the people by the fiscal and public works measures introduced during those years. But of any seeking or strengthening of personal touch with them on the part of the Administration there is comparatively little trace. Much was done for the people, but in concert with them little was attempted. The steps taken in this direction during the eighth decade mark a return to the more personal and human aspects of administration which before 1857 had been perhaps exclusively prominent, but which of later years might be judged to have fallen too greatly into abeyance. In short, after 1880, and for a brief term of subsequent years, the moral development of India again took an equal place in the foreground, and the characteristic note of the decade which succeeded 1880 is to be found in the greater effort made during that period to combine moral with material progress.

When introducing the budget of 1882–83 the financial member of the Viceroy's council was able to announce that the surplus in the preceding year amounted to £1,577,000; the revenue having been £72,913,000, the expenditure £71,336,000. The flourishing condition of the finances, he hastened to point out, so far as it resulted from financial administration, was due, not to the Government existing at that time, but to its predecessor. In point of fact, but for certain readjustments and repayments to provincial governments of sums borrowed from them during the late years, the surplus would have been very much larger, and the sum of £1,577,000 fell far short of the amount by which the normal revenue of the year was estimated to exceed the normal expenditure. It has been explained how, by skilful management of the finances, this surplus had been prepared. To Sir Evelyn Baring (afterwards Lord Cromer) fell the pleasant labour of reaping where Sir John Strachey had sown. The remission of import duties, more particularly of import duties on cotton goods, which had been the object of the latter, and which had been in a small measure enforced by him, was carried by the former into full effect. The remaining cotton duties were abolished, involving a reduction of taxation of £655,000, while at the same time the whole of the general tariff of 5 per cent. *ad valorem* was abandoned, at a net cost (including the cotton duties) of £1,109,000. Thus in 1882 India was freed from taxation on her imports, strong liquors and salt excepted. The customs duty thenceforth, and till further changes, was derived entirely from the produce of an export duty on rice, and from import duties on salt and alcohol. At the same time the salt duty was reduced from a general rate of Rs.2/8 to Rs.2 per maund. The estimated loss of revenue consequent on this reduction was £1,400,000. A total of 2½ millions in taxation was thus remitted to the country. In the light of subsequent events it is necessary and important to record some of the remarks with which Sir Evelyn Baring accompanied the reductions thus effected: "As an incident of her connexion with England, India," he said, "has a right to benefit from English experience and English economic history. That experience and that history show that by the adoption of free trade a country benefits, indeed, all the world, but more especially benefits itself. . . . By the adoption of the measures now proposed India will be more free to exchange her exportable produce for the products of foreign lands than would be possible were the import duties maintained. . . . In addition to the general arguments, which would readily admit of further development, there is one consideration which applies especially to India, and which, I venture to think, is at the present moment of considerable importance. The desirability of rapidly extending our railway system is universally recognized. The main obstacle to any such rapid extension is the difficulty of attracting railway capital to India on terms that shall not be too onerous to the state. No fiscal measure of general application would be so likely to give a stimulus to railway construction as the removal of all restrictions on trade." In their *Finances and Public Works of India* (p. 295) the two Stracheys, writing in 1881, had expressed themselves on the subject in stronger terms: "The policy followed by the Government of India during the viceroyalty of Lord Lytton was one of absolute free trade, without reserve or qualification, and financial necessities alone prevented that policy from being carried out to the fullest extent. The proceedings of the last three or four years have, however, succeeded in rendering inevitable the almost total abolition of the customs duties, which of all Indian taxes are probably the worst." In the debate on his financial statement for 1880–81 Sir John Strachey had said: "I hardly remember the time when I did not argue in the interests of India for the removal of these and all other restrictions on commerce. . . . I would not have accepted my present office if I had not hoped that I should have an opportunity of co-operating with your Excellency in carrying out what I may say without exaggeration have been the convictions of a lifetime" (*op. cit.*, p. 311).

Financial policy.

Tariff reform.

As to the reduction in the salt duty from Rs.2/8 to Rs.2 per maund, we read in the financial statement for 1882–83: "The advantages to be gained by a reduction of the salt duty are twofold. In the first place, it is exceedingly desirable to reduce the price of a necessary of life which is used by the poorest classes. In the second place, the financial situation will be much strengthened." It was explained in subsequent words that, "If any unforeseen circumstance, such as a heavy fall in the value of silver, takes place, and if at the same time the reduction in the salt duty does not result in any considerable increase in the consumption of salt, it would be open to us to return temporarily to a higher rate." The Stracheys had pointed out that if the policy of maintaining a low and uniform rate of duty on salt were followed for some years to come, the average consumption would increase throughout India, and the revenue would become several millions larger. The Government would thus have in its hands a powerful reserve of taxation. "But these results will only be obtained if we steadily persevere in the course that has lately been followed. We must finally abandon the erroneous notion that it is profitable to levy the salt tax at a high rate on a restricted consumption, and resolve to act at all times on the only sound principle, that the interests of the people and of the public revenue are identical; for we shall receive the largest possible revenue when the salt duties are low, and when the people throughout India obtain an unlimited supply of salt at the cheapest possible cost" (*op. cit.*, 233–34).

When we review the subsequent history of finance in India, we shall learn what has been the fate of the reforms introduced in 1882–83. We may then recall to mind the opinions formed in regard to the cotton and salt duties by two of the most competent men who have directed the finances of India. It is, however, necessary to add that the abolition of the import duties on cotton goods was carried out against the very general feeling whether of Europeans or of the educated natives of India. Sir Evelyn Baring, in his financial statement of 1882–83, referred in the following terms to this aspect of the matter:—"Before leaving this subject, I may perhaps be permitted to express the hope that the solution which the Government now offers of this difficult and important problem will be accepted by this council, and by the public opinion of England and India, as satisfactory, and that it will finally set at rest the angry controversy that has for some years been waged. That controversy has unfortunately taken a form which no true friend of England or of India can view without regret. It has been represented, erroneously, as I venture to think, that in respect to the question now under discussion there is an antagonism of interests between the two countries." It is remarkable that when the first step was taken in 1879 of remitting the duties on all grey goods consisting of yarns finer than 30s, it was adopted by Lord Lytton in opposition to the majority of his council. One of the dissentient members stated that there were not a dozen officials in India who did not regard the policy as having been taken in the supposed interests of a political party

The political issue.

in England, the leaders of which deemed it necessary at any cost to retain the political support of the cotton manufacturers in Lancashire. The Stracheys admit that, making allowance for some exaggeration of expression, this statement doubtless contained a good deal of truth as to the state of public opinion (*Finances and Public Works of India*, p. 287). A striking illustration is to be found in pages where we should have scarcely looked for it. In the latest edition of his *Indian Polity* (1894) we find an Indian official of distinction, the late Lieut.-General Sir George Chesney, committing himself to the following expression of views which, in substance and in warmth of expression, recall twelve years later the angry controversy of the year preceding 1882:—"One source of revenue, free from the objections apparent to every other form of import, is to be found in the restoration of the cotton duties. The history of this case is still so fresh in recollection that it is not necessary to recapitulate it. That the tax has not yet been re-imposed is due, not to any consideration for the people of India, but simply to the supposed exigencies of party government at home. The principle involved, however, goes far beyond one of pure finance. It opens up the larger question, whether the Government of India is to be conducted in sympathy with the interests and feelings of the people of the country, or in accordance with the small and shifting policy of party needs; as to which it may be said that, unless the steps lately taken are retraced, an injury will be done to the good faith and character of the British Government of India, which may and probably will lead to far-reaching consequences" (*Indian Polity*, p. 347).

In this matter we may well be guided by the opinion of highly competent Indian financiers like Sir John Strachey and Sir Evelyn Baring, who had devoted to the subject prolonged and anxious inquiry. Nor should undue weight be attached to the *dictum* of a critic who, though deeply versed in military questions, had enjoyed no opportunities of personally handling many of the fiscal or administrative problems, the merits or demerits of which are pronounced upon in his pages.

The salaries of the upper grades of the native subordinate executive services were improved in 1882, at an estimated increase of about £50,000 a year. It was declared to be the intention of the British Government and of the Government of India that a constantly increasing share of the work of the country should be performed by natives of India. Figures showed that of 4082 officials employed in these branches of the public service which are directly engaged in the internal administration of the country, as apart from those employed in special branches (such as the post office or telegraph), 2058 were Europeans and 2024 were natives. In the upper or "covenanted" service, 861 were of the former and 12 only of the latter class. In the subordinate service 1197 were Europeans and 2012 were natives. This question of the employment of qualified natives, and of their advancement to higher grades of employment, is one ever present to the mind of the Indian Government, but beset by the greatest difficulties. Few aspects of Indian administration are more disagreeable at first sight than this, that with few exceptions all the higher posts, which carry with them the larger salaries, are confined to Europeans. Given the conditions and requirements of the administration, this is at present inevitable. But it necessarily bears on the face of it that appearance of a monopoly by a foreign caste of the higher grades of employment, which cannot fail to attract hostile criticism. It may confidently be asserted on behalf of the Indian Government, that it is ever on the watch to modify the existing state of matters, and is more than desirous of finding occasion for the advancement of natives to the higher ranks of civil employ. Its efforts in this direction have not been rewarded, so far, with any corresponding success. But it will be seen that at a somewhat later date than that with which we are dealing the subject was comprehensively considered by the Government of Lord Dufferin. A fresh basis was then established, on which rest the present rules and regulations by which are governed the admission and advancement of natives into the higher service. Any native now who, by education, force of character, probity, or good service, can prove his fitness for advancement to the higher grades of employment is no longer debarred from arriving at them.

Employment of natives in public service.

The system of decentralization, and of assigning to provincial governments the financial profit and loss on certain branches of administration, was largely extended in 1882. Practically, excepting the departments of army, marine, post office, telegraphs, opium, salt, customs, and for the most part the railways, all branches of the public service, with their receipts and expenditure, may be said to have been then made over to provincial hands. The result has been productive of economy and of good government; but on the other hand the measure has erected something of a barrier between the central government and the internal conduct of affairs. Though the central government retains the supreme authority, and regularly exercises its power of general control, it is now exclusively the business of the several provincial authorities, subject to such occasional check, to see to the practical working of the great machine of home administration. It is certain that none but provincial authorities are in close enough contact with local needs, or well informed enough in regard to them, to be prudently charged with the task. But there is reason to fear that by this strengthening of provincial agency the central government has somewhat lost the advantage of the more direct connexion which previously existed between itself and the masses. To borrow a term from telegraphy, there is a fault in communication. The comparative leisure thus gained by the Viceroy and his council has been perhaps the more often turned in later years from the internal requirements of India to military matters, and to territories beyond the Indian frontier. Opinions differ as to whether this need be regarded as a disadvantage. But of the fact there seems little room for question.

Local Government.

In connexion with the extension of provincial finance, greater latitude of self-administration was at the same time accorded to municipalities and local bodies throughout India. Few measures that have been greeted on their introduction with comparative indifference are likely, with lapse of time, to take deeper root in the country than the scheme of conferring self-government on municipalities. The aim and ideal of the energetic and highly-trained officers to whom is entrusted the administration of the various districts into which India for executive purposes is divided, has been hitherto government of and for the people, rather than government by or with the people. The prestige of the powerful Indian civil service is based on successes achieved in past years, when the authority of its officers was the only authority, and when, by the energetic and enlightened exercise thereof, great results had been everywhere obtained. Intimate knowledge of native character, and daily experience of the weaknesses, the jealousies, the animosities, and the trivial aims and pursuits of native society, might well make those who up to the present had been its guides not a little sceptical as to the uses to which local self-government would be put, and doubtful as to the

Municipal progress.

intelligence and interest with which it would be carried into effect. So far as concerns the district or local bodies, these apprehensions have not been without justification. But so far as town and municipal bodies are concerned, the measure of 1882 has met with a degree of success fully equal to any that its authors could have expected. Local self-government in all countries is a plant of slow growth. In India, with its counter-currents of Hindu and Mahommedan, its apathy, its passion for hereditary usages and employment, the indifference of its several units to the general good, the aptitude of the Indian for verbal controversy and inaptitude for collective action, any marked or early development of disinterested public spirit could not be counted on. It would be untrue to assert that the results have so far brought India into line with even moderately progressive European countries. But with regard, at least, to the more important towns, it may be affirmed that the measure enforced by the Government of Lord Ripon has, up to the present time, proved as useful as its authors hoped, and promises with the progress of years to acquire increasing stability. The spirit in which the measure was introduced augured well for its success. The desire was not to force upon all parts of the country a uniform system, but to secure the gradual training of the best, the most intelligent, and most influential men in the community to take an interest and an active part in the management of their local affairs. It was regarded by its promoters as being desirable, less for improvement in administration than as an instrument of political or popular education. The principle of election was introduced under very careful restrictions. Great latitude was left to provincial governments in devising the system best adapted to their several local circumstances. Considerable control was retained over the exercise of the powers to be entrusted to the newly created municipalities.

Reviewing in 1896 the working of the measures introduced fourteen years previously, the Government of India recorded its satisfaction at the marked advance disclosed, and at the activity, intelligence, and general economy with which municipal bodies had improved the conservancy services—the water supply, the drainage, the street paving, the lighting, and the many conveniences of the towns in their charge. At that date, apart from Presidency towns, Rangoon, and Upper Burma, 733 municipalities existed, as against 797 in 1881–82. It was not the number but the composition of municipalities, the mode of nomination by election, the powers conferred on them, and the revenues levied and expended by them, which marked the progress made. Before 1882 municipalities had existed. But they had existed mainly for purposes of local rating, and the consequent relief to the general revenues, enjoying little or no exercise of self-administration. In 1886–87 the total income of all municipalities had amounted to £5,077,754; in 1897–98 it reached the figure of £6,340,661.

Reviewing similarly and at the same time the working of the local boards created in 1882, the Government of India found that useful work had been done. But it is clear from that review that the several provincial governments wrote without enthusiasm of the public spirit, or the administrative energy exhibited by local boards. The interest shown in the closely populated municipal areas, by townsfolk working within more limited spaces, acquainted, for the most part, with one another, aiming at definite ends, and supplied with sufficient funds, far surpasses that which agricultural magnates or rural leaders of native society in their larger orbits exhibited. These men are for the most part content to look after their own estates or to attend to their professional affairs, leaving, as hitherto, to the British official in charge of their district the initiative and main execution of the measures necessary to local administration.

Provincial difficulties.

It is to be noted that in India, and more especially in Upper India, the Mahommedan element, though considerable, is numerically inferior to the Hindu. The former have thus found themselves, wherever election is the rule of appointment, in danger of being left permanently in a minority. They view with distrust and natural dislike the passing of authority into Hindu hands. Especially is this the case where, as often happens, the hands into which power passes are those of classes of Hindus who, though previously of no consideration, of obscure origin, and socially of less than little weight, are enabled by their familiarity with English, and by their education in British colleges, wholly to manipulate and control the municipal councils. In this direction there will for long exist antagonism between Hindu and Mahommedan. Resentment will smoulder on the one side, and on the other there will be little wish to conciliate. In India such differences do not take the form of party, but are inflamed by the virus of race and of religion, and become the more embittered.

The conduct of education and the control of colleges and schools in India is in the hands of the provincial governments. But in this, as in all other departments, the central government retains the ultimate authority. It has been already noted that the main lines on which the system of education in India is carried on were laid down in 1854 and 1859. Since then, necessarily, progress has been made, and fresh developments have called for further instructions. To the three universities of Calcutta, Madras, and Bombay have been added universities at Lahore and at Allahabad, respectively the headquarters of the Punjab and North-Western Governments. All five universities are entirely independent of the department of public instruction. They are autonomous bodies, with a constitution moulded on that of the University of London. The governing body consists of a chancellor, vice-chancellor, and senate. The senate for the most part acts through an executive committee of its members, termed the syndicate. Degrees are conferred at the annual meeting of convocation. These universities are essentially examining bodies, though the Punjab University is responsible for the management of the Oriental College at Lahore, and takes an active part in the improvement of vernacular literature. The influence of the universities, however, extends beyond the mere sphere of examination. By their power to grant or to refuse affiliation they are able to dominate the entire system of higher education from secondary schools upwards. In many cases the universities have themselves been affiliated to the two English universities of Oxford and Cambridge, so that their students can obtain certain exemptions from residence and examination. The universities are practically self-supporting.

Instruction.

Description of the present state of education in India would here be out of place. It will suffice for present purposes to sketch briefly the outlines of the main advance made since 1880. Some particulars have been given in a preceding page of the results achieved before that date. In 1882 a commission of very carefully selected and competent members was nominated to inquire into and report upon the working of the system in force, whether in primary, secondary, or higher education. It presented, as its report, in the following year a most exhaustive and valuable document, to which the reader must be referred who wishes more thoroughly to acquaint himself with the details of Indian education. Educational institutions in

Educational progress.

India are of two classes. First there are those which conform to the standards prescribed by the department of public instruction or the university, and of which the pupils are examined by one or the other. These are called public institutions, but may be under either public or private management, the latter being mostly known as "aided" schools. These are supported largely by grants in aid from the Government. The second class of institution consists of those which do not fulfil the above conditions, and are called private. The grades of education are found in primary and secondary schools, and in colleges. In the former, reading and writing are taught, and such elementary knowledge as may enable a peasant to look after his own interests. Secondary schools are divided into English and vernacular, the former being those in which the teaching of English occupies a more prominent part. In colleges, the students are those who, having passed the matriculation examination of a university, are reading for the further examinations required for a degree.

The statistics of educational progress are given in the preceding article, and they show that the number of pupils in the colleges and of each class of schools is increasing steadily. Of a direct state expenditure in 1896–97 of £1,198,564 on institutions, 68·5 per cent. was devoted to institutions under public management, and 31·5 per cent. to "aided" institutions, under which class falls the great and important section of missionary schools. The average cost of educating each student was, in the arts Government colleges in 1896–97, Rs.160·3; in professional colleges it reached the highest figure, Rs.196·4. Each educated student in the arts college costs the state Rs.269·9.

Western education at the most has as yet touched little more than the fringe of Indian life. But the crying defect of education in India is the failure to find means of extending education to girls. Only 402,158 girls were under instruction in 1896–97, whether in public or private institutions, forming 2·34 of the percentage of school age. Practically, woman in India is wholly uninfluenced by Western education. Mothers, wives, or daughters at no time of their existence come under its influence. Whether from a social or political point of view this is lamentable, and the consequences are far-reaching and injurious. The influence of women in India is very considerable, and it is to be feared that it is exerted consistently in a direction opposed to the ethical or educational standards set up in English teaching institutions. But the position of woman in the East, and the strictness with which, after her earlier years, she is guarded from contact with all but the nearest members of her family, oppose barriers which are at present impassable. Madras and Bengal show the largest number of girl students (116,747 and 113,767), followed by Bombay (82,163). Upper India contributes comparatively few. Thus in the North-West Provinces and Oudh, ·46 per cent. only of girls of school-going age were under instruction in 1896–97. Even of the small total of 402,158 girls under instruction in all India, a considerable number were native Christians, who are outside the pale of native social life. Another point which may be observed is the comparative backwardness of Mahommedans in attending British schools. Thus in 1896–97, while the proportion of Mahommedans to the total population was 21·81, the percentage of Mahommedans to Hindus and others in primary schools was 20·16, in secondary schools 14·20, in arts colleges 7·00, in professional colleges 6·67. In special schools, being schools either for training masters or mistresses, or for technical teaching, such as art, law, medicine, surveying, handicrafts, &c., the proportion rose to 25·06. It may, however, be noted that among the most conspicuous examples of successful native effort in public interests in India is the Anglo-Mahommedan College at Aligarh in the North-West Provinces, founded some years ago by the late Sir Sayad Ahmad Khan.

The instruction for the most part in Indian colleges and schools is literary, as distinguished from professional or technical. Till late years there has been little demand for the engineer, while the lawyer or civil servant has always found openings awaiting him. With the growth of railways and other public works the demand for technical education will increase, but as yet there is little provision for it. In the quinquennial review from which the foregoing figures have been taken it is said that it must not be inferred that the experiment of giving a more favourable practical turn to education, which was actively started in India about 1890, has proved altogether barren. Though the results may fall short of the anticipation of the more enthusiastic, they are to be seen everywhere, in the more important positions assigned to such practical subjects as agriculture, mensuration, and sanitary science in primary schools, in the rapid spread of drawing, in the popularity of the science side of the ordinary curriculum in both secondary schools and arts colleges, in the institution of alternative courses of examination, as well as in the steady growth of engineering colleges, in the art institutions, and industrial schools. It is therefore with some surprise that we find that the number of engineering colleges in the five years ending 1896–97 has remained, as compared with the previous quinquennial period, at four, and that though the total number of students has risen, it did not at that date exceed 667. There are in all India but 29 engineering schools, and 1393 scholars. It is greatly to be desired that the attendance in the science side of the arts college should increase, and that technical education should expand. The product of the literary side of the Indian arts college is, on the whole, disappointing, and with the growth of time the type does not improve. It varies somewhat in different parts of India, but, though the type more or less obviously is influenced by local conditions, the main characteristics are everywhere identical. It lacks stability, substance, balance of judgment, a sane estimate of its own acquirements. Memory, imagination, dialectic skill, have been fostered by education, rather than observation, exactness, and patient thought. "The fact is," said Sir Henry Maine, in one of his addresses to the University of Calcutta, "that the educated native mind requires hardening. That culture of the imagination, that tenderness for it which may be necessary in the West, is out of place here; for this is a society in which, for centuries upon centuries, the imagination has run riot, and much of the intellectual weakness, and worse evils which afflict it in this moment, may be traced to imagination having so long usurped the place of reason. What the native mind requires is stricter criteria of truth; and I look for the happiest moral and intellectual results from an increased devotion to those sciences by which no tests of truth are accepted except the most rigid."

In general terms it may perhaps be added that, so far as concerns the masses, to live under British administration, when at its best, is in itself a liberal education. Enlightened codes, justice, equality before the law, social and religious freedom, protection, order, method, moderation in the assessment of fiscal burdens, good and easy means of transport, are no mean lessons in enlightenment to the millions who, till comparatively recent years, have lived in the dark ages of bigoted tyranny and have cowered under violence and misrule.

Great attention was paid by Lord Ripon's Government towards carrying out the recommendations of the famine

commission of 1880 with regard to the extension of railways. A programme was prepared in 1883–84 covering the ensuing six years, but it was not put into practical effect till Lord Dufferin had assumed the reins of government in 1885. It is dealt with later in this article. This programme contemplated the construction of 3837 miles of railway, including lines in progress, at a cost of $27\frac{1}{2}$ millions, to be provided partly by the state through revenue and loans, partly through the agency of companies. A select committee of the House of Commons also sat in 1884 to consider the question of railway extension in India. Its report was favourable to the projects of the Government of India, with the reserve that railway extension should not involve additional taxation. It was decided by the Secretary of State, in compliance with the select committee's suggestion, that the annual Indian Public Works Rupee Loan for all public works, whether railways or irrigation, should be raised in future from the amount hitherto sanctioned —viz., $2\frac{1}{2}$ millions—to $3\frac{1}{2}$ millions. Events beyond the north-western frontier, and the consequent urgency with which military railways were pushed on, caused the programme of work to be from time to time materially modified. But from that date to the present time the extension of the Indian railway system, whether directly by the state or by aided enterprise, whether for commercial, protective, or military lines, has been pursued with vigour. From a date but little anterior to 1884 commenced also the important changes which have been made in the system of guarantee, without which, in one or other form, it is rare to find enterprise willing to embark capital for railway construction in India. The aim of the Indian authorities is now to retain the ownership of railways in the hands of the state, to make over the construction and working of new railways, or the working or further construction of partly developed railways, to construction or working companies; to compass these arrangements with a guarantee of the lowest possible terms, whether in regard to its amount, or the length of period for which it is granted; and to provide for the reversion of the railway to the state, either by annuities, or by direct purchase after a given term of years.

Railways.

A proposed alteration of the Criminal Procedure Code, with the view of conferring criminal jurisdiction over European British subjects upon certain classes of native judicial officers in the interior, caused during 1883 the greatest excitement throughout India. By the Indian Criminal Procedure Code, as amended in 1872, extended jurisdiction over European British subjects was given to judicial officers in the interior, whose powers in such cases had hitherto been practically limited to the trial of certain classes of offences and forcible entries punishable by fine, all more serious offences being disposed of by high courts of committal. Under the code of 1872 all cases which would be adequately punished by three months' imprisonment or one thousand rupees' fine, or both these punishments combined, were made triable by a first-class magistrate; and all cases which could be met by one year's imprisonment or fine (unlimited), or a combination of both, were made punishable by sessions judges, additional sessions judges, and certain assistant sessions judges. But it was provided that the magistrate or judge must always be a justice of the peace, and himself a European British subject. In 1872 it had been proposed to modify the procedure then under revision so far as to secure to native covenanted civil servants, being justices of the peace, jurisdiction over European British subjects. The official members of the Viceroy's legislative council were divided on the point, and the motion was eventually lost by seven votes to five. Ten years later, on the 6th March 1882, a Code of Criminal Procedure was passed. On the 20th March the Lieutenant-Governor of Bengal, Sir Ashley Eden, submitted to the Government a note received by him before the passing of the code from Mr B. L. Gupta, of the Bengal civil service, a native gentleman acting as presidency magistrate in Calcutta, inviting attention to the anomalous position in which the native members of the covenanted service found themselves under the code of 1872. That law limited the jurisdiction over European British subjects in the interior to judicial officers who were themselves European British subjects, although in the Presidency towns native civilians, and indeed native police magistrates of the uncovenanted service, also had such jurisdiction over European British subjects. The lieutenant-governor expressed the opinion that a discussion on the subject could not with prudence be raised at the final reading of the Criminal Procedure Bill, and it was for this reason that he had not brought forward Mr Gupta's letter at an earlier date. But he suggested that the matter should receive full and careful consideration whenever on any future occasion a fitting opportunity occurred. Sir Ashley Eden was favourable to granting to covenanted native civilians, who had attained the jurisdiction of district magistrates or sessions judges, full powers over all classes, whether Europeans or natives, within his jurisdiction. In April 1882 the question was referred by the Government of India to the several local governments and administrations, and in September 1882 the Government addressed the Secretary of State on the subject, proposing to confine the office of justice of the peace, and with it the powers of trying European British subjects, to those persons, whether European or native, who had received a training that might be presumed to guarantee the possession of the necessary qualities. They advised that all district magistrates and sessions judges should be vested with the powers in question in virtue of their office, and by a definite provision in the law. They proposed, further, to empower the local governments outside the Presidency towns of Calcutta, Madras, and Bombay to confer these powers on members (*a*) of the covenanted civil service, (*b*) of the native civil service constituted under certain statutory rules, (*c*) certain of the classes of natives already exercising first-class magisterial powers and judged fit to be entrusted with these further powers. The majority of the Viceroy's council concurred in these recommendations, and a Bill was accordingly introduced on 9th February 1883. Immediately there arose the clamour of opposition. On the 20th of February a public meeting of the European inhabitants of Calcutta was held in the Town Hall, at which a resolution was passed denouncing the principle of the Bill, and pledging the community to oppose its progress. From that time the opposition rapidly gathered strength, and later in the year became violent beyond all precedent. The British community, with rare exceptions, united in opposing the Bill. Meetings were held throughout the country, but mostly in Bengal and Upper India. Remonstrances poured in; both the European and native sections of the community became greatly embittered. The Secretary of State for India, addressing the Government of India in November, expressed his wish that the Bill, as drafted, should be proceeded with. The measure, however, was not again brought before the legislative council in 1883, and throughout December of that year the British community was at fever heat. The Government of India hesitated to press the business to a conclusion; the opposition awaited watchfully the action of the Government.

Criminal procedure.

The Ilbert Bill.

Matters seemed at a deadlock when, on the 4th of January 1884, Mr Ilbert, who as legislative member of council was in charge of the Bill, moved that it be referred to a select committee. But before that date informal negotiations had been opened with a member of the Government through the medium of an unofficial member of the legislative council, and eventually the Bill was referred to a select committee to give effect to the following arrangement:—The Government undertook to agree in select committee to the right being given to European British subjects, when brought for trial before a district magistrate or sessions judge, to claim trial by jury, such as is provided by section 451 of the Criminal Procedure Code, subject to the following conditions: (1) No distinction to be made between European or native district magistrates or sessions judges; (2) the powers of district magistrates under section 446 of the code to be extended to imprisonment for six months or fine of 2000 rupees. The settlement thus arrived at became law without further opposition in January 1884, and remains the law on this subject to the present time. It was mainly objected to the Act as passed that the extension of the jury system in India is a retrograde measure. The compromise arrived at is believed, however, to have been unattended practically by any of the other disadvantages which were at the time urged against it; and it closed, in terms which were acceptable both to the majority of the Viceroy's council and to the public, a controversy which had become intolerable, and from which neither party could find a means of retiring.

From the seed sown in the stormy year 1883 there sprang up a plant possibly of indigenous growth, but carefully matured by friendly British hands, known as the Indian National Congress. The Congress was in some measure a response to an association calling itself the British Defence Association, and purporting to declare with similarly authoritative voice the wishes of European British subjects whom it claimed to represent. It held its first annual meeting in the winter of 1883; and it continues to meet at the close of each year, and to pass, and to publish, resolutions having for their object changes of a more or less sweeping character. Its resolutions are aimed mainly at what is alleged to be the exclusive conduct of affairs by foreigners, at legal and administrative privileges said to be confined to the ruling race, or at restrictions imposed on the free exercise of the rights of debate and public discussion by elected Indian legislative bodies. The so-called Indian Congress, though sedulously and skilfully "boomed" in its earlier years, has never succeeded in getting itself taken seriously, because the strings are admittedly pulled, and very skilfully pulled, by British hands. But the reason has also been that the Congress is representative only in so far as it represents a small section of the educated classes, who are themselves an infinitesimal section of the people; because this section, again, belongs largely to Bengal, which politically carries little weight in India; because the great body of Mahommedans is opposed to it; and because the resolutions it puts forward in no way interpret to the Government those vital emotions and impulses which ordinarily lie dormant in the breasts of the people, but which are rarely with impunity to be neglected. The Congress, in short, is not national, for there is no one nation covering the Indian peninsula. Nor, either in the persons attending it, or in the mode of their election, or in the views they put forward, are the delegates representative of so wide a range of classes as to justify them in any degree whatever in claiming to be the nominees of the public.

The Indian National Congress.

Among other prominent measures of the early years of the eighth decade was the repeal of the Vernacular Press Acts passed by Lord Lytton. In the opinion of Lord Ripon's Government, the Press Acts passed by Lord Lytton (9 and 16 of 1878) constituted a direct departure from the policy with respect to the press in India which had been followed by the Government of India for upwards of forty years. It was the aim of these Acts to restrain the press, which was stated to have been at that time markedly seditious in its tone. They provided that a paper, after having been warned, would be liable to suspension, and they applied not only to publications of a nature to excite disaffection and endanger the public peace, but also to those affecting private persons and public servants. Other objections apart, it was held by Lord Ripon's Government that an invidious exception was thus permitted in favour of the English press; and it was contended that if the Penal Code did not meet such cases, the existing defect in the code might be remedied. Acts 9 and 16 of 1878 were accordingly repealed. Later, in 1898, in consequence of plague riots in Poona, the murder of two British officers in retaliation for alleged insults to native usage and custom in the searching of women's apartments, and of much seditious writing connected therewith in the Bombay press, the Penal and Criminal Procedure Codes were respectively amended by Acts 4 and 5 of 1898, which rendered the law in regard to seditious writing very considerably more stringent.

Press Acts.

From Lord Ripon's tenure of office date also the revival and reorganization, in accordance with the recommendations of the famine commission of 1878, of an agricultural department, whether in the Government of India or in provincial governments. Such a department had already been brought into existence in 1871, but only to be abolished in 1877. Agricultural inquiry, agricultural improvement, and famine relief were the subjects to which the attention of the department, as revived, was especially directed. In all these branches (more especially in the third) the measure has given useful results, and the department has now taken its definite place in the circle of Indian administration. But exhaustive inquiry and minute survey of local requirements throughout the vast area of India must precede any far-searching reforms in its agriculture. Further, there must be both the will and the power among landlords to expend capital in experiments and in improved methods of cultivation. It is only by slow degrees and with the lapse of time that material results can be hoped for in this direction. The relations of landlord and tenant, especially in Bengal, in Oudh, and in the Central Provinces, formed also at this time the subject of legislation. It was not till the tenure of office by Lord Dufferin that the Bengal and Oudh Rent Bills actually became law; but they had been framed and prepared and made almost ready for legislative sanction before his predecessor resigned office. They aimed at securing to the cultivating tenant a more stable interest in his holding, and they modified previous legislation principally in this direction. It was desired to secure tenants of all kinds of classes, in degrees varying with their occupancy rights, against arbitrary eviction or inequitable enhancement of the rents of their holdings. Compensation for improvements and for disturbance was in many cases arranged for. In Bengal, and in a lesser measure in Oudh, the objects aimed at by the legislature met with strenuous and organized opposition. In both provinces the landlord had hitherto enjoyed in a degree unusual in India the power of rack-renting and evicting his tenants. In neither province had he shown solicitude for the tenant by whose labour he so largely profited. Unless coerced by legal provisions, the landlord

The Land question.

in Bengal or the Oudh Talukdhar was little likely to improve the tenants' position to the prejudice, as he conceived, of his own. In India, as elsewhere, there have always been two opposed points of view, viz., the point of view of those who regard the land as the property of the landlord, and the tenant as an intruder and an encumbrance; and the point of view of those who reverse the position, and see in the tenant the party with vested interests in the soil, and in the landlord a useless interloper. The Bengal and Oudh Rent Acts dealt with a vast variety of local tenures and sub-tenures and complicated questions of tenant right in a spirit of equity and moderation. The result has been everywhere beneficial. Speaking in general terms, it may be said that legislation was more favourable to the tenant than to the landlord. The dust of controversy has since settled down, and the new legislation has become the rule of practice. With protection from arbitrary enhancement of rent and with security of improvements, we may more and more expect to see property accumulated, credit grow up, and improvements effected in the system of cultivation. There could have been no greater misfortune to the country than that the numbers of the occupancy class should decrease, and that such tenants should be merged in the crowd of rack-rented tenants at will who, owning no permanent connexion with the land, have no incentive to thrift or to improvement. It was desirable for all parties that measures should be framed to secure the consolidation of occupying rights, the enlargement of the numbers of those who held under secure tenures, and the widening of the limits of that security, together with the protection of the tenant at will in his just rights and the strengthening of his position by any wise or equitable measure. It is indeed probable that too little, not too much, has been accomplished. The landlord, on whom, in compliance with English analogies framed in the time of ignorance as to local tenures and customs, there were conferred proprietary rights of a nature and extent unknown either to Hindu or Mahommedan law or precedent, is still by far the most powerful and the least valuable asset in the Indian agricultural economy. There are in this, as in all other matters, notable exceptions. But, generally speaking, in those provinces where the soil is best cultivated, where its proceeds are most equally distributed, where the villages are most flourishing, where cattle, fodder, and manure most abound, where contentment and a moderate and reasonable prosperity most palpably meet the eye on every side, we may be sure that the cultivator is himself the proprietor of the land he tills, or is protected by law from arbitrary exaction and from unconditional ouster.

Legislative results.

The year 1885 furnishes the high-water mark of peaceful and uninterrupted progress. From that date clouds again began to accumulate around and about the Indian horizon. Before that year was over Great Britain had been nearly plunged into war by a collision between Russian and Afghan troops at Panjdeh, in Central Asia. Over £2,000,000 had been expended in hurried war preparations; commercial and famine railway extension had been arrested, and a large scheme of unremunerative military railways had in part overlaid and superseded it. Then came, almost on the heels of the Panjdeh incident, the outbreak of the Burma war, which in one or other form dragged on for the space of nearly two years. Meanwhile, in view of the approach of Russia in Central Asia, the Government of India had decided to increase the effective strength both of its British and native army, the former by 10,000, the latter by 20,000 men, at an estimated annual increase of little less than 1½ million sterling. Military defence works and measures for more speedy mobilization added largely to prospective military expenditure. Exchange, which had remained for the space of three or four years fairly stationary, again resumed its downward course. A succession of costly frontier wars was entered on; and, as in 1878, before long the attention of the Government was once more diverted from all home questions. Finally, though at a later date, came a recurrence of famine and the appearance in India of the bubonic plague. Such, during the period from 1885 to 1900, was the accumulation of disastrous circumstances, some of which it was not in the power of the Government of India by the exercise of any prudence or wisdom to avert. Following rapidly one on the other, they again obstructed indefinitely that uncertain and hesitating path of progress which is so soon lost or choked by the sudden and tropical growth of tangled troubles in India.

Before, however, all this had finally occurred, one or two measures of importance remain to be noticed, which originated with Lord Dufferin's Government, though they were in their final stage put into execution by his successor. They are marked by the desire to conciliate native opinion, and to provide a field for the due expansion of native ambitions, which had uniformly characterized the administration both of Lord Dufferin and of his predecessor. In October 1886 a strong mixed commission was appointed by the Government of Lord Dufferin to inquire into the system under which natives of India were at that time admitted by statute to the covenanted civil service, or to offices formerly reserved exclusively for members of that service; and also their employment in all branches of the public service connected with the civil administration of the country. The object of the appointment of the commission was, broadly speaking, to devise a scheme which might reasonably be hoped to possess the necessary elements of finality, and to do full justice to the claims of natives of India to higher and more extensive employment in the public service. The commission was presided over by the late Sir Charles Aitchison, at that time Lieutenant-Governor of the Punjab. It included a former chief justice of the High Court of Judicature in Madras, several civilian and native officials of high standing, and well-known English and native non-officials. The commission presented a report at the close of 1887, dealing with all branches of the civil administration. The more important recommendations were those which concerned the admission of natives of India, Eurasians, or European British subjects domiciled in India into the higher grades of civil employment. This was a matter which had at various times come before the Government of India, and had been dealt with by successive statutes in 1861 and 1870. The object of section 6 of the latter statute had been to provide "additional facilities . . . for the employment of natives of India of proved merit and ability in the civil service of her Majesty in India." It empowered the Government of India, with the sanction of the Secretary of State, to make rules for the appointment of natives of India to posts in the civil service, although such natives had not passed the competitive test in England. By native was meant any person born and domiciled in British India, of persons habitually resident in India, and not established there for temporary purposes only. Rules were framed under this statute in 1873 and 1875, and finally in 1878, these latter being the rules in force when the commission met to reconsider the question. Under the rules of 1878 a proportion not exceeding one-fifth of the total numbers of civilians appointed by the Secretary of State to the civil service in any one year were to be natives selected in India by the local

Civil Service reform.

governments, and each such candidate was to be, save in exceptional circumstances, regarded as on probation for two years. The commission found, and no doubt justly, that the existing "statutory system," as it was called, had failed to fulfil expectation, and that it was generally condemned and should be abolished. They went on to record their opinion that, in the present circumstances of the country, the claims of natives of India to higher employment and the admission of competent natives to a due proportion of the posts hitherto reserved for the covenanted civil service, would be best met by reducing the covenanted civil service to a *corps d'élite*, by limiting its numbers to what is necessary to fill the chief administrative posts of the Government and such a number of the smaller appointments as would ensure a complete course of training for junior civilians, and by transferring a corresponding number of appointments to a local service to be recruited in each province of India. They preferred to substitute for the old term, "Covenanted Civil Service of India," the expression, "Imperial Civil Service," and to reduce the number of appointments expressly reserved to that service under the schedule attached to the statute 24–25 Vict. cap. 54. They desired that, even to appointments reserved in the schedule, special nomination might be made under due authority on account of noted merit and ability. The higher appointments thus excluded from the schedule were to be amalgamated gradually with the higher appointments in the executive and judicial departments of the then existing uncovenanted service, being the service subordinate in status to the covenanted civil service, and previously excluded from most of the higher administrative offices. In future this service would be recruited locally under rules to be made by the Government of India, and would be called the "Provincial Civil Service." Below this again would be a "Subordinate Civil Service," disposing of the lower range of executive posts. Rules were prepared for recruitment, raising of salaries, and so on, with which we need not here concern ourselves. The recommendations of the commission, with comparatively unimportant reservations, were accepted by the Government of India and the Secretary of State for India, and are at the present moment in force. They have greatly improved and strengthened the prospects of higher employment to all classes of natives of India, and have for some time to come, it may be reasonably anticipated, set at rest agitation on this point. It is not to be understood that all the higher appointments thus made available to the provincial civil service were at once made over to the members of that service. It could be by degrees only, with promotion and changes among present incumbents, and with a sufficient number of duly qualified provincial civil servants competent to fill such appointments, that the new rules could be fully applied. But in future a very considerable proportion of the higher administrative posts in India will be available to natives of the country; and they can claim them as of right, if qualified by length of service, by ability or by merit, or by the tests prescribed under rules for the time existing.

Another very important innovation, originating with the Government of Lord Dufferin, was carried into effect in 1892–93, to which statutory effect was given by the Indian Councils Act of 1892, having for its object the introduction of the elective system into the nomination of non-official members of the several legislative councils, and greater latitude of inquiry by such members into administrative matters. Hitherto the members of these councils had been nominated by the several Governments, and debate took place only when Bills came up for consideration. No administrative act of the Government could be directly brought under discussion. Certain municipal corporations and local boards are now allowed the right of recommending a member designated by themselves for a seat on the provincial council. Considerable classes of landlords are given the same privilege. In some cases the chamber of commerce and the local university recommend a member. In the Viceroy's legislative council six are in future to be official members, and five are to be appointed on the recommendation of the non-official additional (legislative) members of the councils of Madras, Bombay, Bengal, and of the North-West and Oudh respectively, and by the Calcutta chamber of commerce. The Governor-General is empowered at his discretion to nominate to such of the remaining seats as shall not be filled by officials (the maximum number of seats being sixteen), in such manner as appears to him most suitable with reference to the legislative business to be brought before the council and the due representation of the different classes of the community. It is obvious that the measure is tentative, and that the admission of the elective principle is safeguarded by the most stringent restrictions. Thus the additional members to be designated by elective bodies in any legislative council form a minority of the total maximum number of its members; the rest are directly nominated by the head of the Government. The recommendation of the local elective bodies may be disregarded; everywhere the nominees of the Government form the majority. It must be remembered further that the legislative council meet for purposes of legislation only, and have no power or authority to discuss, except incidentally in the course of debate, matters of policy or administration. But in remodelling the legislative council a further step was taken towards the introduction of a system of debating, permission being given to discuss the annual budget, heretofore allowable only when legislation affecting taxation was before the council; and also, under strict rules, to use the right of interpellation or of asking questions on matters of administration or general interest.

Indian Councils Act.

A measure was introduced by Lord Dufferin's Government which concerns rather the military and political than the internal administration of India, but which cannot be wholly regarded as outside the general scope of Indian affairs. At the time of the Panjdeh difficulty in 1885, when war with Russia seemed imminent, all the leading native princes made offers of pecuniary aid. Their offers were refused, but it was intimated to them at a somewhat later date that if they would place a small military force in each state at the disposal of the British Government, to be commanded by state officers, but drilled, disciplined, and armed under the supervision of British officers and on British lines, the Government would undertake to find the necessary supervising officer, arms, and organization. The offer was universally accepted, and the Imperial State troops, as they are called, amount at present to nearly 18,000, mainly cavalry and infantry, whose efficiency is very highly thought of. They rendered good service in Chitral and Gilgit, in the wars on the north-west frontier, and in China. The total native state troops are said to number, inclusive of this body, about 110,000, largely an ill-armed and ill-disciplined rabble. The Imperial Service troops, therefore, amount to about 16 per cent. of the total number.

Imperial Service troops.

By resolution of the House of Commons a royal commission was asked for to inquire into the opium question; whether, among other matters, the growth of the poppy and the sale of opium should be prohibited in India except for medical purposes; the effect of such prohibition on the

finances; the amount and effect of consumption, in regard to the moral and physical condition of the people; the attitude of the people of India towards prohibition, and their willingness to bear in whole or part the cost of prohibitive measures. A royal commission was accordingly appointed and reported in 1895. It found no evidence of extensive moral or physical degradation from the use of opium. Opium-smoking, it stated, was little practised in India. It was not shown to be necessary, or demanded by the people, that the growth of the poppy and manufacture and sale of opium in British India should be prohibited, except for medical purposes. The people of India would be unwilling to bear the cost of prohibitive measures. One member of the commission dissented from the report, and from the conclusions recorded by the majority. But the result of the inquiry justified the report, and the anti-opium agitation was laid for a further term of years.

Opium question.

The second general census of India was taken in 1891. The population of India, with an area of 1,560,160 square miles, was returned as 287,317,048, being 184 to the square mile. The total urban population numbered 27,251,176, being 9·5 of the total population, and residing in 2035 towns, of which 1401 did not contain as many as 10,000 inhabitants. Of these towns Bombay (821,764) headed the list, Calcutta (741,144) came next; no other town except Madras (452,518) had as many as 450,000 inhabitants. The proportion of sexes was 958 females to 1000 males. Mahommedans formed 20 per cent. of the population, Hindus more than 72 per cent. The third census, taken in 1901, showed a total population of 294,266,701. Calcutta, with its suburbs, had grown to 1,121,664, but Bombay had declined to 770,843, owing to the devastation of the plague. Madras, however, had advanced to 509,397.

Census.

In 1897 Burma was raised to the status of a lieutenant-governorship, and a legislative council was conferred on that province and on the Punjab, such as existed already for the other lieutenant-governorships in Bengal and the North-West Provinces.

Surveys and land revenue settlements are always in progress in one or other of those districts of an Indian province where the land revenue is fixed for a given period, and which are known, therefore, as temporarily settled districts. But a cadastral survey is also for the first time in full progress in the permanently settled districts of Behar, in the lieutenant-governorship of Bengal, having for its object the record of tenant holdings and the settlement of rents. This, when completed, should be of great value. Forestry has been the object of much attention in later years, and is retained by the Central Government mainly under its direct control. We read in the volume exhibiting the moral and material progress and condition of India (1898–99) that "Within the last twenty years forest laws have been enacted for, and forest administration has been placed upon a permanent basis in, every province of India. The superior officers of the forest service have been, for the most part, selected by competition, and have been trained in forestry, either in Germany, or in France, or at Cooper's Hill College. During the year 1893–94 it was decided that 20 per cent. of the 210 superior posts in the forest department should eventually be filled by selected officers, chiefly natives of India, from the subordinate or provincial branch of the department. Some of the subordinate officials are trained at a forest school near Dehra, in the sub-Himalayan country of the North-Western Provinces, and this system of professional training at local centres will be gradually extended. The first object of the forest administration is to select, acquire, and mark off as reserves an area of state forest in every province sufficient to supply the wants of the neighbourhood and the province in respect of timber, firewood, bamboos, canes, and other forest produce, and sufficient also for supplying the foreign demand for such articles as teak timber, sandalwood, and rubber. The reserves are, or will be, surveyed, conserved, and worked on sanctioned plans, designed so as to obtain the largest possible permanent yield in the most economical way. Private rights in the reserves are bought out or compromised. Among the most important measures of conservancy are the exclusion of the yearly fires which used to devastate forests, the maintenance of adequate seed-bearing trees, and the regular reproduction of timber of the more valuable kinds. At the present time the reserves cover an area of more than 80,000 square miles; and they may hereafter be further extended in Madras and Burma, where the work of reservation is as yet incomplete. Outside the reserves are over 30,000 square miles of state forests, some part of which will be eventually brought within the reserve area, and all of which are managed and worked for the benefit of the people, of their cattle, and of the public revenue. The limited areas of private forest are, except where they have been leased to the Government, being gradually exhausted; and as yet few private, and no communal, forests have been successfully brought under conservancy. In every province a very few of the most valuable timber trees are declared to be reserved trees, and can only be felled under special license. Outside the reserves, the country folk are generally allowed to obtain from the state forests timber, bamboos, firewood, and grass for their own use, free of charge; inside the reserves, only persons specially licensed are allowed to extract timber or other produce, on payment of fees. Forest revenue is raised by royalties on, or by the sale of, timber or other produce, and by the issue at specified fees of permits to graze cattle, or to extract for sale timber, firewood, charcoal, bamboos, canes, and other minor forest produce." The net revenue from forests amounted in 1900–1901 to £536,400 sterling (revenue, Rs.19,195,000; expenditure, Rs.11,120,000; excess of receipts, Rs.8,075,000—equivalent in sterling at Rs.15 = £1, £538,300; expenditure in England, £1900; net revenue, £536,400).

Forests.

Of late years much attention has also been given to the improvement of the police force throughout India. Natives of respectable position are usually unwilling to enter the police force, from fear of the risk of finding themselves entangled in some ruinous intrigue, or, at the least, of being exposed to false charges and malicious accusations; from dislike, too, of rubbing shoulders with bad characters, and moving habitually in an atmosphere of dishonesty and disreputableness. Till of late years the pay and advancement of all grades in the police force have been too inconsiderable to preserve the members of the force from temptation. Hence there was no inducement from either side to take police service, and the force has suffered in consequence both in efficiency and in *morale*. In the absence of an intelligent press and of a powerful bar, and in presence of a timid and ignorant public, the police are believed very generally to abuse their opportunities; and although not inefficient in the maintenance of order, they are little to be trusted in the detection of crime. On the other hand, it must be allowed that there has been in this regard a material improvement, dating from inquiries set on foot under Lord Dufferin's *régime*; and that in the police, no less than in other departments, the standard of quality improves with time.

Police.

It has been already said that the scheme for railway extension, which had been considered and matured by Lord Ripon's Government, came finally into operation

under the administration of Lord Dufferin, his successor; and a brief sketch may now be given of the measures then proposed and their practical outcome at the present day. Lord Ripon's Government had proposed in 1883 that there should be completed by the state or under its control, in the space of about five years, a programme having for its object the construction of 3837 miles of railway, including lines in progress, at an estimated cost of $27\frac{1}{2}$ millions. Nearly the whole of the projected mileage was for protection against famine, but about 1500 miles only were regarded as likely to be financially unproductive. For the construction of these lines three agencies were proposed: that of Government itself for about 1915 miles, that of construction and working companies for 437 miles, and that of private companies under limited guarantee for 1484 miles. It was also proposed that certain other railways should be constructed by private enterprise, unaided except by the free grant of land, such lines being of a commercial character, and not mainly needed, as in the case of the mileage above referred to, for protective purposes. It is not necessary to follow here the subsequent changes introduced into the programme by the course of events and by instructions emanating from the India Office. It is sufficient to add that the proposals of the Government of India were in due course submitted to a select committee of the House of Commons, who reported in July 1884. The conclusions laid down by that committee, which principally concern us here, were as follows:—That the evidence in favour of a more rapid extension of railways was conclusive; that all the leading trunk lines, with their principal feeders, should be on the broad gauge; that the amount proposed for expenditure by the Government of India was moderate; that the $2\frac{1}{2}$ millions' limit of annual borrowing fixed in 1879 might safely be enlarged; that a fixed scale of expenditure should be maintained over a considerable term of years; that the bulk of lines should be made self-supporting; that railway extension should not involve fresh taxation. Before, however, effect could be given to the proposals put forward in 1883, as subsequently modified by the Secretary of State, there occurred the incident of Panjdeh. The Government of India in the spring of 1885 found itself on the verge of war with Russia, and the defects in its frontier communications and want of facilities for the transport of troops and stores were urgently pressed upon it by its military advisers. As a limited sum only could be spared from loan funds annually, and as it was to such funds mainly, apart from the famine insurance annual grant, that expenditure professedly unremunerative could be charged, it followed that the programme of construction adopted in 1884 had even at this early date to be reconsidered. Pressure on the finances both in 1885 and in certain subsequent years, whether from war preparations or from financial difficulties more or less connected with the burden of exchange, has from time to time interrupted the execution both of the original and succeeding programmes. But railway extension has been pursued as steadily as circumstances would allow.

Railway extension.

The following statement shows the length of railway actually constructed and open throughout British India and in native states at the date of 31st March 1901:—

Standard Gauge, 5 feet 6 inches.

	Mileage open.	
State Lines worked by Companies—		
East Indian	1836·15	
Bengal Central	125·01	
Bengal-Nagpur	1190·16	
Indian Midland	796·25	
Miscellaneous	365·15	
		4312·72
State Lines worked by the State—		
North-Western	1913·90	
Frontier Section of (Military)	1039·90	
Haidarabad-Shalipulli	58·91	
Oudh and Rohilkhand	950·76	
Eastern Bengal	268·04	
Calcutta Port Commission	8·53	
East Coast	803·25	
		5043·29
Lines constructed by Guaranteed Companies—		
Great Indian Peninsular	1307·00	
Bombay, Baroda, and Central India	460·90	
Madras	844·23	
		2612·13
Lines constructed by Assisted Companies—		
Luckeeserai-Gya	78·83	
Delhi-Umballa-Kalka	162·24	
Tarkessar	22·23	
Southern Punjab	423·72	
Hardwar-Derha	32·05	
Tapti Valley	155·77	
		874·84
Lines owned by Native States and worked by Companies		703·55
Lines owned by Native States and worked by State Railway Agency		122·97
		13,669·50

Metre Gauge, 3 feet $3\frac{3}{8}$ inches.

State Lines worked by Companies—		
Burma	993·29	
Bengal North-Western (including the Tirhoot State Line)	1157·97	
Lucknow-Bareilly	231·17	
Rajputana-Malwa	1674·57	
Palanpur-Deesa	17·28	
Southern Mahratta	1042·04	
Gantakul-Mysore	119·50	
Mysore Section, South Mahratta	296·00	
South Indian	1030·53	
Mayavaram-Mutapet	54·08	
Assam-Bengal	435·45	
		7051·88
State Lines worked by the State—		
Eastern Bengal	565·03	
Cawnpore-Burhwal	79·60	
		644·63
Lines worked by Assisted Companies		347·56
Lines owned by Native States and worked by Companies		381·58
Lines owned and worked by Native States		997·98
		9423·63
Special Gauge		597·50

We have thus a total open for traffic on the 31st of March 1901—

Standard Gauge	13,669·50
Metre Gauge	9,423·63
Special Gauge	597·40
Total	23,690·53

On the same date 3018·03 miles were under construction or sanctioned for construction.

Of the above list, the principal lines commenced and completed since 1884 have been the Bengal-Nagpur (1190 miles open), the Indian Midland (796 miles open), the great majority of the frontier (military) sections of the North-Western (1039 miles), the East Coast Railway (803 miles), the Bezwada-Madras (254 miles), the Delhi-Umballa-Kalka (162 miles), the Southern Punjab (423 miles), in part the Bengal North-Western (about 440 miles), the Lucknow-Bareilly (231), much of the Southern Mahratta (say 440), the Assam-Bengal (435), the Burma railway (in part about 650 miles), in all, 6863 miles. Taking the mileage in 1878 at 8250 miles, we have therefore an increase of 15,440 in twenty-two years, and the average of, say, 700 open miles per annum.

The later famine commission in its report of 1898 recorded its opinion that most of the necessary protective railways had been completed, and that in existing circumstances greater protection from famine would be afforded by the extension of irrigation works than by construction of further protective railways.

It will be seen that 13,669 of a total of 23,690 miles are on the standard gauge. The select committee of the Commons in 1884 had laid it down that all the leading trunk lines, with the principal feeders, should be on this gauge; the metre gauge

being, as a rule, confined to tracts of country where that system was already in successful operation, and to local lines where the traffic is so light that cheapness of construction more than counterbalances the undoubted disadvantages of break of gauge. The state railways completed or under construction in 1880 have been mostly carried out by allotments from the annual rupee loan of $3\frac{1}{2}$ millions, by assistance from the famine grant, and from funds supplied by construction and working companies having some form of limited guarantee. Thus the Indian Midland and Bengal-Nagpur Companies, both of which have constructed and worked state lines, receive interest on the share capital raised by them in sterling at the rate of 4 per cent. per annum and one-fourth of the surplus profits, that is, of the excess of the net earnings over annual interest on the total capital provided. The Burma railway, also a state railway worked and partly constructed by a company, is guaranteed $2\frac{1}{2}$ per cent. per annum on share capital, retaining in addition one-fifth of surplus profits. The Secretary of State guaranteed, however, to the company up to the 30th of June 1901 not less than $\frac{1}{4}$ per cent. per annum on paid-up share capital as its one-fifth share, thus making the total guarantee up to that date $2\frac{3}{4}$. In all cases there is reserved to the Secretary of State the right to terminate the contract by a given date and on specified terms. It is not necessary further to describe the terms of guarantee given in the case of other less important railways, but it may in general terms be added that the financial conditions imposed on working and construction companies have become progressively less favourable to the companies. In the case of the Bengal and North-Western, no guarantee of interest having been given by the Secretary of State, all net earnings belong to the company. The Rohilkhand and Kumaon Railway also receives no formal guarantee, except during construction; but on the opening of the line an annual subsidy was granted for a period of twelve years from registration of the company, and a fixed sum for carriage of mails throughout the term of contract.

All capital raised from time to time by guaranteed companies is paid into the hands of the Secretary of State, who pays the guaranteed rate of interest on such deposits, which, however, is a first charge on the net earnings of the open line. The Secretary of State annually reallots to each company from the funds deposited a sum based on its requirements for construction of main and feeder lines, as determined, not by itself, but by a commission of officials sitting in India *en permanence*, by which quinquennial forecasts are made, for each guaranteed railway, of the works to be annually carried out. Thus the guaranteed or assisted companies are financially in the position of departments of the state administration rather than of quasi-independent bodies. In ordinary times no great inconvenience may result from this procedure. But in times of financial stress, such as not infrequently occur in India, the deposits of the companies may be partly needed for the cash requirements of the Secretary of State; and construction is delayed until it is found convenient to replace at the companies' disposal sums which may be urgently required for their needs. Their progress is therefore regulated, not so much by their own financial position, as by the requirements of the Government of India. These vary with the seasons, with war or peace, with a hundred disturbing forces, so that the guaranteed railways are sometimes allowed the use of their own funds, and sometimes are denied it, and their development is liable to be constantly arrested. Only in the case of the East Indian Railway have independent powers of borrowing been given by statute. A Government director, nominated by the India Office, attends each London board's sitting of a guaranteed company, and the Secretary of State is kept informed of the progress of its affairs.

The financial results to the state of working Indian railways, according to the estimates for the financial year 1899–1900, were as follows in conventional sterling:—

Losses.	£	Gains.	£
Guaranteed railways	733,900	State railways, commercial	52,600
State railways—			
Military state lines	664,600	State lines, worked by companies	2,288,600
Leased to companies	629,500		
State railways commercial unopen	82,800		
	2,110,800		2,341,200
Add charges debited to land, supervision, and miscellaneous	243,100	Add total Loss	12,700
	2,353,900		2,353,900

The total loss to the state, therefore, was apparently £12,700 on the year's working. But of the charges a considerable sum was due to annuities paid in England, comprising a large contribution for sinking funds for redemption of capital. Of the loss of £2,110,800 in 1898–99, the sum of £664,600, it will be observed, is due to military railways. The loss on the three great "guaranteed" railways is £733,900. The latter source of loss will be lessened as the railways in due course are successively bought up by the state.

Including unfinished lines, the total capital expenditure in all India, from the commencement of railway construction up to 1st December 1899, amounted to 302 crore of rupees (the crore being a million sterling at 10 rupees = £1):—

Standard Gauge.	Metre Gauge.	Special Gauge	Unclassified Expenditure	Total.
220·43	78·94	2·09	0·82	302·28

"The policy," says the royal commission on the administration of the expenditure of India (1900), "under which capital and expenditure amounting to Rx.288,000,000 have been incurred" (this was up to 1898–99 only), "must give opportunity for wide differences of opinion. Some may think that progress has been too fast, some that it has been too slow. There may be legitimate questions as to the manner in which money for these great works has been raised, or as to the amount of outlay on working expenses. There is no necessity for us to enter into these questions. We deal with the facts as they are, and on these facts we think that the Indian taxpayer of the present obtains the benefit of a vast railway system at a comparatively light cost; that the fall in exchange has subjected the financial result of the Government railway policy to very severe trial; that if the loss on purely military lines were transferred to military expenditure, and if the charge of famine protective lines and of lines under construction were eliminated, there would be no charge on the taxpayer—in other words, that the true commercial lines pay their way; and that there is a fair prospect with improved exchange that the charge on the taxpayer will, even on the account as at present presented, entirely disappear. If a fair and constant surplus should hereafter be realized, it will be reasonable subject for consideration whether larger sums might not with advantage be devoted to improvement of the lines, but we quite understand that the Indian Government make it an object in the first instance, and within reasonable limitations, to relieve the taxpayer of any charge in respect of railway administration."

Results of the railway policy on finance.

It would be sanguine to look for a fair or constant surplus, since much remains yet to be done in Indian railway construction of a more or less unproductive nature. The profit on commercial lines will very probably be neutralized for years to come by calls for further protective and military railways which may be to-day unforeseen, but which, if experience should guide us, will to-morrow be declared to be indispensable. That commercial lines, if wisely selected, will yield a fair profit admits of little question. But, in respect of the taxpayer, state railway expenditure must be taken as a whole. There is little practical use in contending that if certain conditions ceased to exist results would prove more favourable, unless there are good grounds for anticipating a change in such conditions. As a matter of fact, the charge for railways has for long years weighed heavily on Indian finance. The gain to India may, notwithstanding, have been greater than the burden of the charge. This is matter of opinion. But to meet the difficulty by a series of assumptions such as those above quoted, viz., that if exchange had been more favourable, or if frontier lines had been charged to military expenditure, or if protective lines had been separately shown, the net profit on commercial lines would have been greater, will not in any way assist the taxpayer. If another method of bookkeeping had been adopted the burden would have been shifted, but not lightened. The deficit would still have to be met, and the charge on the taxpayer would remain the same. Reckoning from 1858–59

to the end of 1899, the total loss to the state on the railway account has been £57,811,487, which, in general terms, may be looked on as the price at which its railway experience and the indirect advantages resulting from the construction of railways have been acquired by the Government of India.

In 1896 the Government of India drew up and published the terms on which it was prepared to consider offers for the construction by the agency of private companies of branch lines, ordinarily not exceeding 100 miles in length, forming feeders either to state lines worked by the state or to railways worked by companies. It is too early yet to be assured that the terms so offered will lead to any considerable extension of feeder lines.

Irrigation has been dealt with in another article. The Indian service, to its credit, has furnished a school of irrigation engineers which has of late years applied to Egypt its resources and experience, and which apparently is destined to repeat in that country and in the Sudan its former triumphs in the Gangetic valley, in Madras and Mysore, and in the arid Punjab plains.

The practical working of the famine grant from 1880–81 to 1899–1900, under the various heads of famine relief, railway and canal construction, and reduction of debt, has been as follows. Nearly £29,000,000 has been distributed from the current revenues which furnish the grant, under the following heads:—

Famine Relief.	Construction of Protective Irrigation Works.	Construction of Protective Railways	Reduction and Avoidance of Debt.	Total.
7,776,097	1,941,688	12,853,885	6,353,799	28,925,469

As the protective railway mileage contemplated by the Government has been practically completed, the famine grant would seem to have done its work. The special taxation devoted to it might be thought therefore to be no longer justifiable. But in the financial statement for 1900–1901 the maintenance of the grant was thus explained:—"The programme of purely protective railway works has been practically exhausted, and that of irrigation works has been much reduced of late years, and, though the latter may be capable of some expansion, the expenditure on these works will not be large, while the amount required to cover the loss on the Indian Midland and Bengal–Nagpur railways, which it was specially decided to charge to the grant some years ago, will not usually exceed Rs.30,00,000. There will therefore, now that the grant is relieved from charges for such railways as the East Coast and South Indian, be a large balance in normal years when there is no direct expenditure on famine, a balance likely to increase as the loss on the Indian Midland and the Bengal–Nagpur lines diminishes. It has hitherto been the practice to show this unappropriated balance under the heading of reduction of debt, a heading which has puzzled people who ask how there can be a reduction of debt in a year when fresh loans are raised or in which no debt is discharged? We hope to clear up the difficulty by altering this heading to that of reduction or avoidance of debt. It may lead people to grasp more readily what is actually happening in a normal year. In such a year the Indian Government raises more revenue than it actually requires to meet its ordinary charges against revenue by the amount of the unappropriated balance of the famine grant. This amount is devoted to expenditure on public works which would otherwise have to be provided by loan. For instance, in a normal year, in which ordinary revenue and expenditure balanced, the Government of India, instead of raising a loan of three crores for public works, would be able to reduce the three crores by the unappropriated balance, say a crore, of the famine grant. Less debt would be incurred in normal years, and the credit of the Government would be higher when it was compelled to borrow."

Sanitation.

Sanitation makes comparatively little progress in India. Difficulties caused by climate, by long periods of drought succeeded by torrential rains, by the great heat, the vast, flat alluvial plains, the overcrowded population and their habits—above all, by the need of very large sums and the difficulty of finding even a fraction of them—interpose an insuperable barrier to rapid progress. Still something is annually done. The Presidency towns have a good supply of water, and are tolerably drained. The large cities in the interior, notably in the North-West Provinces and Oudh, have supplied themselves with waterworks and pumping machinery, which ensure an ample supply. Situated, as the majority of these cities are, on the banks of great rivers, the business of providing themselves with a good supply of suitable water has proved comparatively simple. But in all of them drainage is still in its infancy, and the system in force can be described as little more than makeshift or elementary. In the rural villages some slight attempts have been made to grapple with the difficulties at least of a good water supply. Here again similar obstacles present themselves. Nothing could be more unjust than to charge the provincial governments with indifference to the subject. Sanitary officers and officials in every province alike labour to introduce a better order. But for the reasons given, the circumstances and conditions are not such as to justify the hope that they will achieve any very rapid or signal success. Meanwhile, a fresh factor has been introduced into the problem. The appearance of plague in India has placed sanitary reform, once and for all, in the foreground of the country's needs.

In every large or important town are one or more hospitals supported partly by the provincial governments, partly from private subscriptions, and served by the Government medical staff. In the rural population dispensaries are established, and are maintained partly by private subscriptions, partly by grants in aid. In 1898–99 their number and distribution were as follows:—

Province.	Number of Dispensaries.	Number of Dispensaries, Square Miles.		Number of Patients per Dispensary.
		Square Miles in Dispensary.	Population in Dispensary.	
Bengal	487	311	145,103	5,913
Bombay	337	371	56,086	5,074
Madras	496	280	71,835	8,161
Central Provinces	121	591	78,524	12,499
Punjab	265	417	78,720	12,232
North-West Provinces	331	324	141,707	10,983
Burma	99	1731	76,820	7,620

Mention may here be made of the medical aid and relief for women, the building of women's hospitals, and the arrangements for the education and training of lady doctors and female nurses, which have been inaugurated since 1885 under the auspices of the Countess of Dufferin's fund, and embodied in the National Association for supplying female medical aid to the women of India. The fund owes its origin to the humanity, energy, and wisdom of the Marchioness (at that time the Countess) of Dufferin.

In 1900 there were twelve branches working under the central committees. There were 235 hospitals, wards, and dispensaries of various kinds for the treatment of women by women. In the above hospitals or in their

homes 1,519,990 women and children received medical relief during the year under review. Thirty-three lady doctors of the first grade, 73 assistant surgeons, and 271 hospital assistants and practitioners of the third grade were employed in zenana hospitals and institutions. Three hundred and fifty-four women were studying medicine in the various medical colleges and schools in India. This association, and the institutions supported by it, are of invaluable service to the women of India. Large sums have been subscribed, mainly in India, and are invested in its behalf, so that it is self-supporting. Not only has it proved of incalculable benefit to women, especially of the classes who are precluded from attending public hospitals and are now enabled to receive female medical advice and treatment at their own homes, but it has liberated for the use of males a large number of wards in the general hospitals which had been heretofore assigned to women.

In 1896–97 India was revisited by famine, and the bubonic plague, which has since been constantly present in more or less virulence, first showed itself. The famine of 1896–97 extended over some 310,000 square miles, with a population in round figures of 35 millions, and was most severe in the North-West Provinces, in Oudh, and in the Central Provinces. It lasted from about September 1896 till October 1897. At the worst time the total numbers on relief were 4,609,000. The death-rate per mille in the famine districts rose from 32·80, the normal death-rate, to 39·54. The total Government expenditure and loss to Government is estimated at about 17¼ millions. A commission was appointed at the close of 1897 to report on the working of the Famine Code, and on the sufficiency of measures taken to combat famine. It reported in the ensuing year. The bubonic plague was first identified in Bombay city towards the end of September 1896, and afterwards spread to the Deccan, the western districts of the Nizam's Dominions, the Punjab, the North-West Provinces, and Bengal. From September 1896 to the end of April 1900 the reported plague deaths in the whole of the Bombay country were 299,844, and 58,841 for other parts of India, while the actual plague deaths were probably considerably more. The Bombay and Karachi export trade has been seriously affected by the plague. Grievous as is the mortality from plague, a total even, say, of 475,000 for a period of nearly four years is less than the difference between the highest cholera mortality (727,493 in 1892) and the lowest (152,703 in 1898) in British India in a single year. In November 1898 a mixed commission, consisting of three medical experts from the United Kingdom and two Indian officials, was appointed to investigate the plague question in India. Their report favoured inoculation, opposed the enforced removal of plague patients to hospitals, which had proved the cause of much rioting and violence; and made other suggestions of which the sense generally was unfavourable to segregation, or evacuation of infected places except in villages and small towns, and to cordons, and the search of railway passengers. Again, in 1900, famine appeared and proved itself most severe in Bombay, Rajputana, and the Central Provinces. The tract concerned contained a population of 85 millions, of whom perhaps 52 millions were severely affected. Of the 85 millions, 43¼ millions were inhabitants of native states, and 41¾ millions were in British territory. At the close of May 1900, 5,802,000 were in receipt of relief. After the rainy season of 1900 distress gradually abated. The expenditure necessary to cope with the famine was estimated at £13,000,000 (at 15 rupees to the £1). The death of adults from starvation is stated to have been of rare occurrence, and due entirely to the apathy of the people themselves.

Finance and plague.

Attention may now be turned to the course of finance, and to the disturbing influences to which, successively or simultaneously, it was submitted from 1885 to 1900. In 1884, while the Government of India was engaged in the consideration of the projected extension of its railway system, an agreement had been arrived at between her Majesty's Government and the Government of Russia for the employment of a joint commission to delimit the frontier between the Russian dominions in Central Asia and Northern Afghanistan. Towards the close of that year the respective commissioners had met and commenced operations. In the spring of the ensuing year a collision took place between Russian and Afghan troops owing to claims put forward on either side to the occupation of the district and village of Panjdeh, lying within the disputed frontier zone. The work of the commission was temporarily suspended, and for some weeks it appeared probable that war would be declared between Great Britain and Russia. The difficulty was, however, arranged, and delimitation of the entire frontier ultimately effected. But the incident led to steps being taken by the Government of Lord Dufferin, with the view of strengthening the military system of India, which have had far-reaching effects on Indian finance. In August 1885 the Government of India (two members of the Viceroy's council dissenting) proposed an increase in the strength of the army in India, amounting to 10,657 British troops and 16,540 to the native army, with other changes, of which the result would be an estimated increased annual charge of about £1,500,000. These proposals were approved by the Secretary of State, and immediate measures were taken to carry them into effect. Projects for strengthening the defences of India, whether on its north-western frontier or on its seaboard, were also taken into prompt consideration. A scheme of frontier railways was elaborated, and a vigorous commencement was at once made in the direction of the Khojak tunnel, in the great Amran range, and on the approaches to Kandahar from the British side, and from the direction of Quetta. While clouds were gathering over the finances and internal progress of the country in this direction, a somewhat sudden and abrupt termination to a dispute between the Government of India and King Thibaw of Burma was brought about by the outbreak of war with Burma in 1885. For the causes of the dispute with the Government of Burma, and a description of the military operations which ensued after the deposition of King Thibaw before the country was finally pacified, the reader may be referred to the article on BURMA. The financial results only will be noted in the course of this article. For the present, it will be sufficient to say that the first-fruits of political complications and military measures, combined with a further fall in the exchange, was the repeal of the then existing licence tax and the reimposition of an income tax in March 1886; this being the first of a succession of fiscal measures by which in the course of the ensuing eight years the work of Sir John Strachey and Sir Evelyn Baring was gradually but completely undone, and the country again subjected to methods of taxation which it had been the object of their reforms finally to remove. The principal provisions of the income tax, as reimposed, were and are (for the tax has remained in force since its enactment in 1886) that incomes should be estimated under one or other of certain classified grades; that incomes amounting to Rs.2000 per annum should pay 5 pie in the rupee (2·6 per cent.), and if less than Rs.2000, 4 pie in the rupee (about 2 per cent.). All

Financial changes.

incomes of less than Rs.500 in the year are exempted, and the tax is not levied on agricultural profits, or incomes, or on military salaries of less than Rs.500 *per mensem.* The tax produced in the first year of its assessment £1,369,000, and has since risen in round figures to £1,800,000.

In introducing the Income Tax Bill in 1886, the financial member of the council had said: "With the present year our brief spell of happiness has come to an end. The fat kine have passed on, and the lean kine have come in. . . . Three uninterrupted years of prosperity is a godsend in the annals of every nation; in our Indian annals it is extraordinarily good fortune." In 1885–86 the fall in exchange which had been temporarily suspended recommenced, and the Burma war broke out. In 1886 India definitely entered into the region of depression and storm from war, famine, pestilence, and exchange, from which in 1902 she had not yet emerged.

The following paragraphs show the accumulation of difficulties during the years 1896 to 1900, and the measures taken to meet them:—

In 1881–82 the net sterling expenditure had amounted to	£14,029,700
The average rate at which remittances were effected was	d.19·815
The total charge for exchange was . .	£2,985,500
In 1886 the net sterling expenditure was .	£14,172,300
The average rate at which remittances were effected was	d.17·441
The total charge for exchange was . .	£5,631,800

An increase of £2,646,300 had thus been charged to the Indian revenues in five years, mainly by a fall of 2½d. in the exchange, as the net sterling expenditure had but little increased.

The following table shows the progressive charge on account of exchange from 1881–82 to 1899–1900, the last two years being estimates:—

Year.	Net Sterling Expenditure	Average Rate.	Exchange on Net Sterling Expenditure.	Total Charge for Exchange.
	£	d.	£	£
1881–82	14,029,700	19·895	2,894,300	2,985,500
1882–83	13,692,200	19·525	3,140,900	3,205,500
1883–84	14,764,100	19·536	3,373,700	3,358,900
1884–85	13,844,000	19·308	3,364,000	3,535,900
1885–86	13,755,700	18·294	4,329,900	4,289,800
1886–87	14,172,300	17·441	5,329,700	5,631,800
1887–88	15,128,000	16·898	6,356,900	6,049,300
1888–89	14,652,600	16·379	6,817,600	6,383,100
1889–90	14,513,200	16·566	6,512,800	6,758,000
1890–91	15,176,900	18·090	4,959,000	5,468,000
1891–92	15,716,800	16·733	6,825,200	7,200,900
1892–93	16,114,300	14·985	9,694,800	10,287,300
1893–94	15,633,400	14·547	10,159,600	11,523,400
1894–95	15,504,000	13·101	12,899,100	15,045,000
1895–96	15,380,000	13·638	11,685,200	13,990,900
1896–97	15,468,700	14·451	10,222,200	12,116,400
1897–98	16,004,600	15·354	9,012,500	10,562,300
1898–99	16,091,200	16·00	8,045,600	9,253,600
1899-1900	16,324,500	15·750	8,550,900	9,686,500

The reason of the difference between columns 4 and 5 is that in the latter are included additional payments to European soldiers on account of exchange from 1883–84 onwards, and exchange compensation to officers from 1893–94. It will be seen that from 1881–82 to 1884–85 exchange remained fairly stationary. In 1885–86 there was a fall of more than 1d., another fall in 1886–87, and again in 1887–88, when a pause ensued till 1890-91, in which year there was a marked temporary rise, due to legislation in America. In 1891–92 the exchange again fell, and continued to fall till 1894–95, when it reached its lowest point, viz., 13·101, the total charge for exchange amounting in that year to £15,045,000. In 1893 the Indian mints were closed to the coining of silver, with little immediate effect on exchange. In 1898 a gold standard was adopted, the sovereign was made legal tender in India, and interchangeable at the rate of one sovereign for fifteen rupees. From that time the exchange has remained comparatively steady.

Taking the average net expenditure of the years 1883–85, and contrasting it with 1895–96, the Indian expenditure commission found that the increase in the later period amounted to 12½ millions, thus:—

	India.	England.	Exchange.	Total.
	£	£	£	£
Defence and Foreign Affairs .	5,747,000	-201,000	4,240,000	9,786,000
Civil Charges .	1,637,000	238,000	1,415,000	3,290,000
Interest on Debt .	-2,073,000	112,000	1,393,000	-568,000[1]
Railways and Irrigation . . .	-4,371,000	922,000	3,341,000	-108,000
	940,000	1,071,000	10,389,000	12,400,000

[1] In 1888, 53½ millions of sterling 4 per cent. debt were converted into 3½ stock, securing a reduction of £266,000 annually. In 1894, 90 millions of rupee 4 per cent. debt was similarly converted, causing a saving of Rx.450,000.

To meet the increased expenditure it had therefore become necessary that the resources of the Indian treasury should be increased by about £12,000,000. This was effected over the term of years 1886 to 1894 as follows (the figures taken here are those furnished by the Indian expenditure commission report):—

Income Tax .	. £1,319,000	April 1886, licence duty repealed and income tax imposed.
Salt Tax .	. 1,500,000	Duty raised in 1888 from 2 to 2/8 per maund.
Customs .	. 2,750,000	In 1894 the 5 per cent. *ad valorem* duties of customs repealed in 1882 were reimposed, cotton goods being exempted, and a further import duty was put on petroleum. In 1895 the 5 per cent. import duty was extended to cotton, and an excise duty was imposed on Indian cotton mills.
Excise . . .	. 1,000,000	Estimated by Indian expenditure commission to be due to increase of taxation.
Patwári (village accountant) cess .	242,000	Repealed in 1882 by Sir E. Baring, but reimposed in 1888.
	£6,811,000	

Normal growth of net revenue .	£5,800,000
Add new taxation .	6,811,000
Total .	£12,611,000

Thus the taxation on salt and imports, which was abolished by Sir John Strachey and Sir E. Baring, has now been reimposed, and remains in force. Other taxation has been added; apart from the taxes above enumerated, countervailing duties were in 1899 imposed on bounty-fed beet sugar. The normal growth of revenue during the period of comparison (£5,800,000) was absorbed by the increase of expenditure under "defence and foreign affairs"—in other words, military and political—in India, and apart from the charge for exchange.

Of the total increased expenditure of £12,400,000, not less than £9,786,000, inclusive of exchange, was due to military and political expenditure. Inclusive of exchange, but exclusive of military works and minor charges, the net army expenditure is stated by the Indian expenditure commission to have risen from £16,147,000 in 1884–85, which was the last year before the increase in the army and the resumption of military activity, to £23,202,000 in 1896–97, an increase of 44 per cent. But this was only the increased charge on account of military expenditure of a permanent character. From 1886 onwards, with but brief intervals, there has occurred a series of wars and frontier expeditions, some of which, such as the Burmese war of 1886–87, were extremely costly. The preparation for possible war with Russia amounted, in 1885–86, to over two millions. The war with Burma cost, in the three years 1885–86 to 1887–88, over four millions. Minor expeditions, from 1887–88 to 1895–96, cost over five millions. The Tirah campaign of 1897–98 (though this was of a date later than 1896-97, the last year of the commission's comparison) cost over three millions —say in all, in round numbers, fourteen millions in eleven years. Increase in military and political expenditure, and increased loss by exchange (itself partly caused by the increase in military expenditure), are the causes which have led to the reimposition of the customs duties on cotton and other goods, and to the raising of the salt duties. The increased loss by exchange has been checked by closing the Indian mints to the coinage of silver and by the adoption of a gold standard. The further increase of military and political expenditure must largely depend on the policy

pursued by the Government of India with regard to the tribes on its north-western frontier, and to the course of events hereafter in Afghanistan.

From 1880-81 to 1899-1900 the following have been the years respectively of surplus and deficit, and the chief causes of increase or decrease in the revenues are indicated in the final column :—

Year.	Surplus.	Deficit.	Remarks.
	£	£	
1880-81	...	4,044,000	Afghan war.
1881-82	2,582,727	...	Financial effect of Sir John Strachey's reforms.
1882-83	706,633	...	Customs duties abolished, Salt duty lowered.
1883-84	1,879,707		
1884-85	...	386,446	
1885-86	...	2,891,726	Russian war scare; commencement of Burma war; fresh fall in exchange.
1886-87	178,427	...	Income tax imposed, and Burma war.
1887-88	...	2,028,832	Burma war and civil charges; continuous fall in exchange.
1888-89	37,018	...	Salt duty raised.
1889-90	2,612,033		
1890-91	3,688,171	...	American silver legislation.
1891-92	467,525		
1892-93	...	833,410	Heavy fall in exchange.
1893-94	...	1,546,998	Exchange compensation first granted to officers.
1894-95	693,110	...	Customs and cotton duties reimposed during year.
1895-96	1,533,098		
1896-97	...	1,705,022	War and famine.
1897-98	...	5,359,211	War.
1898-99	3,961,310	...	Gold standard adopted.
1899-1900	4,059,400		
Total .	22,399,159	18,795,645	

In 1882-83, the year in which the customs and salt duties were removed, the gross revenue was £70,125,231, and the gross expenditure was £69,418,598. In 1898-99, the year in which the finances were restored to order by the adoption of a gold standard, the gross revenue was £101,426,693, the gross expenditure was £97,465,383. From 1881-82 to 1899-1900, £6,350,000 are estimated as having been spent from the famine insurance grant—in other words, from current revenue—in reduction or avoidance of debt. On the other hand, in comparing surplus and deficit, it must be remembered that between 1886 and 1894 taxation yielding annually since the latter date £6,800,000 has been at different times reimposed. If we remove on the one hand the deficit of 1880-81, as due to the Afghan war, and on the other the surplus of 1898-99 and 1899-1900, as due to improvement in exchange following on the adoption of a gold standard, we have for the remaining seventeen years practically equilibrium. But this equilibrium is entirely due to the taxation imposed since 1886. It is probable that the necessity of accumulating a large gold reserve will compel the Government of India to maintain for a time much of this taxation which might otherwise have come under reduction.

The position therefore is this: The total charge on account of exchange remains, and is likely to remain, steady unless the Secretary of State increases his drawings. We may on the present revenues reckon on a surplus of revenue over expenditure of not less than four millions, in the absence of war and famine. But there remain on the taxation roll import duties and enhanced salt duties, yielding collectively about four millions annually, which have been unreservedly condemned by the highest financial authorities in India, as permanent sources of revenue, and which were removed in 1878 and subsequent years. The surplus of revenue over expenditure, viz., £4,000,000, and the proceeds of these taxes balance one another, leaving the finances in bare equilibrium, with the prospect, on the one hand, of an annual addition say of £500,000 from normal expansion of revenue, against which, on the other hand, will be debited corresponding annual growth in expenditure.

Reference has been frequently made in these pages to the royal commission on the administration of the expenditure of India. This commission was appointed in 1895 "to inquire into the administration and management of the military and civil expenditure incurred under the authority of the Secretary of State for India in council and of the Government of India, and the apportionment of charges between the Governments of the United Kingdom and of India for purposes in which both are interested." The commission presented in 1900 an exhaustive and very valuable report, dealing, however, with revenue and expenditure up to 1895-96 only, between which date and 1900 there had occurred two famines, two or three very costly frontier expeditions, and the very important currency legislation of 1898, so that by 1900 the course of events had already discounted much of the value of the commission's conclusions. The report, nevertheless, presents an exhaustive study of the financial mechanism of the Indian Government, with a careful, if somewhat favourable, review of the progress of its revenues and expenditure from 1862 to 1895-96. It also deals with the apportionment of charges between England and India in respect of army and naval and certain civil and miscellaneous charges, and recommends grants to the annual amount of £230,000 from the Imperial Government to the Government of India being as follows :—In aid of the charge for the India Office (£50,000), one-half of the military charges for Aden (£108,000), increased contribution to the charge of the Persian mission (£5000), half the cost of transport of troops to and from India (£130,000).

Currency difficulties.

Some account must here be given of the measures successively adopted by the Secretary of State for India for the reform of Indian currency by the closing of the Indian mints and the adoption of a gold standard. In 1892 Indian representatives were sent to the International Monetary Conference at Brussels, which was convened for the consideration of measures for the increased use of silver as money. The Government of India in June 1892 proposed that, should the conference fail to arrive at a satisfactory conclusion, it should at once close its own mints to the free coinage of silver and make arrangements for the introduction of a gold standard. Its proposals were submitted by the Secretary of State to a committee in October 1892, which in May of the ensuing year reported that they could not oppose the proposals of the Government of India as to closing the mints against the free coinage of silver, but recommended that they should be accompanied by an announcement that, though closed to the public, the mints should be used by the Government for the coinage of rupees in exchange for gold at a rate to be then fixed, say 1s. 4d. per rupee, and that at the Government treasury gold would be received in satisfaction of public dues at the same rate. The committee's recommendations having been approved by the Imperial and Indian Governments, an Act was passed on the 26th June 1893 for the closing of the Indian mints to the free coinage of both gold and silver. Arrangements were at the same time made for the receipt of gold at the Indian mints in exchange for rupees at the rate of 16d. per rupee; for the receipt of sovereigns and half-sovereigns in payment of sums due to the Government at the rate of 15 rupees for a sovereign; and for the issue of currency notes in exchange for British gold at the above rates, or for gold bullion at a corresponding rate. Gold, therefore, was not made a legal tender in India in pursuance of these arrangements, though the Government was prepared to receive it in payment of public dues.

The rupee remained by law the only coin in which other than small payments could be made; no legal relation was established between rupee and gold, but the Government of India declared (until further notice) the rate at which rupees could be purchased for gold or bullion. In 1893-94 the average rate per rupee at which council bills and telegraphic transfers were sold in London was 14·547d.; in 1894-95 the exchange fell to 13·101d.; in 1895-96 it was 13·638d.; in 1896-97 it had risen to 14·491d.; and in 1897-98 it reached 15·354d. The effect of closing the mints in 1893 thus first began to make itself distinctly felt in 1896-97.

In 1898 the Government of India made further proposals with the view of keeping the exchange value of the rupee at a steady level of 16d. These proposals were, in their turn, submitted in April of that year to a mixed committee, which reported in July 1899. The recommendations of the committee were :—

(1) That the British sovereign should be made a legal tender and a current coin in India.

(2) That the Indian mints should be thrown open to the unrestricted coinage of gold on terms and conditions such as govern the three Australian branches of the royal mint.

(3) That no legal obligation should be imposed on the Government of India to give gold for rupees, or, in other words, to substitute the former for the latter on demand of the holders.

But though there should not be convertibility on demand, gold should be freely available for foreign remittances whenever the exchange fell below specie point. The Government of India should make its gold available for this purpose, when necessary, under such conditions as the circumstances of the time might render desirable. The exclusive right to coin fresh rupees should remain vested in the Government of India. Though the existing stock of rupees might suffice for some time, regulations would hereafter be needed for providing such addition to the silver currency as might prove necessary.

The fixed permanent relation which the rupee should bear to the sovereign should be 1s. 4d.

Legislative effect was given to these proposals in September 1899, and the currency system of India is at present arranged in conformity with them. The time has not come when the success of the measure adopted can be confidently affirmed, whether as regards the Government or the course of trade. While the experiment is viewed with distrust by the majority of export traders, it has been uncompromisingly condemned by the authority of Sir Robert Giffen. Writing in 1898 to *The Times* (19th May 1898), Sir Robert expressed his belief that the attempt to introduce a gold standard in a poor country like India must fail; that gold to the amount of £90,000,000 at least should be accumulated beforehand; and that the Indian Government could not bear the expense. On the other hand, in his financial statement for 1900–1901, the financial member of council stated that before the beginning of 1899–1900 the Government had added 305 lakhs from the reserve to the volume of silver in circulation in exchange for gold presented to them. During the year 1899–1900 they had added 776 lakhs (a lakh is equal to Rs.100,000) in exchange for gold presented in India, and 225 lakhs in exchange for gold presented in England, a total for the year of 10 crores (1 crore is equal to one million rupees). To enable the Government to make these additions they had coined $1\frac{1}{2}$ crores of new rupees, and had decided on supplementary coinage to the extent of 1 crore, a total of $2\frac{1}{2}$ crores. The position in respect of gold was strong. In India and in London nearly £8,600,000 had been accumulated. £5,000,000 had been set aside for the present as a minimum reserve against eventualities, against the contingency of the Secretary of State's being obliged to restrict or curtail his drawings or to ask the Government of India to ship home gold to enable him to meet his obligations. Gold was coming in in large quantities. There was no appearance of any falling off of the export trade owing to the adoption of a gold standard, or gold currency convertible at 1s. 4d.

The statistics of trade are given elsewhere. Of the three great industries introduced by British capital into India, two are unhappily at the present moment in a state of singular depression, and one is in chronic insecurity. Tea is suffering from the effects of over-production and the placing of inferior teas on the European market. The cotton-spinning industry has been depressed owing to keen competition from China and Japan, and unfavourable seasons for the purchase of cheap cotton. Indigo, though not depressed, is continuously threatened with competition, and possible extinction, by the introduction and perfecting of chemical dyes.

Events on the north-west frontier.

Since 1889 India has suffered from a succession of frontier wars. At the close of the Kabul war in 1880 the British Cabinet decided to withdraw not from Kabul only, but from Kandahar. The policy of the Government of that day is fully stated in the two despatches of the Marquis of Hartington (afterwards Duke of Devonshire), respectively dated 21st May and 11th November 1880 (to be found in the Afghanistan Blue Book, No. 1 of 1881). Events were shaped accordingly; and with the exception chiefly of the Pishin and Sibi districts, and of Quetta, the British retired within their former borders. So matters remained till 1883–84, when the advance of Russia in Central Asia again turned the attention of the Government of India to affairs on and beyond the frontier, and led ultimately to the final abandonment of the policy of observation and reserve, which is known as the Lawrence policy. The control of the frontier was transferred in the latter part of the eighth decade from the Lieutenant-Governor of the Punjab to the Government of India in its foreign department. From that time the policy of non-interference was replaced by increasing activity. From 1885, when war with Russia seemed imminent, there has been more or less (less from 1885 to 1889, and in later years far more) continuous movement along one or other part of the frontier and beyond the British border, indicating the gradual development of a prearranged plan of operations. Between the years 1885–95 there were delimited at various times by joint commissions the Russo-Afghan frontier between the Oxus and Sarakhs on the Persian frontier, the Russo-Afghan frontier from Lake Victoria to the frontier of China, and the Afghan-Indian frontier from the Kunar river to a point in the neighbourhood of the Nawa Kotal. To the westward, after various disagreements and two military expeditions, the territories comprising the Zhob, Barhan, and Bori valleys, occupied by Pathan tribes, were in 1890 finally incorporated in the general system of the Trans-Indus protectorate. About the same time (in 1889) at the other end of the frontier, where it touches China, the post of British resident in Gilgit had been re-established. The result became very shortly apparent. The government of Kashmir having for the time passed under the direct control of the British authorities through the death of the Maharaja in 1889, a council of regency was established under the supreme direction and authority of the British resident in Kashmir. Acting under his instructions, the Council asserted and, with the aid of its troops led by the Resident of Gilgit and by other British officers, re-established its supremacy over the petty states of Hunza and Nagar, in the neighbourhood of Gilgit, which it claimed as feudatories. The former chieftains were deposed, and others, more friendly to the British Government, replaced them. In 1893 the frontiers of Afghanistan and British India were defined by a joint agreement between the two Governments. There followed, on the part of the British authorities, interference in Chitral, which had fallen to India, ending in an expedition in 1895 and the ejection of the local chiefs in favour of candidates amenable to British influence. A more formidable hostile combination, however, awaited the Government of India. By the agreement of 1893 with the Amir most of the Waziri clan, the Bajouris, and the Afridis had been left outside the limits of the Amir's influence and transferred to the British zone. Soon after that date the establishment by the British military authorities of posts within the Waziri country had led to apprehension on the part of the local tribesmen. In 1895 the occupation of points within the Swat territory for the safety of the road from India to Chitral similarly roused the suspicion of the Swatis. The Waziris and Swatis successively rose in arms, in June and July 1897, and their example was followed by the Mohmands. Finally, in August the

powerful Afridi tribe joined the combination and closed the Khyber Pass, which runs through their territory, and which was held by them, on conditions, in trust for the Government of India. This led to the military operations known as the Tirah campaign, which proved very costly both in men and money. It was not till February 1898 that hostilities finally ceased along the border, with a total British loss in all the several engagements with the several tribes of 506 of all ranks killed, 537 dead of disease, 1428 wounded, and 9 missing—in all 2480. By the middle of 1898 British authority had been made paramount throughout the whole belt of territory which stretches between the former British frontier and the frontiers of Russia and Afghanistan, and from the Karakoram Pass to Pishin.

These campaigns on the frontiers occurred at a time of great difficulty, when, owing to increasing loss by exchange, and latterly to famine and plague, the resources of India were subjected to excessive strain. Public attention in the United Kingdom was consequently much engaged upon the whole question of Indian frontier policy; and it was very generally felt that of late years the Government of India had been permitted to embark in a course of aggression and adventure on its frontier for which no adequate necessity could be shown to have existed. From 1890 to 1898 many millions were spent in asserting British supremacy over the territories brought within what is sometimes known as its "political frontier." The active exercise of such supremacy still remains, however, in abeyance. The tribes to be dealt with are noted for their lawlessness, treachery, and violence, even among Afghan tribes. It is to be hoped that they may gradually allow themselves to be peacefully incorporated within the system of British India. However this may be, considerable increase of expenditure must be anticipated as a result of the new departure. At the best, roads must be constructed, military levies must be raised and paid, and some efforts must be encouraged to introduce among the tribesmen the elementary institutions of civilization.

Other smaller frontier expeditions were undertaken by the Government of India in the Hazara country on the north-west frontier in 1888–89 and 1891–92, in Sikkim in 1888–89, in Miranzai in 1891–92, and in Manipur in 1891–92. But these entailed comparatively little expenditure (about one million in all); they were isolated and apart from any general plan of frontier policy, and have been productive of no great increase of permanent expenditure.

The main incidents of the course of events within British India since 1880 have now been briefly reviewed. Much of interest has of necessity been omitted. But it is hoped that a general idea may have been conveyed of their tendency and progress. It has been seen that the state barometer, which stood at its highest in 1881 and 1882, began again to fall in 1885, and passing rapidly from that year through periods of violent disturbance, remained at its lowest from 1892 to 1899. Since 1899 there are signs of more settled conditions, and it may be that before long India will have returned to the brighter promise of 1881. If war, famine, and exchange no longer deplete the treasury, more funds may be forthcoming from the proceeds of taxation to meet the pressing civil needs of the taxpayer, such as sanitation, education, better remuneration to subordinate officials, a higher-paid and better-conducted police force, good feeder roads—in short, the many internal requirements for which little consideration has been available in recent years of stress. The promotion of the internal prosperity of India is, by common consent of all parties, the main obligation which rests on its Government; and to secure this it is above all necessary that the administration should have the leisure, the will, and the means to provide the conditions most favourable to such an end. Prolonged peace and comparative freedom from fiscal burdens are among the most important of such conditions. There seems some ground for now hoping that the difficulties caused of later years by the burden of exchange have been at least restricted within practical limits. But famine is ever a probable danger; and political and military ambitions, with the complications attendant on them, have always to be reckoned with.

Summary 1880-1901.

Viceroys, 1880-1901.

The Viceroys who held office during the period here dealt with were the Marquess of Ripon, 1880–84; the Marquess of Dufferin and Ava, 1884–88; the Marquess of Lansdowne, 1888–95; the Earl of Elgin, 1895–99; Baron Curzon of Kedleston, 1899. Few of his predecessors in the government of India were animated by greater zeal, or sustained by a higher conception of duty, than Lord Ripon. In the prime of life, possessed of much ability, an indefatigable worker, and of experience in public affairs, he was greeted on arrival in India with a welcome the more warm in that the public had grown distrustful of his predecessor. Before he laid down office the goodwill with which he had been received had turned into hatred such as had never before dogged the footsteps of an Indian Governor-General. So long as Lord Ripon confined himself to raising and improving the status of the native of India his action was followed by the British community, if not with warm approval, at least with kindly goodwill. But when he proceeded to assimilate the authority of native magistrates over European British subjects to that of British magistrates themselves, he was rudely made to feel that the Government of India, autocratic though it may at times be with the natives, must be more circumspect in dealing with the British community. The struggle with his fellow-countrymen in which Lord Ripon suffered himself to be involved dealt a death-blow to his usefulness as Viceroy. Instead of holding the balance between all parties, the Viceroy became seemingly a partisan of one against another. When Lord Ripon's name grew to be a symbol between contending factions, nothing remained for him but to withdraw from an office in which he could no longer render useful service. But the Indian historian will hereafter record that to Lord Ripon belongs the distinction of having been the first Viceroy openly to recognize and give practical encouragement to the growth of a self-respecting spirit of endeavour and of the desire for some measure of self-government among the more advanced classes of the natives. He sought, as events have shown not unsuccessfully, to assist them in raising themselves from an attitude of passive administrative subjection to a position more worthy both of themselves and of the Government under whose liberal rule they live. His generous and kindly recognition of their claims and capacity was warmly responded to by all classes of natives; and if he was condemned to leave Calcutta in whatever disgrace may be thought to attach to the censure of that city, he received from the natives of India throughout his journey to Bombay a spontaneous and enthusiastic ovation, of which the like has never been accorded to his predecessors or successors. It is greatly to the honour of Lord Dufferin that, though by no means indifferent to popularity among his countrymen, he never for a moment hesitated to continue and to carry farther the main lines of the enlightened policy which had been initiated by Lord Ripon. But in Lord Dufferin's sagacious hands the rocks and shoals on which his predecessor foundered were avoided. In raising the

status of the native civil service, and in enlarging the basis and extending the attributes of the several legislative councils, Lord Dufferin laid the native population under a lasting debt of gratitude. In the historic interview with the Amir of Afghanistan in 1885 at Rawalpindi, as throughout his treatment of the Panjdeh incident, his characteristic firmness and suavity were equally displayed. His term of office was darkened by financial difficulties, largely owing to the fall in exchange. The conquest of Upper Burma, though it increased his popularity and added to the lustre of his Viceroyalty, reopened the floodgates of military expenditure and added to financial troubles. He maintained throughout his term of office a high standard of administration, while his personal charm of manner, his tact, his hospitality, his wit and genial humour, secured for him universally the affection of his countrymen. With the advent of Lord Lansdowne the liberal policy of his immediate predecessors suffered eclipse. Lord Lansdowne's urbanity and high distinction conciliated and impressed all with whom he was brought into personal contact. But, as time passed, it became evident that his thoughts were more occupied with affairs beyond the north-west frontier of India than with the interests of good government within its limits. The growing influence exercised over the Viceroy by his chief military and political advisers became more and more matter of uneasy comment. Under their influence, and probably with approval in Whitehall, Lord Lansdowne renewed in substance Lord Lytton's policy, and the wars which have drained India of money and men since 1896 were due to the course of action adopted under his auspices in the years preceding. There never was a time since 1838 when Simla was so actively the centre of ambitions, and of designs beyond the Indus. The most favoured type of Indian official was no longer the provincial governor or the sagacious resident, but that warden of the marches of Baluchistan, Sir Robert Sandeman, whose unique aim it was to extend the zone of British influence beyond the frontier, and whose method was to participate in tribal dissensions, and to profit by them. "Sandemania," which has proved so contagious, then first became epidemic in high quarters. It should be added, however, to the credit of his administration, that Lord Lansdowne grappled successfully with one hideous evil in Hindu social life, which required all the more courage to combat because it rested on immemorial custom, and was hallowed by religious sanction. He left behind him an Act to raise the age of consent among Indian wives from ten to twelve, which, while it provoked much popular clamour, was approved by men of enlightenment of all creeds and races. During so much of his term of office as was not occupied with combating famine and plague, Lord Elgin was engaged in conflict beyond the frontier with enemies who were none of his own seeking, or in acrid controversy with political friends in England on questions arising out of the political difficulties which had been bequeathed to him by his predecessor. Though the credit of introducing a gold standard into India does not personally rest with Lord Elgin, it was during his term of office that the measure was matured and effect given to it. Of Lord Curzon it is premature to speak. But his frontier policy would seem to be conciliatory and judicious, and to be framed with that regard for economy which of late years has been conspicuously absent. The creation of a border province beyond the Indus under a separate head (the North-West District), which was accomplished in 1901, would have been, when Lord Lytton first proposed it, premature. At that time, when the frontier was as yet undefined, and when the relations of the tribes with the British and Afghan Governments, and of those Governments with one another, were unsettled, the measure would certainly have provoked collision, especially if a successful and ambitious soldier had been selected to be chief of the proposed province. As matters now are, the arrangement may be regarded with more satisfaction.

Towards the latter years of the 19th century the last of the old Haileybury civilians, who entered the service as nominees of the East India Company's directors under the system abolished in 1857, were leaving India. For thirty years or so they had been contemporaries and rivals of their brethren who had been recruited since 1856 by the present rule of open competition. It is noticeable that, towards the close of their term of corporate existence, most of the highest offices available in India to the civilian were held by Haileybury men. The public works and financial members of the Viceroy's council, with the Lieutenant-Governor of the Punjab, the North-West Provinces, and Bengal, were in 1887 all nominees of the East India Company. While none will regret the demise of the system of nomination, the fact shows that with much rubbish it furnished also useful material. It may interest Etonians to find that in 1890–91 the Viceroy (Lord Lansdowne), the Commander-in-Chief (Lord Roberts), the Governor of Madras (Lord Wenlock), the Lieutenant-Governor of Bengal (Sir Steuart Bayley), the Lieutenant-Governor of the North-West Provinces (Sir Auckland Colvin), and the Lieutenant-Governor of the Punjab (Sir James Lyall) were all old Etonians.

Anglo-Indian relations.

In the course of the debate in the House of Commons on the Indian budget of 1900–1, Lord George Hamilton observed that he sometimes doubted whether, in spite of all their labours, the popularity of the British in India had increased. The substitution of a mechanical for a patriarchal system of rule seemed to the Secretary of State for India to lie at the bottom of any loss of popularity which might have occurred. To observers who have better opportunities of personally judging than the Secretary of State, there seems no good reason for believing that British unpopularity has increased among the Indian masses. They are as amenable as of old to British officers, they consult them as freely, they crowd to their camps when on tour, and are as friendly in intercourse and bearing as in former times. It is in the so-called "educated classes," the outcome of Western education, that goodwill is less apparent. The native educated by English methods looks on himself and his countrymen as unduly debarred from many prizes offered to his British fellow-subjects, and keenly resents the social ostracism to which he is too frequently subjected. He has command of a press, both English and vernacular, which vividly reflects his discontent, and therefore suggests the existence of more widespread disaffection than in truth exists. By these and similar methods he seems to possess more influence than he really wields, and he labours to have it appear that the dissatisfaction which he personally feels is generally shared by his fellows. Then again the glamour of success, the mesmeric fascination, the *ikbál* (to use an expressive Arabic word in familiar Indian use), the star, as Napoleon would have said, which did so much for British influence in an earlier day, when no one knew much about the new rule, but every one saw that it was irresistible, has greatly died away. The nature, the defects, the limitations, and the difficulties of British rule are now matter of more analysis and speculation. Familiarity has produced something of its proverbial effect, and there is little in the present social relations between the races to bring the critics and the criticized on to a footing of more mutual goodwill. The levelling tendency of British rule again is abominable to the powerful classes which have hitherto monopolized authority. The "new man," viewed as a type of humanity, is often but a poor creature compared with many of those whose influence he is displacing. The dislike which attaches to his ascendancy is passed on to

the Government which has created him. As the new man is himself foremost in censuring and in criticizing British authorities, the Government meets on either side with disfavour. Finally, outside of all this, there arise from time to time special causes of dissatisfaction. In Bombay and in the North-West Provinces the population has rebelled against restrictive measures which were thought necessary to prevent the spread of plague. As the plague commission has also pronounced against many of these measures, it is much to be regretted that resort should have been had to them. There is little that the native of India will not submit to in the way of arbitrary exaction or injustice, but the Government which violates the privacy of his hearth will infallibly rouse him to fury. Little has happened at Bombay and in the North-West but what men of experience must have expected. The memory of that painful time will long rankle in the hearts of those who have survived it. Nothing has hitherto lent more strength to the British Government than its invariable regard for the sanctity of domestic life and for the free exercise of religious faith. One of these bulwarks has been seen momentarily to crumble, and it is to be hoped that the administration, which has now hastened to retrace its steps, will remain within the limits of its former policy. The curious demonstrations against cow-killing which occurred in recent years in parts of the North-West Provinces are more obscure in origin. But it may be conjectured that the zealots of the Hindu faith do not witness without emotion the widespread sapping of their creed which is everywhere obvious, or harbour towards the Government with which they connect it any feeling except that of hatred.

Personalia. During the years 1880–1900 various figures have flitted across the Indian stage and have come more or less into notice. Of such, among the British, was Mr Allan Hume, the sponsor of the Congress, a retired Indian civilian. The late Sir George Allen left India in recent years, after a lifetime spent in maturing and bringing to a successful issue various useful industrial enterprises. Sir George Chesney, whose comparatively early death is greatly to be deplored, took with him to Parliament, where he represented the city of Oxford, the prestige of his career and some remembrance of his literary successes. Sir William Hunter, also too soon summoned away, employed his pleasant and instructive pen in familiarizing the general public in England with the history and circumstances of their great dependency; Sir Alfred Lyall strengthened his reputation as an original thinker on Indian and Asiatic problems. The Stracheys published their important volume on the *Finance and Public Works of India.* Mr Crooke and Mr Grierson explored the folklore, the dialects, and the rural customs of the North-West Provinces and Behar; Mr Growse wrote on Hindu architecture and archæology. The classical age of Anglo-India—the age, that is to say, of Warren Hastings—was brought before the eye of the present generation by Dr Busteed, in his charming *Echoes from Old Calcutta.* Mr Howell brought to a term the heavy labours of his *Arabic Grammar.* Mr Arnold, of the Anglo-Mahommedan College at Aligarh, took up the cudgels for the Mahommedan conquerors of past time in his *Preaching of Islam;* Mr. C. J. Lyall published an interesting volume of extracts translated from pre-Mahommedan Arabic poetry. But conspicuous among all has been the rise to fame in England of Mr Rudyard Kipling, whose earlier efforts, when they first appeared in the early 'eighties in India, were at once hailed with unanimous recognition. Regarded as pictures of society, his *Plain Tales from the Hills* were manifestly caricature. But as clever etchings of types and characters, and as brilliant sketches of lighter aspects of Anglo-Indian life, they were felt to be pertinent and truthful. The language in which they were written was by no means conspicuous for purity or refinement. But it served all the more to bring vividly home to its readers the scenes and the persons described; for it was served up smoking-hot from the mess, the cutchery, the assembly rooms, the gymkhana—from wherever, in a word, Anglo-Indians resort. When Mr Kipling passed on to other conquests in other lands, the good wishes of all whom he left behind in India accompanied him. But when presently it was found that his pen and ink sketches, which were taken quite seriously in England as pictures of daily social life in India, brought no little obloquy on its society, and when it was seen that the author was at no pains to put his readers right, Anglo-India somewhat faltered in its allegiance. His popularity, nevertheless, in India, as elsewhere, eclipses that of all other Anglo-Indian writers. Yet there is one whose memory his admirers would not willingly let die. Many recall, with singular pleasure, the gentle malice of Aberigh Mackay; nor would they hesitate to barter many chapters of the *Plain Tales* for the delicate vignettes, the sparkling epigrams, the keen but inoffensive banter, and the incisive word, in a single page of *Ali Baba.*

Among natives of India, Sir Madhava Rao and Sir Sayad Ahmad remained severally conspicuous among their Hindu and Mahommedan contemporaries for all that is most worthy and sincere in Indian aspiration and performance. Two Indian gentlemen, Mr Dadabhai Naoroji and Sir Mancherjee Bhownaggree, succeeded in gaining admission to the House of Commons in the Radical and Conservative interest respectively. H.R.H. the late Duke of Clarence and the Cesarewitch, afterwards the Tsar Nicolas, successively visited India in the early 'nineties. Various Indian princes, such as Holkar, Baroda, and Rampur, came to England. A host of minor Indian writers burst out from time to time into ephemeral life and activity, or were hatched in tropical heat of controversy. Mr Bahramji Malabari, author and reformer, continued, not without success, his great crusade against infant marriage and in favour of the re-marriage of Hindu widows. Intellectual struggle, increasing antagonism between old and new ideas, the growth of a corporate feeling of self-respect, a keen and fixed desire, therefore, among educated and enlightened men to be of more account in the affairs of their country, the weakening of old bonds, the sapping of old prejudices—to apply, in short, to a peninsula a simple but expressive metaphor from progress in another line—the "gradual getting up of steam"—are the great characteristics of the present day. From 1860 to 1900 what changes! what advance! Every year adds to the number of Indians who flock to British colleges or to the Inns of Court. The iron bands of caste, of custom, and of spiritual authority are more and more relaxing. The sanctions and the penalties by which Hindu society was regulated are gradually but surely falling into disuse, and as yet there is no new system to replace them. Slowly (and better therefore if slowly) an ancient creed is nodding to its fall. It is the story of the sleeping Princess. For long ages India has slumbered immovable, but at length the spell is broken. From the far West has come the awakening. Suddenly life is actively resumed. The parrots and the monkeys scold, the geese cackle, the ass brays, but man hurries anew about his business. Torpor is shaken off, and a nervous activity takes the place of silence and inaction. The Princess has arisen, and moves forward, though with dazed eyes and uncertain steps, encumbered by the folds of her old-world garments. In confidence, yet not without hesitation, she follows the stranger into a world which is new and unimaginable to

her. The dawn as she draws onward quickens all her pulses, and shines more and more upon her, as she advances, with the light of incomparable promise. (A. Co.)

The Native States.

The origin of the native states of India, and their political relations to the British empire, can only be explained historically by a reference to the condition of India in the middle of the 18th century. At the opening of that century the Moghal emperor was still formally supreme throughout, from the northern mountains almost everywhere to the sea; and the whole country was distributed into great provinces directly under imperial rule, except where petty chiefships survived which more or less acknowledged the Moghal supremacy and professed to be feudatories, or in districts that were openly defying the imperial governors. The strength and size of the chiefships, as of the districts in rebellion, varied in proportion to their distance from headquarters, to their accessibility, and to the vicissitudes of the imperial policy. In the wilder parts of India there were tribes that had never been effectively subdued, and there were chiefs in the highland tracts whose subordination to the Delhi Government had been merely nominal. On the western side the Marathas had raised, and were maintaining, a formidable insurrection. Yet it may be affirmed generally that from the Himalaya mountains to Cape Comorin no separate state existed that had established and openly asserted its independence or denied the imperial sovereignty. But after the death (in 1707) of Aurungzeb, the Moghal empire declined rapidly towards its fall, and within the next forty years it had subsided into complete dilapidation. Nadir Shah had crossed the north-western frontier of India in 1735, sacked Delhi, and extorted the cession of the emperor's western provinces along the Indus. The Afghans poured down from the north into the Punjab; the Marathas overspread the central region, and were pushing northwards and southwards; the great viceroyalty of the Dekhan had been converted into a rulership under the Nizams of Haidarabad; while in Bengal and Oudh there were military adventurers who governed in the emperor's name, but were actually carving out possessions for themselves. In that wide central region, which had been occupied for centuries by the Rajput clans, the chiefs kept up a precarious resistance against Marathas from the south and Mahommedans from the north. The map of the Moghal empire had thus been torn into pieces, and the whole territory was being parcelled out again into principalities which merely represented the fragments that rival potentates could seize and hold. If we set aside the group of ancient Rajput chiefships, every considerable native state that at the present moment exists in India traces its formation no farther back than to this epoch, and is ruled by some family whose founder won his lands in this period of universal confusion.

Historical origin.

Almost all the native states of India, therefore, represent the scattered remnants of those rulerships that were hastily built up out of the ruins of the Moghal empire, which had itself consolidated a number of pre-existent kingdoms. The whole Indian continent had fallen back into that condition of separate contending principalities, professing but not practising allegiance to an emperor at Delhi, which prevailed before Baber founded the Moghal dynasty in the early part of the 16th century. That dynasty had now succumbed; but it had hardly passed away before another empire began to take the vacant place, growing slowly at first and with almost imperceptible advances. The rise and progress of the British power, however, in no way followed the method of its predecessor; and this difference had an important effect upon the formation of the native states as we now see them. In the 16th century Baber conquered all northern India by force of arms, and his successors extended their dominion by a series of campaigns; they subdued all opposition by superiority in war. They left standing no rivals whom they could overthrow; their object was to bring the whole country under their yoke; they tolerated no equality; their monarchy was avowedly military and aggressive; their power levelled every obstacle that it could reach.

The British dominion began in another manner and went on by other methods. Englishmen had obtained their foothold on the Indian sea-coast as traders, and for some time afterwards they neither attempted nor desired territorial possessions. Their gradual interference in the quarrels and intrigues of the native princes was mainly forced upon them in their commercial competition with the French; and thus they entered upon a system of extending their sphere of influence by alliances with the nearest states, assisting them with troops and money, so that their general policy was to join any friendly power in resistance against a common enemy. When in 1757 Clive made for the East India Company their first substantial conquest of territory—the province of Bengal—he merely added one more to the long list of states, held nominally by a grant from the Delhi emperor but really independent, into which the old empire had been broken up piecemeal. And as the British dominion inevitably expanded by reason of its superior military strength and resources, this policy of alliances with friendly or needy potentates against hostile and jealous rivals was steadily preserved, sometimes with a view to a balance of powers, at other times in order to interpose a belt of protected states between the English border and formidable neighbours, and occasionally to unite in some offensive operation against a common foe. The East India Company extended their territory by cessions from their friends, taken in exchange for assistance, as well as by conquests from enemies; they received assignments of land as security for subsidies or for the payment of troops lent. At the end of a successful war they did not, at this period, utterly destroy their antagonist; they disabled him by annexing or distributing large portions of his territory, by disarming him, and sometimes by placing an English garrison with a diplomatic agent at or near his capital.

Extension of British control.

The policy of the East India Company, therefore, during the first period of their establishment in India had been to avoid aggrandizement and to fortify their position by alliances with the neighbouring states. They soon found themselves obliged by stress of circumstances to fight for their safety, and afterwards to contend for ascendency, as the only sure basis for maintaining themselves in the prevailing confusion and for securing the tranquillity of the country. They could not reduce their own troops while other armies were incessantly in the field. The course they adopted was to cut down the strength of their enemies, and gradually to assume control over the military forces and political relations of their allies, obtaining large accessions of territory by conquest and by cession. At the close of the 18th century there were only two native powers in contact with British possessions whose hostility was formidable—the Mahommedan dynasty in Mysore, and the group of Maratha chiefships. During the Governor-Generalship of Lord Wellesley (1798–1805) Tipu, sultan of Mysore, was defeated and slain, and the Maratha confederacy was broken up. Lord Wellesley introduced that system of subsidiary treaties which has played so important a part in the expansion of British dominion. His

policy was to extend the British protectorate over all the states with which Great Britain had then any concern, by insisting that each native ruler should reduce his army, and should rely for external defence upon the military power of the British Government. Each protected state was required to supply, not troops as formerly, but money, and the British Government undertook to raise, train, and pay a fixed number of troops in return for a subsidy, or for a cession of land yielding equivalent revenue, that would provide the cost of the troops furnished by the protecting authority.

But Lord Wellesley's policy, which aimed at the universal dominion of the English in India, and indeed laid its foundation, was discontinued for a time by his successors, who desired to free themselves from such extensive liabilities, and to be content with the defence of British territories, leaving the states beyond the frontier to fight out their own quarrels. The result was that all central India fell back into a condition of incessant war and disorder, for the predatory Maratha hordes and bands of armed adventurers overran the country, and were rapidly destroying all the weaker states. Many of the chiefs appealed to the British Government, affirming that the imperial power in India, by whomsoever it had been exercised, had always recognized and acted upon the inherent duty and obligation of protecting the minor states, and of imposing peace and good order throughout the empire. This was the principle upon which Lord Hastings at last interfered, in 1817, to suppress the Pindarees, whose predatory armies roved at large through the midland country, and to preserve the minor chiefships from aggression and gradual dismemberment. The Pindaree hordes were attacked, pursued, and broken up. The great Maratha chiefs were compelled by force of arms to sign treaties acknowledging the supreme prerogative of the British Government for adjusting the reciprocal rights and relations between them and the minor states which they were holding in tributary subjection. The petty chiefships were thus placed under the protection of the British Government; and treaties were made directly with the larger Rajput states, whose independence was thus secured and whose territories were saved from imminent destruction. The same system was extended to the minor states in Gujarat and western India generally, while all the principal states were required to accept the position of subordinate alliance with the British Government, which assumed the paramount powers of supreme authority and control. The rulership in the Punjab and in Sind lay at this period outside the sphere of British dominion. But for all the rest of India it became thenceforward a recognized principle of public policy that every state should make over the control of its foreign relations to the British Government, should submit all disputes to their arbitration, and should defer to British advice regarding internal management. A British resident was appointed to the courts of all the greater princes, while military supremacy was consolidated by locating the subsidiary forces at important capitals, and by placing British officers in command over the auxiliary troops that some states were under obligation to supply.

It is to be observed that under this system, although the British empire increased mightily in territory and in the extension of irresistible influence, yet the original policy of the preservation of native states was never abandoned. The Mahommedan dynasty of Mysore was destroyed in 1799, yet the Mysore state exists, under its ancient Hindu family of rulers, to this day. The Maratha confederacy were the most obstinate of England's enemies, yet none of the five great chiefs who fought against her were completely stripped of their possessions by Lord Wellesley or Lord Hastings, and the descendants of three (Holkar, Sindia, the Gaekwar) still govern considerable states. The barbarous rule of the chief of Coorg, in South India, and his obstinate refusal to amend it, did indeed bring about the absorption of that small state in 1834. But with this exception it may be generally affirmed that the policy of complete annexation and absorption into British territory came in during Lord Dalhousie's Governor-Generalship (1849–56). He declared the doctrine that it was the prerogative, and indeed the duty, of the British Government to assume possession of a subordinate state that should have lapsed to the sovereignty by failure of heirs natural, unless there were some strong reason to the contrary; and he acted on this doctrine by annexing Satára, Nagpore, and Jhansi. The Punjab was taken by conquest after two fierce wars, and the kingdom of Oudh was annexed on the ground of long and incurable misrule. But after the mutiny of 1857 this doctrine was virtually abandoned. The policy now consistently prevailing is expressed by Lord Canning's formal recognition in 1862 of the right of all ruling chiefs, upon failure of heirs natural, to adopt successors according to the customs of their religion, race, or family, so long as they are loyal to the British crown and faithful to their engagements. Yet no subordinate principality can pass to an heir, whether by adoption or ordinary succession, without the assent of the paramount power, a condition that is undoubtedly based on established usage and long tradition.

Present position in the Indian Empire.

We have now traced rapidly the course of events and transactions by which the dominion of the Moghal emperors, which began in the middle of the 16th century, became transformed into the British dominion of India, and was centralized under one great sovereignty during the reign of the Queen-Empress Victoria. Its full development is to be surveyed in the present constitution of the Indian empire, composed partly of the British-Indian provinces and partly of states under British protection and undisputed ascendancy. An official paper issued by the Government of India in 1886 recorded 629 subordinate or feudatory states, with territories aggregating 628,672 square miles and a population of 66 millions. Most of these states—indeed, almost all the larger ones—represent, as has been said, the military chiefships which arose out of the confusion that followed the fall of the Moghal empire, and which the British Government has preserved on a diminished scale instead of absorbing them. Some of them are constituted from the domains that were left to adversaries who submitted after war; others belong to a class which, like the Haidarabad state, were originally allies of Great Britain, and have retained their internal dependence under the limitations imposed by treaties or by the general constitution of the empire. Of the minor chiefships the greater number owe their existence to the protection given them by Great Britain against predatory aggression. They had been tributaries of the larger native states, and the dominion over them was transferred, by conquest or cession, to the British Government, which has now guaranteed their rights and obligations, and allows no other person to interfere with them. Every one of these native states, great and small, has yielded up the management of its external relations to the British Government, and has no sovereign rights internationally; while in all matters that concern the empire at large the states are expected to conform to the decision of the paramount suzerain. In measures taken for the common defence of India they may be required to co-operate, and to permit anything to be done that is necessary for the general safety. On the other hand, the British

Government undertakes to regard their interests in all external affairs as identical with its own, to make no arrangement which would place them at a disadvantage, and to protect them if necessary with the whole force of the empire.

The regulating authority of the British Government is exercised over the states in various modes and degrees. In deciding disputes over succession to the rulership, in questions of adoption, in the control of affairs during minorities, in the limitation of their armaments, and in any matter affecting the peace of the empire, the British Government is supreme arbiter. And since this supreme power is prepared to support the legitimate ruling authority of the chiefs, to assist them in suppressing revolts, and to prevent usurpation, the obligation to interfere for the purpose of checking gross abuses, serious misgovernment, or the excessive squandering of the states' finances, which leads to misrule, necessarily follows. What circumstances constitute a case for such interference, and how far it should be carried, are matters for discretion in each instance. On subjects which concern the general interest, such as commerce, coinage, and railways, the states are expected to defer to the advice of the British Government; over all trunk lines of railway communication, and indeed over every line that does not begin and end within the territory of a single state, the supreme Government retains jurisdiction. The states are all bound to give extradition, on demand, of heinous criminals; and in one department of internal administration, the judicial authority of the chief, there are degrees of limitation. For while in the larger states sentences of death can be passed by the state's tribunals, in others a reference to the British agent is necessary, and in the lesser states the judicial power is graduated according to class or capacity. The residuary superior jurisdiction in these cases is vested in the British Government. Many of these petty chiefs are little more than large proprietors with privileged jurisdiction of a feudal kind, not unlike some of those which existed under the German empire up to the end of the 18th century.

It is necessary to understand clearly the real nature and constitutions of all these native states. In the first place, they in no sense represent nationalities; they are marked off by no differences of language, by no separate community of religion or race; they do not contain homogeneous populations under a national ruler. They are territorial jurisdictions, or imperfect sovereignties, marked out on the general map of India, usually formed by acquisitions, for the most part fortuitous, of each ruling family, and fixed within the limits finally recognized and confirmed by the British Government. With the majority of his subjects the ruler has not necessarily any connexion—religious, tribal, or linguistic. At Haidarabad a Mahommedan prince of foreign descent governs an indigenous population that is mainly Hindu; at Gwalior a Maratha chief from south-west India reigns over millions of northern Indians to whom the Maratha language is foreign—his capital has grown up round the fortress where his ancestor pitched a standing camp. Secondly, it must be explained that there is a great difference in structure between the different groups of these states. Many of them were formed by simple conquest; they are the lands which the founder of the dynasty seized by the power of a mercenary army. But a Rajput state in central and western India denotes the territory over which a particular clan, or division of a clan, claims dominion for its chief and possession for itself by right of ancient settlement and continual habitation, although the existing territorial boundaries were constantly changing under incessant warfare up to the period of British pacification. The chief of the ruling clan is chief of the state, and all the great landholders are usually his kinsmen, while the people who are not Rajputs hold a lower position as merchants and cultivators, or as inferior castes and aboriginal tribes. In the wilder outlying tracts these aboriginal tribes have kept up their local independence in political subordination to the Rajput chief.

Nature and constitution.

For conducting, upon the principles above described, the relations between the Government of India and the native states a system has grown up of establishing political agents, who usually reside within the states' territory. A resident officer of superior rank has charge either of a single important state, or of a group of minor states, having in the latter case other agents of lesser rank under his orders. And since this arrangement is connected historically with the position, geographical or political, of the several chiefships, it may conveniently be followed as a classification in the sketch which will now be given of their origin, their character, and the circumstances that have led up to and determined their existing status within the empire. The superior Agencies correspond directly with the Government of India; but since many of the minor chiefships are by their situation and interests closely intermixed with British provinces, their business is primarily managed by the adjoining local governments, subject to reference, on questions of principle, to the Governor-General in council.

The states of the first magnitude, to each of which a superior Resident is attached, are as follows:—

1. Haidarabad.	4. Gwalior.
2. Mysore.	5. Indore.
3. Travancore.	6. Baroda.
7. Kashmir.	

The first three states in this list are situated in southern India, Travancore being at its extreme promontory. The next three are in the central region; and Kashmir, with its tributaries, lies in the highland country on the farthest northern frontier of the Indian empire.

Haidarabad.

The ruler of this state is entitled the Nizam. His family was founded by Asaf Jáh, a very able military leader, who was appointed in 1714 governor of the great imperial province of the Dekhan, and raised his governorship to an independent principality during the confusion of the next twenty years. His death in 1748 was followed by a war of succession, in which the French and British companies on the south-eastern coast of India took part, and which ended in the rulership of Asaf Jáh's son, with the hereditary title of the Nizam. By that time the French had lost all their political influence in southern India, and the rivalry between the native powers for territory and dominion lay between the Marathas, the Nizam, and the Mahommedan dynasty at Mysore. The English East India Company on the sea-coast, whose position was put in jeopardy by these turbulent neighbours, became entangled in their quarrels; and when hostilities began between Haidarabad and Mysore the Company sent a subsidiary force to co-operate with the Nizam, in consideration of the cession by him of certain districts. But the Nizam soon afterwards made a secret compact with Hyder Ali of Mysore for a joint attack upon the Company. Some sharp fighting ensued, in which the Nizam was so roughly handled by the British that he was glad to make terms.

During the period that followed, the policy of the Haidarabad state varied with the vicissitudes of the incessant contest that went on among the three native powers. With the English Company the Nizam was alternately in

alliance and at enmity; but as his military strength was much inferior to that of the Mysore sultan and of the Marathas, who were also formidable adversaries of the British, the concurrence of their common interests gradually drew the Nizam and the Company into a less unstable alliance. So in the first war (1790) against Tippu, sultan of Mysore, the two Governments acted together in the field, and shared the lands which were wrested from him. But in 1795, when the Marathas invaded the Haidarabad territory, the Nizam's urgent appeal for assistance was rejected by the English Governor-General (Lord Teignmouth), who feared the consequences of joining in hostilities against the Maratha power. The results were, in the first place, that the Marathas routed the Nizam's army and forced him to make peace on very extortionate terms; and, secondly, that the Nizam's deep resentment against the way in which the British had deserted him led him to increase those regiments in his own service that were commanded by French officers, whose influence at his court was proportionately augmented. When, in 1798, Lord Mornington assumed the Governor-Generalship of India, the Nizam's army was largely in the hands of Frenchmen. As war with Tippu of Mysore was imminent, an alliance with the Nizam became again of importance to the English, and the Nizam's own condition forced him to the conclusion that in this alliance lay his only assurance of permanent protection from the Marathas and the powerful hostility of Mysore. He was therefore induced to agree by a treaty to disband the French corps (nearly 14,000 men), to dismiss the officers, and to allow a substantial increase of the troops furnished by the British Government on payment of a subsidy. The Nizam's army co-operated in the war which terminated in the conquest of Mysore, and a considerable share of the conquered territory was handed to Haidarabad. In 1800 was made another treaty, which is not only the foundation of British relations with Haidarabad, but has also served as the model of subsequent relations with other important states. By this treaty the British Government engaged to defend Haidarabad against foreign aggression, while the Nizam placed in British hands the direction of all his foreign affairs, admitted a British force to be stationed at his capital, and ceded territory yielding revenue sufficient to defray the cost of its maintenance. Since that time the only material transaction with the Haidarabad state has been the assignment to the British Government of certain districts yielding a net revenue set apart for the payment of an auxiliary force that the Nizam had undertaken to maintain, the surplus, if any, of revenue after payment of the troops to be credited to the Haidarabad treasury. The districts that are still thus held in trust under British management constitute what is commonly called the province of Berar.

As the Nizam's family is Mahommedan, the nobles and most of the chief officers of the state are of that religion; but a very large majority of the population are Hindu.

Mysore.

The present Maharaja of Mysore has descended from a Hindu dynasty that took its rise in the 15th century. During the confusion that spread over south India in the 18th century the reigning prince was deposed and his kingdom was seized by Haidar Ali, a soldier of fortune, who established a strong military power in that country and pillaged all his neighbours. These incursions, and the active correspondence of the Mysore rulers with the French at a time when France and England were at war, produced a state of intermittent hostility with the British Government, while Mysore was also alternately in alliance or at enmity with the Nizam and the Marathas. In 1780 Haidar Ali invaded the Carnatic with a large army, and ravaged the lands protected or possessed by the East India Company up to the suburbs of Madras, defeating the English troops sent against him. A French squadron appeared off the coast to co-operate with him, but withdrew, and Haidar was at last beaten and driven away at the battle of Porto Novo. His son, Tippu Sahib, carried on the war until peace was made in 1783; but war broke out again in 1791, with the result that a British army under Lord Cornwallis forced him to sign a treaty that ceded half his territory to the British Government. Tippu Sahib nevertheless continued to strengthen his army, to negotiate with France for assistance, and generally to prepare for fresh hostilities, until Lord Mornington formally required him to disarm and relinquish his alliance with France, then again at war with England. On his refusal he was attacked in 1799, was driven into Seringapatam, and besieged there until the place was taken by assault, and Tippu was slain in the fighting. After allotting certain portions of his kingdom to the British Government and its allies in the war, Lord Mornington reconstituted the remainder into a state under the old Hindu reigning family. Then followed a period of oppressive misrule and serious squandering of the revenues, until in 1831 the Government of India placed the state in sequestration, and assumed the direct administration for fifty years. In 1868 it was publicly resolved that the representative of the family, then a minor, should be restored to the rulership, and in 1881 he was formally placed upon the throne. The instrument recording the transfer of the Mysore state to its hereditary ruler laid down certain conditions, territorial, financial, and military, that have been attached to the rendition in accordance with the general principles that govern the reciprocal relations of the native states with the British Government.

Travancore.

The country belonging to this state, which lies along the south-eastern coast-line of India, where it runs down to a point at Cape Comorin, was consolidated out of several petty chiefships into one principality about the middle of the 18th century. It was never conquered by the Moghals, and although the ruler at one time paid tribute to the nearest Mahommedan governor, his successor, finding himself threatened by the sultan of Mysore, obtained aid and protection from the British authorities at Madras. When Tippu of Mysore invaded Travancore in 1789, the British compelled him by force of arms to restore the territory that he had seized; and in 1799 the troops of Travancore joined in the campaign that ended with his death and the extinction of his dynasty in Mysore. In 1805 the state was brought formally within the British protectorate by a treaty in which its ruler acknowledged British suzerainty, and bound himself to the payment of a subsidy toward the maintenance of troops for his territory's defence. With the exception of some internal troubles, which were from time to time suppressed or adjusted by the interposition of the British Government, the state has since had an uneventful history, and is now prosperous and orderly. According to the laws which determine the succession in this state, the descent is in the female line; so that, for example, the rulership would pass on the death of a chief, not to his sons, who can in no case inherit, but to his uterine brothers, or else to his sisters' sons. And if an adoption became necessary for the continuance of his line, a female could be chosen to transmit the succession. The latest adoption of this kind occurred in 1857.

The three states of Gwalior, Indore, and Baroda are alike in their origin. It may be explained that at the

beginning of the 18th century the Marathas had acquired a great dominion in western India under the leadership of the famous Sivaji and his successors, who had rebelled against and driven out the imperial governors in that region. By the middle of the century the house of Sivaji had been supplanted and reduced to merely titular sovereignty by the family of the Peshwas, or prime ministers of the Maratha Government; and the Peshwas in their turn soon found themselves unable to control their own military commanders, who used their troops for seizing territory on their own account, and defied the attempts of the central Maratha power at Poona to enforce subordination. In these three states, therefore, the rulers are the descendants of successful generals who rose to independent power towards the end of the 18th century, who were the leaders of the Maratha confederacy that contended against the British arms in several wars for predominance, and who finally submitted at different times to treaties according the states protection with internal autonomy under British supremacy.

Gwalior.

The Gwalior state was founded by Madhaji Sindia, who had commanded an expedition sent in 1770 by the Maratha Government at Poona into northern India, where he established by conquest a considerable Maratha dominion. His operations brought him into collision with the British, but although he concluded a treaty with them in 1782, the policy of Madhaji and of his able successor, Doulut Rao, naturally continued adverse to the growing power of the British Government. The jealousies and dissensions among the leaders of the Maratha confederation, however, disorganized their resistance to the common enemy. They fought among themselves for territory and for supremacy until the Peshwa, who was the titular head of the confederation, was completely defeated in battle by the Maratha chief Holkar, fled from his capital, and placed himself under British protection by the treaty of Bassein in 1802. This interposition of the British Government was resented by the confederacy, and it brought on the Maratha war of 1803. In the campaign that followed a combined Maratha army, in which Sindia's troops furnished the largest contingent, was defeated by General Arthur Wellesley at Assaye and Argaum, in central India; and Lord Lake routed Sindia's forces in northern India at Agra, Alighur, and Laswaree. Many districts that Sindia had seized in the north and some in the south were ceded to the British Government, and his state's territory was materially reduced.

In 1817, when the Peshwa attempted to raise the Maratha chiefs in combination against the British Government, Sindia was only deterred from joining in the war by a movement of British troops to overawe him, and his connivance with the enemy cost him the compulsory cession of two fortresses. Under Doulut Rao, Sindia's successor, the state fell into confusion and was distracted by mutinies, until the growth of turbulence and misrule on the British border induced Lord Ellenborough to interpose, and a British force advanced upon Gwalior. The Maratha troops were defeated at Maharajpur and Punniar, with the result that the Gwalior government signed a treaty ceding territory with revenue sufficient for the maintenance of a force to be stationed at the capital, and fixing the future strength of the Gwalior army. In 1857 this force joined the general mutiny; the ruling chief abandoned Gwalior until the place was retaken and his authority restored by Sir Hugh Rose (Lord Strathnairn) in 1858; and since that pacification of the country its princes have continued in firm and loyal amity with the British Government.

Indore.

The state of which Indore is the capital had its origin in an assignment of lands made early in the 18th century to Mulhar Rao Holkar, who held a command in the army of the Maratha Peshwa. Before his death in 1765 Mulhar Rao had added to his assignment large territorial possessions acquired by his armed power during the confusion of the period; and by the end of that century the rulership had passed to another leader of the same class, Tukaji Holkar, whose son, Jeswant Rao, took an important part in the contest for predominance in the Maratha confederation. He did not, however, join the combined army of Sindia and the raja of Berar in their war against the British in 1803, but after its termination he provoked hostilities which led to his complete discomfiture. At first he defeated a British force that had marched against him under Colonel Monson; but when he made an inroad into British territory he was completely defeated by Lord Lake, and was compelled to sign a treaty which deprived him of a large portion of his possessions. After his death his favourite mistress, Tulsi Bace, assumed the regency, until in 1817 she was murdered by the military commanders of the Indore troops, who declared for the Peshwa on his rupture with the British Government. After their defeat at Mehidpore in 1818, the state submitted by treaty to the loss of more territory, transferred to the British Government its suzerainty over a number of minor tributary states, and acknowledged the British protectorate. For many years afterwards the administration of the Holkar princes was troubled by intestine quarrels, misrule, and dynastic contentions, necessitating the frequent interposition of British authority; and in 1857 the army, breaking away from the chief's control, besieged the British Residency, and took advantage of the mutiny of the Bengal sepoys to spread turbulent disorder over that part of central India. They were subdued and the country was pacified after some fighting; but the relations of subsequent rulers with the British Government have since been frequently unsatisfactory, although no material change has taken place in their status or territorial settlement up to the present time.

Baroda.

The family of the Gaekwar, the hereditary title of the ruling prince of Baroda, was established about the middle of the 18th century in Gujarat, then a province of the Moghal empire on the western sea-coast of India. The founder of this family had been, like the other Maratha chiefs, a commander in the armies of the Peshwa, and, like the others, his descendant succeeded, after some fighting, in winning his independence and consolidating a separate chiefship. During the latter part of the century the Gaekwars contended with varying fortunes against the attempts of their nominal sovereign, the Peshwa, to regain his supremacy, until in 1780 the state's independence was recognized by a treaty made with the British Government, under which that Government afterwards interposed on several occasions to protect the Gaekwar's territory from dismemberment by his rivals, and to support him against other claimants to the rulership. The mutinies and internal disorders, which are ordinary events in the history of these military chiefships, followed in due course; and the British Government, after lending aid to suppress them, applied the usual remedy of placing at the capital a subsidiary force, to be commanded by British officers and maintained by cession of land yielding revenue equal to its cost. The Gaekwar also had to keep up a body of cavalry for co-operation with the British army when required, and for upholding peace and good order within his own dominion.

It is unnecessary to recount the many instances in which maladministration, financial difficulties, and the caprice of successive princes compelled the British Government to interfere during the 19th century, but it must be mentioned that in 1874 Mulhar Rao Gaekwar was deposed, after a formal trial instituted by the Viceroy's order, for proved unfitness and incapacity. The widow of his predecessor was allowed to adopt a child, one of the family, who after the expiry of his minority was placed upon the throne, and has since proved himself a loyal and very capable ruler.

Kashmir.

The territory ruled by the Maharaja of Kashmir, with its tributary chiefships, comprises a wide highland region of 80,000 square miles, situated between the northern frontier of the Punjab and the Mustagh and Karakoram ranges of high mountains which mark the south-west frontier of Chinese Tibet. The early history of this country is obscure, although several invasions by the first Mahommedan conquerors of India are recorded, until the southern portion, Kashmir proper and Jamu, was finally annexed to his Moghal empire by Akbar in 1587. But when Nadir Shah, the Persian, overran northern India and had sacked Delhi in 1735, he afterwards occupied Kashmir, which was incorporated with the kingdom of Kabul, and remained under that sovereignty until the Mahommedan governor of Kashmir revolted and made himself independent in 1809. Ten years later it fell beneath the rising power of the Sikhs, became a province of Ranjit Singh's kingdom in the Punjab, and on the conclusion of the campaign in 1846, in which the Sikh army was defeated after some fierce battles by the British, Kashmir was surrendered to the British Government and transferred as an independent rulership to Raja Golab Singh, the Sikh governor, who had assisted the British forces during the war.

Rajputana.

In the official nomenclature of India Rajputana denotes a group of nineteen states, with varying area and importance, having each its own autonomy and separate chief, whose aggregate territories extend across India from the borders of the North-West Provinces and the Punjab on the east and north to Sind and the Bombay Presidency on the west. To the south Rajputana marches with the states of central India. Sixteen of these states are ruled by chiefs of different Rajput clans, two of them by chiefs of the Ját tribe, and one by a Mahommedan prince. If the three last-mentioned states are for the present set aside, Rajputana may be described as the region within which the Rajput clans have maintained their independence under their hereditary chiefs ever since the Mahommedan irruptions drove them out of northern India to seek fresh settlements in the wilder and less accessible country where they are now found. Here they maintained constant resistance against the Mahommedan powers, until in the 16th century they submitted to the suzerainty of the Emperor Akbar, and began to furnish contingents to the Moghal armies in the incessant wars of the empire. When that empire collapsed the Rajput states were very nearly involved in its ruin, for during the political anarchy of the 18th century they were invaded, pillaged, and almost brought under subjection by the Marathas and other predatory leaders. And although at the beginning of the 19th century the Maratha confederacy was broken up by the British forces, the Rajput states were incessantly harried and plundered by Pindarees and others, until, in 1818, the English Governor-General, Lord Hastings, interfered to save and protect them. Then ensued a great rectification of boundaries and restoration of territory that had been violently seized. The Rajput states made treaties acknowledging the British supremacy, and the whole country has thenceforward enjoyed security, disturbed only by a short period of confusion during the sepoy mutiny of 1857, and by occasional disorders that have arisen out of misrule or disputed successions in particular states.

The geographical position, within Rajputana, of the nineteen states may be roughly given as follows:—In the west and north are Marwar or Jodhpur, Bikanir, Jesulmer, ruled separately by chiefs belonging to the same clan. In the north-east is Alwar and a tract called the Shaikhawati, subject indirectly to Jaipur. Jaipur, Bhartpur and Dholpur (the two Ját states), Karauli, Bundi, Kotah, and Jhalawar may be grouped together as the eastern and south-eastern states. The southern states are Partabgarh, Banswara, Dungarpur, and Meywar or Oodipur, with its subordinate chiefship of Shahpura. Sirohi lies in the south-west corner, Kishangarh near the centre, while the Mahommedan state of Tonk consists of six isolated patches of territory. The Rajput states, ruled by the hereditary chiefs of the clans, represent by far the oldest principalities in India, tracing their origin to a period long anterior to the Moghal empire, whereas we have seen that almost all other states in India arose in the confusion that followed the empire's dissolution. The states of Bhartpur and Dholpur were founded towards the end of the 18th century by families of the Ját tribe, and Tonk is formed out of the lands confirmed in the possession of a famous freebooting leader, Amir Khan, by the British Government in 1817.

Central India.

Under this official heading are grouped a number of states lying to the south and east of Rajputana. They include seventeen principal states, of which the largest are Gwalior and Indore, already noticed separately, and a number of petty chiefships that had been made tributaries to the great Maratha states, but which are now under the immediate protection of the British Government. Many of the minor chiefships belong to Rajput families; others were acquired by Maratha leaders at the time when this part of India had fallen almost entirely under the Maratha domination; and Bhopal was founded early in the 18th century by an Afghan commander in the service of the Moghal emperor. The petty chiefships of Dewas and Dhar are ruled by the descendants of an ancient Maratha family which acquired lands in central India during the 18th century.

At the close, in 1818, of the Pindaree war the whole country that is now under the central Indian agency was in great confusion and disorder, having suffered heavily from the extortions of the Maratha armies and from the predatory bands. It had been the policy of the great Maratha chiefs, Holkar and Sindia, to trample down into complete subjection all the petty Rajput princes whose lands they seized and from whom they levied heavy contributions of money. Many of these minor chiefs had been expelled from their possessions, had taken refuge in the hills and forests, and retaliated upon the Maratha usurpers by wasting the lands which they had lost until the Marathas compounded for peace by payment of blackmail. In this state of affairs all parties agreed to the interposition of the British Government for the restoration of order, and under Lord Hastings the work of pacification was effected. The policy pursued was to declare the permanency of the rights existing at the time of the British interposition, conditionally upon the maintenance of order; to adjust and guarantee the relations of subordinate and tributary chiefs with their

superiors, so as to prevent all further disputes or encroachments; and to settle the claims of the ousted landholders who had resorted to pillage or blackmail, by fixing grants of land to be made to them, or settling the money allowances to be paid to them. The general result was to place all the privileges, rights, and possessions of these inferior chiefs under the guarantee or protection of the British Government, to whom all disputes between the superior and inferior states must be referred, and whose decision is final upon all questions of succession to hereditary rights or rulership.

Other States.

There is also a group of minor states lying along the south-west border of the British North-Western Provinces, in political relation with the Central Indian agency, whose country has the general name of Bundelkhand. In number they are thirty-one, the largest being Rewa; and most of them resemble in origin and formation the states in Rajputana, being ruled by chiefs of dominant Rajput clans. Their history is similar to that of the Central Indian chiefships: they were invaded and partly subdued in the course of the 18th century by the Maratha powers; they suffered much from the confusion of that period, until at the beginning of the 19th century some of them placed themselves under the protection of the British Government; and when, in 1817, the Peshwa ceded all his sovereign rights over this country to the British, a general settlement ensued. Some portions of the territory accrued, by cession or lapse, to the British Government; and all the remaining chiefships were secured in their rights and possession by treaties or grants, or by taking acknowledgments of fealty, on the usual conditions of allegiance and orderly rule.

The very numerous minor states not belonging to the groups that have already been described are all attached, for supervision and immediate control, to the local governments of the British provinces to which they are adjacent, or within whose territories they are enclosed, important political questions being referred to the Government of India. They may be thus classified:—

States in relation with the Punjab, including the petty Himalayan chiefships.

States in relation with the North-West Provinces and Bengal.

States within or attached to the Bombay Province.

States within or adjacent to the Central Provinces.

States within or adjacent to the Madras Province.

The petty chiefships and tribal tracts on the borderland between Burma and China or Siam, and on the north-eastern frontier of Assam, can hardly be reckoned geographically among the native states of India, although they are in political subordination to the nearest local governments, or, as in the case of Manipur, to the Government of India. There are, moreover, some important states situated within the great mountain ranges that separate India from the rest of Asia, which are in treaty relations with the British Government, and over which that Government maintains a protectorate, in the sense of allowing no interference with them by any foreign Power. In this class may be placed Bhotan and Sikkim on the north-east frontier, with Nepal; and Gilgit, Hunza, and Chitral on the extreme north-west frontier of the Indian empire. Between the north-west border of the Punjab province and the kingdom of Afghanistan are the highlands inhabited by various unruly tribes, whom the Indian Government is gradually bringing under some control. And beyond the western frontier of India, extending to the borders of Persia, lies Baluchistan, a wide, sparsely populated region, occupied by tribes under the nominal headship of the khan of Kelat. It may be classed as a protectorate under the superintendence of a British Resident at Quetta, a military station in the British district that has been established at the north-eastern corner of Baluchistan.

Further details concerning the native states will be found under the separate headings. (A. C. L.)

India, French.—This name denotes the French establishments in India—on the Coromandel coast, Pondicherry and Karikal; on the Orissa coast, Yanaon; on the Malabar coast, Mahé; and in Bengal, Chandarnagar. In addition there are a few "lodges" divided among these five districts, but they are merely nominal remnants of French dominion. The total area extends to about 200 square miles, of which 120 square miles belong to the territory of Pondicherry. In 1897 the total population amounted to 283,053, that of Pondicherry being 172,941 (city only, 48,473); of Karikal, 70,526; of Chandarnagar, 24,281; of Mahé, 9978; of Yanaon, 5327. In 1901 the total was only 273,185. By decree of 25th January 1879 French India was provided with an elective general council and elective local councils. The results of this measure have not been very satisfactory, and the qualifications for and the classes of the franchise have been variously modified. The governor resides at Pondicherry, and is assisted by a privy council. There are two tribunals of first instance (at Pondicherry and Karikal), one court of appeal (at Pondicherry), and five justices of the peace. The local budget for 1901 balanced at £78,135. In the colonial budget of France for 1900 the possessions figured for £18,200. The debt (annuity) amounts to £4000. The agricultural produce consists of rice, earth-nuts, tobacco, the betel nut, and vegetables. Earth-nut cultivation is passing through a serious crisis, which has considerably affected the trade of Pondicherry. There are 35,000 head of cattle. Pondicherry manufactures and exports "quinées" and muslins; Karikal, linen cloth; Chandarnagar, jute; Mahé, spirits.

The following table shows the value of the imports and exports in 1898:—

District.	Imports.	Exports.
Pondicherry	£83,000	£231,000
Karikal	36,000	82,800
Chandarnagar	...	...
Mahé	2,400	1,900
Yanaon	3,800	500
Total	£125,200	£316,200

Of the total imports France sent to the value of £82,500; of the total exports she received to the value of £19,600. In 1899 the imports reached a total value of £192,560 (£59,520 from France), and the exports a value of £371,320 (£119,320 to France). The trade with France has declined more rapidly than the general trade, though that has fallen from a total (imports and exports) of £1,020,000 in 1888. British India and Great Britain have a predominating share in both imports and exports. At Pondicherry and Karikal, in 1898, 397 vessels of 543,760 tons entered, and 397 of 543,710 tons cleared.

See HAURIGOT. *French India.* Paris, 1887.—HENRIQUE. *Les Colonies Françaises.* Paris, 1889.—LEE. *French Colonies.* Foreign Office Report, 1900.—*L'Année Coloniale.* Paris, 1900. (P. L.)

Indiana, one of the central states of the American Union, was admitted into the Union in 1816. Then it was the most westerly state on the frontier. The centre of population of the United States now rests within her borders. The soil is fertile, the climate equable, the average temperature being 52° F., and the rainfall $39\frac{26}{100}$ inches per annum.

Population.—The population has increased steadily

from the first, and, as shown by the national census, nearly constantly at the rate of 300,000 in each decade except that ending with 1890. In 1890 the population was 2,192,404, of whom 2,046,199 were native and 146,205 foreign-born. In 1900 it was 2,516,462, showing an increase of 324,058, or 14·8 per cent., as compared with 214,103, or 10·8 per cent., in the preceding ten years. Of the total population in 1900, 1,285,404 (51·1 per cent.) were males, and 1,231,058 (48·9 per cent.) females; 2,374,341 native-born, and 142,121 (5·6 per cent.) foreign-born; 2,458,502 were white, and 57,960 (2·3 per cent.) coloured, of whom 57,505 were negroes, 207 Chinese, 5 Japanese, and 243 Indians. The total land surface is approximately 35,910 square miles, so that the average number of persons per square mile was 70·1 in 1900, as compared with 61·1 in 1890. There were in 1900 42 incorporated places with more than 5000 inhabitants; of these 23 had between 5000 and 10,000 inhabitants, 14 had from 10,000 to 25,000, and 5 had more than 25,000. These 5 were Indianapolis with 169,164, Evansville with 59,007, Fort Wayne with 45,115, Terre Haute with 36,673, and South Bend with 35,999. In 1890 the urban population (persons in cities of 8000 inhabitants or more) was 400,566, or 18·3 per cent. of the total population of the state; in 1900 it was 607,834, or 24·2 per cent. of the total population.

Agriculture.—Agriculture was the first, and remains the chief industry. All kinds of cereals, fruits, and domestic animals, common to the temperate zone, are raised throughout the state. In 1900 there were grown 169,926,921 bushels of corn, and in 1899 31,357,099 bushels of wheat. In 1899 farm products yielded an aggregate value of $167,967,870.

Coal, Gas, and Oil.—Since 1880 great progress has been made in mechanical and mining industries, owing largely to the development of the coal-fields and the discovery of natural gas and petroleum. The coal-fields lie in the south-western part, and have an area of 7560 square miles. The coal is practically inexhaustible, excellent in quality, and finds a ready market in the state, and also in Chicago, St Louis, and other cities. It is a favourite fuel with railway companies. The output was 4,228,086 tons in 1897, 5,177,044 tons in 1898, and 6,283,063 in 1900. Natural gas was discovered in 1884. It was soon ascertained that the field was the largest known in the United States. It covers an area 100 miles long and 70 miles wide, between Indianapolis and Fort Wayne. The gas is found in a porous (Trenton) limestone, at an average depth of 1000 feet. Since 1887 it has been used almost exclusively for fuel and light over the entire field. At first the natural pressure (325 pounds to the square inch) was sufficient to carry it for many miles, and it was supplied through pipes to the towns and cities within 40 or 50 miles of the rim of the reservoir, and used for fuel. Pipe lines also extend to Chicago, Dayton, and other cities, the natural force being supplemented by artificial power. The enormous draft on the reservoir is reducing the pressure and narrowing the area. The state has passed necessary laws to prevent waste. Soon after the discovery of gas, oil was found just underneath it. In popular parlance, "as gas gives out oil comes in." A dead gas well is sometimes turned into a live oil well. On 1st January 1900 there were in the state 5480 wells, producing oil at the rate of 4,912,675 barrels per year. Coal, gas, oil, and other resources, including great beds of Oolite limestone and excellent clays, have since 1880 made Indiana a great manufacturing state. The gas field has become a hive of industry. Glass of all kinds, tin-plate, iron and steel products, wire, nails, tiles, bricks, and many other articles are manufactured.

Manufactures.—The condition of manufacturing industries in 1890 and 1900 is shown in the following general table:—

	1890.	1900.	Per Cent. of Increase.
Number of establishments . . .	12,354	18,015	45·8
Capital . . .	$131,605,366	$234,481,528	78·2
Wage-earners (exclusive of salaried officials, clerks, &c.) .	110,590	155,956	41
Total wages . .	$42,577,258	$66,847,317	57
Miscellaneous expenses	$16,500,903	$33,052,160	100·3
Cost of materials used	$130,119,106	$214,961,610	65·2
Value of products . .	$226,825,082	$378,120,140	66·7

The following table shows the statistics of the leading industries:—

Industry.	Number of Establishments.	Wage-Earners.	Value of Products.
Flouring and grist mill products . . .	897	2,124	$30,150,766
Foundry and machine-shop products . .	337	10,339	17,228,096
Glass	110	13,015	14,757,883
Iron and steel . .	27	7,579	19,338,481
Liquors, distilled and malt	66	1,281	22,738,105
Lumber and timber products	1849	9,503	20,613,724
Slaughtering and meat packing . . .	36	3,597	43,862,273

Railways.—Railway facilities have developed hand in hand with the manufactures. The mileage rose from 4963 in 1880 to 9072 in 1900, and the business has grown in a greater ratio. Nineteen through lines cross the state from east to west, and eight lines from north to south. Over these through lines passes almost the whole of the trans-continental traffic. The gross earnings in the state on domestic and through traffic were reported in 1898 as follows: Local freight traffic, $49,903,808; through freight traffic, $39,127,558; local passenger traffic, $20,827,316; through passenger traffic, $6,235,542.

Valuation, Banks, &c.—The assessed valuation of all property in the state in 1880 was $767,387,172. The appraised value for 1900 was as follows:—

Value of lands	$452,647,064
Improvement on lands	84,058,993
Value of lots	159,572,824
Improvement on lots	162,450,544
Personal property	318,942,386
Railway property	153,938,059
Telegraph, Telephone, Express and Sleeping Car Companies	6,136,828
	$1,337,746,698

The state debt on 1st July 1901 was only $4,204,615. In 1901 there were 123 national banks, with resources amounting to $97,142,000; 104 state banks, with resources amounting to $25,644,273; 29 trust companies, with resources amounting to $12,335,207; 5 savings banks, with resources amounting to $7,237,684; 408 building and loan associations, with resources amounting to $31,435,587. The business done through the Indianapolis clearing-house in 1898 was $272,285,316; in 1899 it was $304,242,272.

Education and Charities.—Education is general and compulsory. In 1901 there were in the state 757,616 persons of school age (between six and twenty-one). All children between seven and fourteen are required to attend public, private, or parochial schools for a period each year not less than the length of the term of the public school in the district in which the child lives, which in 1901 was at least six months. The average length of the annual term throughout the state was 152 school days. Attendance is enforced by truant officers. Out of 720,206 males of voting age, 40,016 were illiterate (unable to write), of whom 7083 were foreign-born and 5042 were negroes. The state maintains graded and high schools, a university at Bloomington, a normal school at Terre Haute, and an agricultural and mechanical school (Perdue) at La Fayette. In 1898 there were twenty-seven higher institutions of learning in the state, with 4422 students and 537 instructors. The state also maintains a school for the orphans of soldiers and sailors. It also maintains four hospitals for the insane, with 3520 inmates; one school for the blind, with 135 inmates; one school for the deaf and dumb, with 336 inmates; one boys' reform school, with 562 inmates; one girls' reform school, with 56 inmates; one prison for confirmed criminals, with 769 inmates; one prison for reforming criminals, with 918 inmates; one women's prison, with 253 inmates. Over all these institutions a state board of charities exercises a general supervision, and also over the gaols and poorhouses throughout the state.

Religion.—In 1900 the number of communicants or members of the principal religious denominations in the state was as follows: Roman Catholic, 145,269; Methodist, 174,862; Baptist, 52,992; Presbyterian, 43,433; Lutheran, 59,697; Disciples of Christ, 92,788; Protestant Episcopal, 5603; Congregational, 3732. The total membership of all denominations was 725,409.

Local Government.—In 1899 the state adopted a new system of local administration, which is still in its experimental stage. In each township the voters elect a board of advisers, in whom is

vested the legislative power of settling the township expenditures for the ensuing year and levying taxes to meet the authorized outlay. In each county a board of seven councillors is elected, with similar powers and duties. These bodies are in fact local legislatures. They sit in public on certain fixed days, and pass the appropriations and levy the taxes for their several localities. Other local officers are charged with executing these laws, but they are prohibited from creating any debts except as authorized by the proper local boards. It is thought that this entire separation of legislative and executive duties will work a reform in the administration of local affairs and conduce to the public welfare.

Since 1860 the population has doubled, and owing to deaths, immigration, emigration, and natural growth, has almost entirely changed; yet the political division of the voters has been so nearly equal that, during the period 1860–1900, each party won the election ten times, and owing to the presence of a small third party neither has generally polled quite 50 per cent. of all the votes cast. In the Presidential election of 1900 the total of votes cast was 664,094, of which 336,063 were Republican and 309,584 Democrat. Constant rivalry and change have resulted in an honest administration of state affairs, and continued interest has not only trained many men to the duties of government and developed them into wider fields of statesmanship, but it has aroused others to activity in literature and art. (A. C. H.)

Indianapolis, the capital and chief city of the state of Indiana, U.S.A., situated in the centre of the state, in 39° 47′ N. lat., 86° 6′ W. long. In 1900 it embraced an area of 17,792 acres. Its population in 1890 was 105,436; in 1900, 169,164, with a death-rate of 16·7. Of the total population in 1900, 17,122 were foreign-born and 15,931 negroes. There were 48,597 persons of school age (5 to 20 years inclusive). Out of 52,544 males of voting age, 2526 were illiterate (unable to write). The streets are broad, well paved, shaded, and are often lined with lawns on either side. The state house and the court house stand in the centre of large squares, and the new post-office building is surrounded by a park. These, with its broad and shady streets and its many parks, aggregating in all over 1200 acres, make it one of the beautiful cities of the United States. The monument erected by the state in the centre of the city at a cost of over half a million dollars, to the memory of her soldiers and sailors of the Civil War, was designed by Bruno Schmidt of Berlin and executed in part by Macmonnies, and is considered to possess fine artistic qualities. There is an art school, and the University of Indianapolis, founded in 1896, has more than a thousand students. In 1900 there were 1910 manufacturing establishments with a capital of $36,828,114, an average number of 25,511 wage-earners (exclusive of salaried officials, clerks, &c.), and products valued at $68,607,579. The most important industry was that of slaughtering and meat packing, with four establishments, 1920 wage-earners, and products valued at $18,382,679. Other important industries with the value of their products were: carriages and waggons, $2,264,928; flouring and grist mill products, $3,820,373; foundry and machine-shop products, $5,733,469.

As a railway centre Indianapolis is one of the leading cities of the Union, owing largely to its geographical position at a point where the roads connecting north and south, east and west, naturally converge. It is estimated that 25,000 passengers daily pass through the Union Station near the heart of the city. The freight traffic is handled on a loop line (the Belt Railway) through the outskirts, over which a million cars pass annually. Indianapolis is the great live-stock market for the Ohio valley, and the third largest in the United States. The railway traffic, together with the introduction of natural gas as a cheap fuel, has given a great impetus to industrial enterprise. In addition to the steam railways, electric street railways diverge from the centre of the city and run to many surrounding towns. The assessed value of real and personal property in 1900, on a basis of about two-thirds of the full value, was $126,675,040, and the total tax rate for all purposes was $19·20 per thousand dollars. The power to create municipal debts is limited by the state constitution to 2 per cent. of the approved value. The debt in 1900 was $2,152,000. The capital invested in manufactures in 1890 was over fifteen million dollars, and the value of the product $36,426,974. (A. C. H.)

Indian Ocean, The, bounded on the N. by India and Persia; on the W. by Arabia and Africa, and the meridian passing southwards from Cape Agulhas; and on the E. by Farther India, the Sunda Islands, West and South Australia, and the meridian passing through South Cape in Tasmania. As in the case of the Atlantic and Pacific Oceans, the southern boundary is taken at either 40° S., the line of separation from the great Southern Ocean, or, if the belt of this ocean between the two meridians named be included, at the Antarctic Circle. It attains its greatest breadth, more than 6000 miles, between the south points of Africa and Australia, and becomes steadily narrower towards the north, until it is divided by the Indian peninsula into two arms, the Arabian Sea on the west and the Bay of Bengal on the east. Both branches meet the coast of Asia almost exactly on the Tropic of Cancer, but the Arabian Sea communicates with the Red Sea and the Persian Gulf by the Straits of Bab-el-Mandeb and Ormuz respectively. Both of these, again, extend in a north-westerly direction to 30° N. Murray gives the total area, reckoning to 40° S. and including the Red Sea and Persian Gulf, as 17,320,550 English square miles, equivalent to 13,042,000 geographical square miles. Karstens gives the area as 48,182,413 square kilometres, or 14,001,000 geographical square miles; of these 10,842,000 square kilometres, or 3,150,000 geographical square miles, about 22 per cent. of the whole, lie north of the equator. For the area from 40° S. to the Antarctic Circle, Murray gives 9,372,600 English square miles, equivalent to 7,057,568 geographical square miles, and Karstens 24,718,000 square kilometres, equivalent to 7,182,474 geographical square miles. The Indian Ocean receives few large rivers, the chief being the Zambezi, the Shat-el-Arab, the Indus, the Ganges, the Brahmaputra, and the Irawadi. Murray estimates the total land area draining to the Indian Ocean at 5,050,000 geographical square miles, almost the same as that draining to the Pacific. The annual rainfall draining from this area is estimated at 4380 cubic miles.

Relief.—Large portions of the bed still remain unexplored, but a fair knowledge of its general form has been gained from the soundings of H.M.S. *Challenger*, the German *Gazelle* Expedition, and various cable ships, and in 1898 information was greatly added to by the German *Valdivia* Expedition. A ridge, less than 2000 fathoms from the surface, extends south-eastwards from the Cape (see ATLANTIC OCEAN). This ridge, on which the Crozet Islands and Kerguelen are situated, is directly connected with the submarine plateau of the Antarctic. From it the depth increases north-eastwards, and the greatest depression is found in the angle between Australia and the Sunda Islands, where "Wharton deep," below the 3000-fathom line, covers an area of nearly 50,000 square miles. Immediately to the north of Wharton deep is the smaller "Maclear deep," and the long narrow "Jeffreys deep" off the south of Australia completes the list of depressions below 3000 fathoms in the Indian Ocean. The 2000-fathom line approaches close to the coast except (1) in the Bay of Bengal, which it does not enter; (2) to the south-west of India along a ridge on which are the Laccadive and Maldive Islands; and (3) in the Mozambique Channel, and on a bank north and east of Madagascar, on which are the Seychelles, Mascarene Islands, and other groups.

Islands.—Like the Pacific, the Indian Ocean contains more islands in the western than in the eastern half. Towards the centre, the Maldive, Chagos, and Cocos groups are of characteristic coral formation, and coral reefs occur on most parts of the tropical coasts. There are many volcanic islands, as Mauritius, the Crozet Islands, and St. Paul's. The chief continental islands are Madagascar, Sokotra, and Ceylon. Kerguelen, a desolate and uninhabited island near the centre of the Indian Ocean at its southern border, is noteworthy as providing a base station for Antarctic exploration.

Volume and Mean Depth.—The greatest depth hitherto recorded is 3232 fathoms, by the *Valdivia*, in 18° 18′ S. and 96° 20′ E. Karstens gives the total volume of the ocean down to 40° S. as 187,396,627 cubic kilometres, or 29,352,683 (geographical) cubic miles, whence he obtains a mean depth of 2216 fathoms. Calculating for the area down to 66½° S., he finds the volume to be 266,354,254 cubic kilometres, or 41,720,132 cubic miles, giving a

mean depth of 1997 fathoms. Murray's value for the total volume (to 40° S.) is 44,446,700 (English) cubic miles, giving a mean depth of 2286 fathoms. For the areas and depths at different levels Murray gives the following:—

Depth (Fathoms).	Area (Square Miles).	Volume (Cubic Miles).
0–100	979,500	1,910,300
100–500	809,100	7,243,800
500–1000	551,700	8,720,100
1000–2000	1,596,950	16,416,100
2000–3000	13,344,600	10,153,550
3000–4000	38,700	2,850
	17,320,550	44,446,700

Deposits.—The bottom of the Bay of Bengal, of the northern part of the Arabian Sea, of the Red Sea and the Persian Gulf, and of the narrow coastal strips on the east and west sides of the ocean, are chiefly covered by blue and green muds. Off the African coasts there are large deposits of Glauconitic sands and muds at depths down to 1000 fathoms, and on banks where coral formation occurs there are large deposits of coral muds and sands. In the deeper parts the bed of the ocean is covered on the west and south by Globigerina ooze, except for an elongated patch of red clay extending most of the distance from Sokotra to the Maldives. The red clay covers a nearly square area in the eastern part of the basin bounded on two sides by the Sunda Islands and the west coast of Australia, as well as two strips extending east and west from the southern margin of the square along the south of Australia and nearly to Madagascar. In the northern portion of the square, north and east of Wharton deep, the red clay is replaced over a large tract by Radiolarian ooze.

Temperature.—The mean temperature of the surface water is over 80° F. in all parts north of 13° S., except in the north-west of the Arabian Sea, where it is somewhat lower. South of 13° S. temperature falls uniformly and quickly to the Southern Ocean. Between the depths of 100 and 1000 fathoms temperature is high in the north-west, and in the south centre and south-west, and low in the north-east, the type of distribution remaining substantially the same. At 1500 fathoms temperature has become very uniform, ranging between 35° and 37° F., but still exhibiting the same type of distribution, though in a very degenerate form.

Salinity.—The saltest surface water is found in (*a*) the Arabian Sea and (*b*) along a belt extending from West Australia to South Africa, the highest salinity in this belt occurring at the Australian end. South of the belt salinity falls quickly as latitude increases, while to the north of it, in the monsoon region, the surface water is very fresh off the African coast and to the north-east. Little is known with certainty about the distribution of salinity in the depths, the number of trustworthy observations available being still very small. Probably the northern and north-eastern region, within the monsoon area, contains relatively fresh water down to very considerable depths.

Circulation.—North of the equator the surface circulation is under the control of the monsoons, and changes with them, the currents consisting chiefly of north-east and south-west drifts in the open sea, and induced streams following the coasts. During the northern summer the south-west monsoon, which is sufficiently strong to bring navigation practically to a standstill except for powerful steamers, sets up a strong north-easterly drift in the Arabian Sea, and the water removed from the east African coast is replaced by the upwelling of cold water from below; this is one of the best illustrations of this action extant. Along the line of the equator the *Indian counter-current* flows eastwards all the year round, acting as compensation to the great *Equatorial current* flowing westwards between the parallels of 7° and 20° S. The equatorial current, on meeting the northern extremity of Madagascar, sends a branch southwards along the east coast of that island, sometimes called the *Mascarene current.* When the main equatorial current reaches the African coast a minor stream is sent northwards to the source of the Indian counter-current, but the discharge is chiefly by the *Mozambique current*, which south of Cape Corrientes becomes the *Agulhas current*, one of the most powerful stream currents of the globe. On the west coast of Madagascar and on the banks off the African coast south of 30° S., reaction currents or "back-drifts" move in the opposite direction along the flanks of the Agulhas current; these back-drifts are of great importance to navigation. On clearing the land south of the Cape the waters of the Agulhas current meet those of the *west wind drift* of the Southern Ocean, and mingle with them in such a manner as to produce, by interdigitation, alternate strips of warm and cold water, which are met with at great distances south-west and south of the Cape. Between South Africa and Australia the waters form a part of the great west wind drift. The waters of this drift are, in general, of very low temperature, but it is remarkable that the interdigitation just mentioned continues far to the eastward, at least as far as Kerguelen. This fact is probably due partly to the actual intrusion of warm water from the Mascarene current east of Madagascar, and partly to the circumstance that the different temperatures of the waters are so compensated by their differences of salinity that they have almost precisely the same specific gravity *in situ*. The west wind drift sends a stream northwards along the west coast of Australia, the *West Australia current*, the homologue of the Benguela current in the South Atlantic. The principal feature in the circulation in the depths of the Indian Ocean is a slow movement of Antarctic water northwards along the bottom to take the place of that removed from the surface by evaporation, and by currents in the lower latitudes. Little is known beyond the bare fact that such movement does take place.

(H. N. D.)

Indians, North American.—The last quarter of the 19th century was marked by a few significant uprisings among the Indian tribes of the United States. The year 1875 closed with the Indians generally peaceable, although trouble had been anticipated with mixed bands of Sioux, under Sitting Bull, who had refused to recognize Federal authority, and who for some years had been leading a roving life, plundering and murdering settlers and extending their hostility to friendly tribes. This force, numbering 3000, was augmented from time to time; and early in 1876, owing primarily to infraction of treaty stipulations by the white invasion due to the discovery of gold in the Black Hills, a large number of starving Sioux fled from their agencies and joined the hostiles. As the Indians refused to return to their reservations when so ordered, the matter was placed in the hands of the War Department, 1st February 1876.

Sioux rising of 1876.

Under the leadership of Sitting Bull, Crazy Horse, and others, the uprising assumed a more general nature by the enlistment of the northern Cheyennes in the Sioux cause. The first blow was struck by Crook, who surprised the camp of Crazy Horse, 16th March, and destroyed 110 lodges and other property. Later a force of about 2700 men (besides the Crow scouts), in three columns, under Terry, Gibbon, and Crook, was made ready; and on 17th June the last mentioned, with 1000 men, met the enemy near Rosebud river, and after fighting for six hours the Indians retired. On 22nd June Custer, with 7th cavalry, was sent up the Rosebud, and continued up that stream until the evening of the 24th, the next morning passing over the divide to the Little Big Horn, where the Sioux were discovered. Custer divided his regiment into four commands, his own comprising 262 men. Continuing a few miles down stream, he soon came upon what was supposed to be a single Sioux village, and began to attack its lower end; the Indians, however, proved to number from 8000 to 10,000, including 2500 to 3000 warriors. Custer's little force was soon completely surrounded, and the entire command, save a single Crow scout, was slaughtered. The Indians now separated into two bands, under Sitting Bull and Crazy Horse, who were soon reinforced by other reservation Indians. Fresh troops were hurried forward. On 29th September a band under American Horse was defeated and their leader killed. In October Sitting Bull was pursued by Colonel Miles for 40 miles, and by the close of the month about 5000 Indians surrendered. The campaign continued throughout the winter and early spring under Crook and Miles, and several fights occurred, in which the Indians suffered severely. In March 1877 300 surrendered, and these were followed on 22nd April by 2000 under Crazy Horse. Sitting Bull, however, eluded capture, and crossing the Canadian border was soon largely reinforced. This warrior held out defiantly until 1880, when he returned to Dakota with his 2856 followers and surrendered. One of the immediate effects of the beginning of this revolt was the appointment of a commission which negotiated for the surrender of the Black Hills country. The treaty was approved by Congress on 28th February 1877.

Trouble in Idaho.

Before the conclusion of difficulties with the Sioux trouble was experienced with the Nez Percés of northern Idaho, the course of which was similar to that of most of the Indian hostilities—the discovery of gold, the influx of miners and settlers, the establishment of towns on Indian lands, the confiscation of Indian property. To regulate the difficulties a series of treaty commissions was appointed, which succeeded in effecting a reduction of the Indian tribal lands, although the action was bitterly opposed by a non-treaty element of the tribe. Such, in brief, were the transactions up to 1875; then a member of the band of chief Joseph, the leader of the non-treaty Nez Percés, was killed by whites, and the Indians are said to have made depredations on the crops of the latter; while a

native religious sect, known as Dreamers, under the leadership of Smohalla, tended to widen the breach. Matters grew so serious that, in October 1876, another commission was appointed, and in December it recommended that the medicine-men be ordered to their reservation, that Wallowa valley be occupied by the military, and that Joseph and his band be placed on Lapwai reserve. These recommendations were adopted, and a force was despatched under General O. O. Howard. In May 1877 he held three councils with the discordant Indians, and even induced them to visit Lapwai reserve to select their lands; but when the time came for leaving their ancestral home, although Joseph used his influence to avert the clash, open hostilities began on 14th June by the massacre of twenty-one white men and women in revenge for the recent murder of one of the Nez Percés by white robbers. From this time the fighting between Joseph's hundred warriors and the troops was brave, though severe; but surrounded by an overwhelming and well-equipped force, hindered in their movements by 350 helpless women and children, and discouraged by the loss of some of their leaders, the struggle ended on 5th October, after a retreat of over a thousand miles, probably unequalled in Indian warfare, by the surrender of almost the entire force to Colonel Miles on condition that they were placed on Lapwai reserve. Regardless of this agreement, the surrendered Nez Percés were sent to Quapaw Agency, Indian Territory, whence, after seven years of delay, and the loss by death of nearly two-thirds of the band, they were returned to the north-west.

These experiences seemed to be of little avail in causing the Government to carry out its treaty obligations; consequently there were outbreaks by the Indians, owing mainly to the loss of their hunting lands, the diminution of the bison herds, and the failure of Congress to render timely relief. It was principally these causes which led to the Bannock outbreak of 1877, their trouble, like that of the Nez Percés, being of long standing. The climax was almost reached early in the year named, when, during the exciting times of the Nez Percés war, the Bannocks were forced to remain on their inhospitable reservation, to face the continued encroachment of the whites, and to subsist on goods provided from an appropriation amounting to $2\frac{1}{2}$ cents per capita per diem. During the summer a drunken Indian of the tribe shot and wounded two teamsters; the excitement and bitter feeling caused by his arrest on 23rd November resulted in the killing of an agency employee. Troops were called for, and the murderer was pursued, captured, tried, and executed. This so increased the excitement of the Indians that, fearing what was assumed to be threatening demonstrations, the troops surrounded and captured two Bannock camps in January 1878; but most of the Indians were afterwards released. On account of insufficient food the Bannocks left the reservation in the spring and went to Camas prairie, where they killed several settlers. A vigorous campaign under General Howard resulted in the capture of about a thousand of them in August, and the outbreak came to an end after a fight, 5th September, at Clark's Ford, where twenty Bannock lodges were attacked, and all the women and children killed.

Bannock outbreak.

After the close of the Sioux outbreak of 1876–77 the Northern Cheyennes, numbering 937, who participated with the Sioux in that rebellion, were sent to Indian Territory. Early in September 1878 about 300 of these Indians, dissatisfied with their new quarters, left the reservation, determined to rejoin the Sioux. In passing through Kansas they killed more than forty whites, and committed other outrages. They were pursued, and 150 were captured and confined at Fort Robinson, Nebraska, whence it was decided to return them to Indian Territory, a plan to which the Indians refused to agree. After starving and freezing for several days, they made a desperate attempt to escape in June 1879, when nearly all were killed. The survivors were sent back to Indian Territory.

In July 1879 about 100 men of the White River Agency, Colorado, roamed from their reservation into southern Wyoming to hunt. During this time some forests were fired by railway tiemen, resulting in great loss of timber, and calling forth complaint against the Indians, who were ordered to remain henceforth on their reservation. In September the agent, Meeker, was assaulted after a quarrel with a petty chief, and requested military aid, which was granted. Orders were later issued for the arrest of the Indians charged with the recent forest fires, and Major Thornburgh was sent with a force of 190 men. Suspecting the outcome, the Indians procured ammunition from neighbouring traders, and informed the agent that the appearance of the troops would be regarded as an act of war. On 20th September Thornburgh's detachment was ambushed, and their leader and thirteen men were killed. The command fell back. On 2nd October a company of cavalry arrived, and three days later Colonel Merritt with 600 troops reached the scene. At or near the agency the bodies of Meeker and seven employees were found; all but one of the agency buildings had been rifled and burned. The conflict was soon ended, mainly through the peaceful attitude and influence of chief Ouray.

Ever since they have been known to history the various bands of Apaches have been hostile in character; and although some of their raids have seemingly been unprovoked, the most serious outbreaks in modern times have been attributable to mismanagement on the part of the civil authorities. The most important series of outbreaks during this period was by the Chiricahua band under Cochise, and later Victorio, who, together with 500 Mimbreños, Mogollones, and Mescaleros, were assigned, about 1870, to the Ojo Caliente reserve, New Mexico. Cochise, who had repeatedly refused to be confined within reservation limits, fled with his band, but returned in 1871, at which time 1200 to 1900 Apaches were on the reserve. Complaints by neighbouring settlers caused their removal to Tularosa, some distance north-westwards, but a thousand fled to the Mescalero reserve on the Pecos river, while Cochise left on another raid. Efforts of the military agent in 1873 to compel the restoration of some stolen cattle caused all (then numbering 700) again to decamp, but they were soon captured. Following the wishes of the Indians, they were returned to Ojo Caliente in 1874. Soon afterwards Cochise died, and the Indians began to show such interest in agriculture that by the following year there were 1700 Apaches at Ojo Caliente, and no depredations were reported. In 1876 the Chiricahua reservation in Arizona was abolished, and 325 of the Indians were removed to the San Carlos agency; others joined their kindred at Ojo Caliente, while some either remained in the mountains of their old reservation, or fled across the Mexican border.

Apaches.

This removal of Indians from their ancestral homes was in pursuance of a "policy of concentration." The cost of the experiment is difficult to estimate; the expense of the campaigns which followed during the next ten years of warfare amounted to millions of dollars, while fortunes were lost in the destruction of property, and hundreds of lives were sacrificed on both sides. This policy was thoroughly tested in the Chiricahua removal in Arizona, for in April 1877 Geronimo and other chiefs, with the remnant of the band left on the old reservation, and evidently the Mexican refugees, began depredations in southern Arizona and northern Chihuahua; but in May 433 were captured and returned to San Carlos. At the same time, the policy of concentration was applied to the Ojo Caliente Apaches of New Mexico, who were making good progress in civilized pursuits, but when the plan was put in action only 450 of the 2000 Indians were found, the remainder forming into predatory bands under Victorio. In September 300 Chiricahuas (mainly of the Ojo Caliente band) escaped from San Carlos, but surrendered after many engagements. These were returned to Ojo Caliente, but they soon ran off again. In February 1878 Victorio surrendered, in the hope that he and his people might remain on their former reservation. Instead of this, another attempt was made to force the Indians to go to San Carlos, with the same result. In June the fugitives again appeared at the Mescalero agency, and arrangements were at last made for them to settle there; but the civil authorities finding indictments against Victorio and others, charging them with murder and robbery, this chief with his few immediate followers, and some Mescaleros, fled from the reserve and resumed marauding. There was the usual call for an increased force of military, but the skirmishes in which they were engaged with the Chiricahuas met with remarkable success for the latter, while seventy settlers were murdered during a single raid. Thus encouraged, Victorio was joined before April 1880 by 350 Mescaleros and Chiricahua refugees from Mexico, and the repeated raids which followed struck terror to the inhabitants of New Mexico, Arizona, and Chihuahua. On 13th April 1000 troops under Colonel Hatch arrived, and these were later greatly augmented. Victorio's band was frequently encountered by overwhelming forces, and although supported during most of the time by only 250 or 300 warriors, this warrior usually inflicted severer punishment than he suffered. In these raids 200 citizens of New Mexico, and as many more of Mexico, were killed. At one time the band was virtually surrounded by a force of over 2000 cavalry and several hundred Indian scouts; but Victorio eluded capture and fled across the Mexican border, where his bloody campaign was continued. Pressed on both sides of the international boundary, and at times harassed by American and Mexican troops combined, Victorio finally suffered severe losses and his band became divided. In October 1880 Mexican troops, under Colonel Terrazas, encountered Victorio's party, comprising 100 warriors, with 400 women and children, at Tres Casillos. The Indians were surrounded and attacked in the evening, the fight continuing throughout the night. In the morning the ammunition of the Indians became exhausted, and although rapidly losing in strength, the remnant refused to surrender, until Victorio, who had been wounded several times, finally fell dead. This disaster to the Indians did not quell their hostility. Victorio was succeeded by Nana, who collected the divided force, received reinforcements from the Mescaleros and the San Carlos Chiricahuas, and between July 1881 and April 1882 continued the raids across the border, but was again driven back into Chihuahua.

The policy of concentration.

While these hostilities were in progress in New Mexico and

Chihuahua, the Chiricahuas of San Carlos were striking terror in the settlements of Arizona. In 1880 Juh and Geronimo, with 108 followers, were captured and returned to San Carlos, and in June 1881 trouble arose among the White Mountain Apaches on Cibicu Creek, owing to a medicine-man named Nakaidoklini, who claimed the power to revive the dead—for a consideration. Being liberally compensated, the prophet began the incantations that were to fulfil his predictions. His adherents waited the resurrection until August, when Nakaidoklini avowed that the dead refused to return because of the presence of whites. As affairs were assuming a serious aspect, the prophet's arrest was ordered. He surrendered quietly, but as the troops were making camp the scouts and many other Indians opened fire on them. After a sharp fight Nakaidoklini was killed and his adherents were repulsed. Skirmishes continued during the next day, but the troops were reinforced, and the Indians soon surrendered in small bands. Two chiefs, known as George and Bonito, who had not been engaged in the White Mountain troubles, surrendered to General Wilcox, 25th September, at Camp Thomas, but were paroled. On 30th September Colonel Riddle was sent to bring these chiefs and their bands back to Camp Thomas; but they became alarmed and fled to the Chiricahuas, seventy-four of whom left the reserve, and, crossing the Mexican border, took refuge with the late Victorio's band in Chihuahua. During the same year Nana (Victorio's successor) made one of his bloody raids from across the line, and in September Juh and Nahchi, with a party of Chiricahuas, again fled from the reservation, and were forced by the troops into Mexico, where, in April 1882, they were joined by Geronimo and the rest of the hostile Chiricahuas of San Carlos, with Loco and his Hot Springs band.

Depredations in Arizona.

The depredations committed in northern Chihuahua under Geronimo and other leaders were perhaps even more serious than those within the limits of the United States. In March 1883 Chato, with twenty-six followers, made a dash into New Mexico, murdering a dozen persons. Meanwhile the white settlers on the upper Gila consumed so much of the water of that stream as to threaten the Indian crops; then coal was discovered on the reservation, which brought an influx of miners; and investigation by the Federal grand jury of Arizona on 24th October 1882, showed that, in the management of Indian affairs on San Carlos reservation, "fraud, peculation, conspiracy, larceny, plots and counterplots seem to be the rule."

Meanwhile General Crook had been assigned the task of bringing the raiding Apaches to terms by co-operating with the Mexican troops of Sonora and Chihuahua. In May 1883 Crook crossed the international boundary to the headwaters of the Rio Yaqui with 50 troops and 163 Apache scouts. On the 13th the camp of Chato and Bonito was discovered, and attacked with some loss. By employing two captives as emissaries, communication was soon had with the others, and by 29th May 354 Chiricahuas had surrendered.

On 7th July the War Department assumed police control of the San Carlos reservation, and on 1st September the Apaches were placed under the entire charge of General Crook, who began to train them in the ways of civilization, with such success that in 1884 over 4000 tons of grain, vegetables, and fruits were harvested. In February 1885 Crook's powers were curtailed; this led to conflict of authority between the civil and military officers, but before matters could be adjusted half the Chiricahuas left the reservation in May and fled to their favourite haunts. Troops and Apache scouts were again sent forward, and many skirmishes took place, but the Indians were wary, and again Arizona and New Mexico were thrown into a state of excitement and dread by raids across the American border, in which seventy-three white people and many friendly Apaches were killed.

In January 1886 the American camp, under Captain Crawford, was attacked through misunderstanding by Mexican irregular Indian troops, resulting in Crawford's death. By the following March the Apaches became tired of the war and asked for a parley, which Crook granted as formerly; but before the time for the actual surrender of the entire force arrived the wily Geronimo changed his mind, and with his immediate band again fled beyond reach. This led to severe criticism of Crook's policy. He was consequently relieved, at his own request, in April, and to General Miles was assigned the completion of the task. Geronimo and his band finally surrendered, 4th September 1886, and with numerous friendlies were sent to Florida as prisoners. They were later taken to Fort Sill, Oklahoma, where, now numbering 298, they are making progress towards civilization. Some of the malcontents were never captured, but remained in the mountains, and as late as November 1900 manifested their warlike propensity in a fight with Mormon settlers; but Apache hostility in Arizona and New Mexico has entirely ceased.

No further trouble of a serious nature was experienced among the Indians until 1890, in which year occurred the so-called Sioux outbreak, which culminated in the tragedy of Wounded Knee. This difficulty was due in part to a religious excitement, known as the ghost-dance craze, which had its origin in the dream of a Paiute Indian of Nevada, and which spread from the Canadian boundary to Oklahoma; and secondarily, to the failure on the part of the Government to fulfil its treaty stipulations in the matter of rations. By October 1890 it was reported that some of the Sioux, under the influence of the noted Sitting Bull, had become excited over the prediction of an approaching millennium, or "return of the ghosts," when the white people would be annihilated; but to bring about this result the Indians must believe and organize the ghost-dance. By 13th November, some of the agents having lost control owing to the excitement caused by the new doctrine, the War Department assumed authority. On 15th November the agent at Pine Ridge became panic-stricken and sent for troops, and soon there were nearly 3000 soldiers in the Sioux country. The appearance of the military was a signal for the flight to the Bad Lands of 1500 Indians, who were soon followed by others, until 4000 had left their agencies. As Sitting Bull still continued the ghost-dance, his arrest was planned. On 15th December Indian police surrounded his house, when he agreed to surrender, but the gathering of his immediate followers encouraged him to change his mind; he defied arrest; one of his friends shot a policeman, and Sitting Bull himself, his son, and seven others were killed in return, the Indian police losing six. The killing of Sitting Bull resulted in the stampede of another party, but they were overtaken. An attempt to disarm them on the morning of 29th December at Wounded Knee Creek, a few miles from the Pine Ridge agency, led to a hand-to-hand encounter, in which nearly every Indian warrior and a number of their women and children fell. The women and children who survived the first volleys were pursued by the troops for two miles, their dead bodies littering the way. Of the 370 members of Big Foot's band, including all ages and both sexes, about 300 were killed. This broke the backbone of the outbreak. The remaining Indians surrendered 16th June 1891, and thus was ended what, in all probability, will be the last experiment in warfare by the Sioux.

"Wounded Knee" tragedy.

The last Indian trouble occurred among the hitherto friendly Pillager Chippewas of Leech Lake, Minnesota. In 1889 the Chippewas ceded large tracts of valuable pine land on the representation that the sale of the timber would yield them a large fund. In the course of time three boards of appraisers were appointed, their expenses, payable from the Indian funds, amounting to $280,000, the only return which the Indians received being an appraisal of their timber at from a fourth to a half of its value. Then authority was granted to white lumbermen to dispose of only "dead and down timber," but green timber was cut in enormous quantities at the expense of the Indians, while groves were burned to bring the trees nominally under the head of "dead" timber. In further justification of their final protest against white interference, it was officially announced that wholesale arrests of the Chippewas were made for the sake of the fees which accrued to the state officials, and that Indians had been helped to obtain whisky by those who arrested them for using it. It was an arrest of this sort in September 1898 that led to the rescue of the prisoners by a number of their relatives, the result of which was the issuing of warrants against the Indians who had thus defied the law. Councils were held by the Chippewas, at which the decision was reached not to surrender the men wanted by the court officials. On 3rd October, special Government agents having reached the scene, a general council was called, with assurance that none who attended would be arrested. Meanwhile troops had arrived to quell any threatened disturbance and to aid the sheriff in making the arrest. The accidental discharge of a gun by a soldier on 5th October caused some Indians secreted in the woods to open fire, killing Major Wilkinson and several soldiers. On the following day additional troops arrived, another council was held, and difficulties came to an end with the arrest and moderate punishment of most of those for whom warrants had previously been issued.

Chippewa disturbance.

Such is the history of the strife between the Indian and the white man during the last quarter of the 19th century. It has been seen that, in addition to delays on the part of the United States Congress in fulfilling its treaty obligations, the cause of many of the outbreaks was due to the fact that the Indian had too often failed to receive the sympathy which his savage state should have inspired in his civilized neighbour; again, as has been officially recognized, corrupt and ignorant agency employees frequently promoted discontent among their charges, while changing administrations often caused changes in the Indian service at times when men of experience were greatly needed. For these and other reasons there was for many years no definite policy on the part of the

United States Government for solving what became known as the Indian question. Indeed, as late as 1876 it was officially declared that "the fundamental difficulty in our relations hitherto with Indians has been the want of a well-defined, clearly-understood, persistent purpose on the part of the Government." Nevertheless, it was not until 1887 that any definite plan for the civilization of the Indian was adopted, although much had been accomplished towards his education. At one time the policy was to concentrate all the Indians within the limits of the United States on three great reservations, an expansion of the plan adopted earlier in the century, which set aside for the use of the eastern Indians the former "Indian country," which in after years became restricted to the Indian Territory. The sentiment in regard to great reservations, however, gradually weakened, until in 1878 it was proposed to concentrate the Indians on smaller reservations, "where they might be more readily protected in their property rights," their vacated lands to be sold for their benefit. But gradually a feeling against the entire reservation system arose, and grew in strength from year to year, until finally definite action was taken by Congress 8th February 1887, which has had greater effect than any other towards dissolving tribal relations. This was the enactment of the "land severalty" law, which, as amended in 1890, provides for the survey of reservations and the allotment to each person of a tract ranging from 40 to 160 acres. The law also provides for doubling the allotments when the land is found valuable only for grazing, and the sale of the remainder to white settlers. Provision is also made that after receiving such land allotments the Indians are declared citizens. Allotments in severalty had been made to various Indians under treaty provisions and congressional enactments, but it is under the law of 1887 that most of the allotments have been made. To 30th October 1900, 6,736,504 acres had been allotted to 56,996 Indians. With the general allotment law in operation, the way was clear for the final abolishment of the reservation and agency systems. All subsequent laws and treaties have had these ends in view.

The Indian question.

Land Severalty law, 1890.

Ever since the establishment of the Government, interest in the education of the Indians has been felt, and as treaties were made and ratified, funds were sometimes provided for this purpose. Reservation boarding-schools were founded in 1865; in 1870 Congress appropriated $100,000 for Indian education. In 1877, $20,000 was appropriated for the support of Indian schools; and in 1878, $30,000 was granted for that purpose. In the latter year 103 Indian children were received at Hampton Institute, Virginia; and on 1st November 1879, Lieutenant R. H. Pratt opened an Indian school at Carlisle Barracks, Pennsylvania, with 158 children. This was the beginning of the now well-known Carlisle school, which in 1900 had an enrolment of 1080 Indian pupils. The Indians are given a common school and industrial education, and an effort is made to equip each pupil with means for self-support. Unfortunately, many of the Indians on returning to their homes, owing to the lack of demand for their acquired knowledge, lapse into the primitive ways of their fathers. One of the features of the Carlisle school is its "outing system," by which pupils are employed by farmers and others as labourers, domestic servants, &c. In 1890, 807 youths were employed during the summer, and 316 during the winter season. The earnings of the pupils during this year amounted to $27,255. One of the objects of establishing the school at Carlisle was its remoteness from tribal influence and its proximity to civilization, where constant object-lessons might be taught. For the same reason other non-reservation schools were established at various points between 1880 and 1898, so that by June 1900 25 such schools were in operation, with 7430 pupils enrolled. In addition, there were 81 reservation boarding-schools with an enrolment of 9604, and 147 day schools with 5090 pupils. Contracts are also made with public schools in various localities; in these there are 246 children. In the boarding-schools of all classes the average attendance increased from 3077 in 1882 to 17,708 in 1900; in the day schools the increase was from 1637 to 3860 during the same period. In 1900 there were also 884 children in various contract schools, mainly sectarian in character. In addition, there are 22 reservation mission schools, with an average attendance of 946 boarding pupils and 193 day pupils.

Education.

In the education of its Indian wards Congress has been liberal. From 1877, when the first regular appropriation of $20,000 for Indian schools was made, until 1900–1, when $3,087,367 was allotted for Indian schools alone, more than $35,000,000 has been expended in this direction. Of the estimated 268,000 Indians within the limits of the United States, 45,270 (exclusive of school-children) are supported entirely by rations issued at public expense, while 12,570 are partially supported. Almost without exception these Indians formerly gained their livelihood through bison-hunting. Apart from the cost of supporting these dependent people, which amounts to about $1,250,000 per annum, the ration system tends to encourage idleness, and thus to retard advancement towards enlightenment. Again, mainly in pursuance of treaty stipulations from time to time during the century, but also through interest on trust funds (amounting to $33,317,955) and moneys derived from grass-land leases, &c., annuities are paid to Indians, which range in sums per capita from 50 cents to $255 per annum; these annuitants number 63,495, and the aggregate sum paid them in 1900 was $1,507,542. Owing to the evils arising from the prospective payments from time to time, the present policy is gradually to extinguish the trust funds, just as the policy for years has been to dissolve the reservation system by allotting lands in severalty.

Federal support.

While the Government has been responsible for many Indian revolts and their terrible consequences, it must not be assumed that the United States has been illiberal in its support of its Indian wards, for the total expenditure on account of the Indian service (exclusive of the vast sums expended in the prosecution of warfare against the tribes) from 1789 to 1900 has reached the enormous sum of $368,358,217, although a goodly proportion of this sum has been devoted to the purchase of tribal lands.

In order to render an idea of the progress of the United States reservation Indians in the pursuits of civilization, the following statistics for 1899 are given:—Land cultivated, 334,666 acres; land under fence, 1,657,143 acres; corn raised, 1,386,977 bushels; wheat, oats, and barley raised, 1,832,507 bushels; vegetables raised (exclusive of melons and pumpkins), 445,935 bushels; hay produced, 250,231 tons; lumber sawn, 5,917,000 feet; timber marketed, 68,678,795 feet; wood cut, 91,023 cords; horses, mules, and asses owned, 298,277; cattle owned, 325,898; swine owned, 50,216; sheep owned, 1,100,912; goats owned, 257,445; domestic fowls owned, 222,047; earnings from freightage, $91,768; value of products of labour sold, $1,324,103.

Current progress.

The total number of Indians in the United States in 1890 was 273,607; in 1900 it was 266,760. In 1890 the number of "Indians

not taxed," that is, of Indians living in tribal relations, was 189,447; in 1900 it had fallen to 129,518. In 1890 the number of "Indians taxed," that is, of Indians found living among the general population, and therefore liable to taxation, was 84,160; in 1890 the number had grown to 137,242, a large increase, especially in view of the fact that the total number of Indians had somewhat decreased. The states and territories which contained the largest numbers of Indians in 1900 were as follows:—Indian Territory, 52,500; Alaska, 29,536, including 2499 of mixed parentage (descendants of native Indians and Russians); Arizona, 26,480; South Dakota, 20,225; California, 15,377; New Mexico, 13,144; Oklahoma, 11,945; Montana, 11,343; Washington, 10,039; Minnesota, 9182; Wisconsin, 8372.

The following is a list of the principal tribes within the limits of the United States, Canada, and Mexico. Mexico has no reservation system, its numerous Indians (statistics of the population of whom are untrustworthy) being regarded as citizens of the Republic:—

Indian Tribes of America North of Mexico with Population of 500 *or more.*

Tribe.	Stock.	Situation and Population.
Abnaki	Algonquian	1182 in Canada, 625 in Maine. Total 1807.
Aht	Wakashan	Includes several small divisions on Vancouver Island and the Makah in Washington. Population 3600.
Algonkin	Algonquian	400 in Ontario, about 4400 in Quebec. Total 4800.
Apache	Athapascan	298 Chiricahua prisoners at Fort Sill, Oklahoma; 647 Coyoteros on White Mountain reservation, Arizona; 831 Jicarillas and 443 Mescaleros in New Mexico; 176 Kiowa Apaches (Nadiishañdina) in Oklahoma; 2155 "San Carlos" Apaches and 1849 "White Mountain" Apaches on White Mountain reservation, Arizona; 30 children at Carlisle school. Total 6429.
Arapaho	Algonquian	976 in Oklahoma, 806 in Wyoming, 5 children at Carlisle. Total 1787.
Assiniboin	Siouan	1323 in Montana, 1245 in Canada, 9 children at Carlisle. Total 2577.
Auk	Koluschan	640 in Alaska.
Bannock	Shoshonean	513 (including others) in Idaho, 4 children at Carlisle. Total 517.
Bellacoola	Salishan	About 2500 (including Heiltsuqs of Wakashan family) in British Columbia.
Blackfeet (Siksika)	Algonquian	1060 in North-west Territories, Canada. See Bloods, Piegans.
Bloods	Algonquian	1247 in North-west Territories, Canada. (A Blackfoot division.)
Caddo	Caddoan	About 500 in Oklahoma.
Cariboo-eaters (Ethen-eldeli)	Athapascan	About 1200 east of Lake Athabasca, Canada.
Caughnawaga	Iroquoian	2005 in Quebec.
Cayuga	Iroquoian	About 1075 in Ontario, 170 in New York, about 164 in Indian Territory, 4 children at Carlisle. Total 1413.
Cherokee	Iroquoian	1363 in North Carolina, 29,511 in Indian Territory (excluding 4000 negroes and intermarried whites). Total 30,874.
Cheyenne	Algonquian	2071 in Oklahoma, 1363 in Montana, 61 in South Dakota, 22 children at Carlisle. Total 3517.
Chickasaw	Muskhogean	About 5000 in Indian Territory (excluding about 4000 freedmen and intermarried whites).
Chippewa	Algonquian	26 in Kansas, 3480 in Michigan, 3304 at Leech Lake, and 4619 at White Earth, Minnesota; 2551 in North Dakota; 4982 in Wisconsin, 73 children at Carlisle, 11,862 in Ontario, about 4117 in Manitoba, about 1340 in North-west Territories. Total 36,354.
Chippewaian	Athapascan	About 3000 in vicinity of Lake Athabasca.
Choctaw	Muskhogean	About 15,000 in Indian Territory (excluding 4250 freedmen and intermarried whites).
Comanche	Shoshonean	1490 under Kiowa agency, Oklahoma.
Cree	Algonquian	3000 in Manitoba, 7000 under agencies, and about 5000 roving in North-west Territories. Total 15,000.
Creeks	Muskhogean	About 8700 in Indian Territory (excluding about 6000 freedmen and intermarried whites).
Crows (Absaroka)	Siouan	1962 under Crow agency, Montana.
Delawares	Algonquian	About 1000 with the Cherokees in Indian Territory, 95 in Oklahoma, about 753 (including Munsees and "Moravians") in Ontario, 26 in Kansas, 60 in Wisconsin, 40 with the Iroquois in New York. Total 1974.
Dogribs	Athapascan	About 1000 between Great Slave and Great Bear Lakes, Canada.
Eskimo	Eskimoan	About 20,000 Innuit in Alaska, about 1100 Eskimo in Baffin Land, about 2000 in Labrador, about 11,000 in Greenland. Total 34,100 (estimated).
Flatheads	(Mixed)	1816 under Flathead agency, Montana (includes Pend d'Oreilles and Kutenais).
Grosventres (Atsina)	Algonquian	619 under Fort Belknap agency, Montana. Distinct from the Hidatsa or Minitari, a Siouan tribe, also called Grosventres, numbering 459 on Fort Berthold reservation, North Dakota.
Haida	Skittagetan	2500 in British Columbia, including 630 under North-west Coast agency.
Hares or Kawcho-tinneh	Athapascan	600 on Mackenzie, Anderson, and MacFarland Rivers, Canada.
Hidatsa	Siouan	See Grosventres.
Hopi or Moki	Shoshonean	About 1800 in north-eastern Arizona.
Iroquois	Iroquoian	See under the tribal names.
Kaibabits	Shoshonean	600 (including Shivwits) in Nevada, 470 in Utah. Total 1070.
Kickapoo	Algonquian	246 in Kansas, 234 in Oklahoma, about 200 in Mexico. Total 680.
Kiowa	Kiowan	1074 in Oklahoma.
Klamath	Lutuamian	731 in Oregon, 673 in California. Total 1404.
Kutenai	Kitunahan	491 in British Columbia, 450 in Montana. Total 941.
Kwakiutl	Wakashan	1597 (including 291 Lekwiltok) in British Columbia.
Loucheux or Kutchin	Athapascan	About 4400 on lower Mackenzie River and in Alaska.
Menomini	Siouan	1389 under Green Bay agency, Wisconsin.
Miami	Algonquian	439 in Indiana, 101 in Indian Territory. Total 540.

Tribe.	Stock.	Situation and Population.
Micmac	Algonquian	634 in Quebec, 960 in New Brunswick, 2018 in Nova Scotia, 308 on Prince Edward Island. Total 3920.
Mission Indians	Shoshonean Yuman	Under Mission Tule agency, California.
Missisaga	Algonquian	764 in Ontario.
Mohave	Yuman	1962 under Colorado River agency, Arizona.
Mohawk	Iroquoian	3103 in Ontario and Quebec.
Monsoni	Algonquian	4000 (including Maskegon) in eastern Rupert Land.
Montagnais	Algonquian	1793 in Quebec; distinct from a group of Athapascan tribes known under the same name.
Munsee	Algonquian	See Delawares.
Nahani	Athapascan	700 on Stickeen river and Connolly lake, B.C.
Nascapi	Algonquian	About 2800 on lower St Lawrence, Quebec.
Nasqa or Nass	Chimmesyan	2781 in British Columbia.
Navaho	Athapascan	About 20,000 on reservation in New Mexico and Arizona.
Nez Percés or Chopunnish	Shahaptian	1639 in Idaho, 127 in Washington. Total 1766.
Okanagan	Salishan	573 in Washington, about 900 in British Columbia. Total 1473.
Omaha	Siouan	1157 on Omaha and Winnebago reservation, Nebraska.
Oneida	Iroquoian	1941 in Wisconsin, 255 in New York, 1068 in Ontario. Total 3264.
Onondaga	Iroquoian	551 in New York, 385 in Ontario. Total 936.
Osage	Siouan	1765 under Osage agency, Oklahoma.
Ottawa	Algonquian	4000 in Michigan, 165 in Indian Territory, 1000 in Canada. Total 5165 (estimated).
Paiute	Shoshonean	1415 under agencies and 6815 wandering in Nevada, 200 in California, 200 in Oregon, 100 in Utah. Total 8730, including Pahvant, Gosiute, &c.
Papago	Piman	1726 under agencies and 2046 wandering in Arizona, about 1000 in Sonora. Total 4772 (estimated).
Pawnee	Caddoan	664 in Oklahoma.
Piegan	Algonquian	1957 (including some Bloods and Blackfeet) in Montana, 519 in North-west Territories, Canada. Total 2476.
Pima	Piman	4260 in southern Arizona.
Pit River Indians	Palaihnihan	1573 (estimated) in northern California, 94 in Oregon. Total 1667.
Ponka	Siouan	567 in Oklahoma, 231 in Nebraska. Total 798.
Potawatomi	Algonquian	569 in Kansas, 77 in Michigan, 1618 in Oklahoma, 280 in Wisconsin, about 334 in Ontario. Total 2878.
Pueblos of New Mexico	Tanoan Keresan Zuñian	Excludes the Hopi. Acoma, 566; Cochiti, 355; Isleta, 1000; Jemez, 456; Laguna, 1143; Nambe, 98; Picuris, 96; Sandia, 77; San Felipe, 650; San Ildefonso, 150; San Juan, 378; Santa Ana, 300; Santa Clara, 248; Santo Domingo, 1015; Taos, 402; Tesuque, 84; Sia, 104; Zuñi, 1422; Pojoaque, 20; Hano (Arizona), 600 (?). Total 9164.
Puyallup	Salishan	555 in western Washington.
Sauk and Fox	Algonquian	522 in Oklahoma, 390 in Iowa, 78 in Kansas. Total 990.
St Regis Iroquois	Iroquoian	About 1171 in New York, 1351 in Quebec. Total 2522.
Seminole	Muskhogean	2900 (including 1450 freedmen) in Indian Territory, 575 in Florida. Total 3475.
Seneca	Iroquoian	165 with Cayugas in Indian Territory, 2812 in New York, 230 in Ontario. Total 3207.
Shawnee	Algonquian	674 in Oklahoma, 93 under Quapaw agency, and about 800 with the Cherokees in Indian Territory. Total 1567.
Shoshoni	Shoshonean	1437 in Idaho (including Sheep-eaters), 296 in Nevada, 842 in Wyoming. Total 2575.
Sicanni	...	See Tsekehne.
Sioux or Dakota:		
Santee	Siouan	1285 in Nebraska (includes Mdewakantons and Wahpekutes), about 54 in North Dakota, 907 Mdewakantons in Minnesota, 161 Mdewakantons and Wahpekutes in North-west Territories. Total 2407.
Sisseton	...	1884 in South Dakota (includes Wahpetons), about 863 Sissetons, Wahpetons, and Cutheads (Yanktonnais) in North Dakota, 283 Wahpetons and Sissetons in North-west Territories. Total 3030.
Yankton	...	1701 in South Dakota, about 126 in North Dakota. Total 1827.
Yanktonnais	...	1222 in Montana, 3575 (including about 1000 Uncpapa and Sihasapa Blackfeet) in North Dakota, 1047 in South Dakota. Total 5844.
Teton	...	2552 Two-kettles, Sihasapa Blackfeet, Sans Arcs, and Minneconjous under the Cheyenne River agency, South Dakota; 6452 Oglalas under the Pine Ridge agency, South Dakota; 4862 Upper Brulés, Loafers (Oglalas), Wazhazhas (Oglalas), Two-kettles, and Lower Brulés under the Rosebud agency, South Dakota; 472 Lower Brulés under the Lower Brulé agency, South Dakota. Total 14,338.
Miscellaneous	...	52 children at Carlisle, 172 at Muscowpetung, and 60 roving in North-west Territories. Total 284.
Slavés	Athapascan	About 1000 west of Great Slave Lake and Mackenzie River.
Spokan	Salishan	91 in Montana, 695 in Washington. Total 786.
Thompson River Indians (Ntlakyapamuq)	Salishan	About 4500 in British Columbia.
Tsekehne	Athapascan	About 1400 (including 500 Tsekehnes proper) about Canadian Rockies, 700 Beavers about Peace River, 203 Sarsis east of Rockies, 51° N. Total 2303.
Tuscarora	Iroquoian	378 on Tuscarora reserve, New York; 365 in Ontario. Total 743.
Ute	Shoshonean	998 Moaches, Capotes, and Wiminuchis in Colorado; 471 Uintas, 851 Uncompahgres, and 380 White River Utes in Utah. Total 2700.

Tribe.	Stock.	Situation and Population.
Walapai	Yuman	611 on Colorado river, north-western Arizona.
Wallawalla	Shahaptian	529 at Umatilla agency, Oregon.
Wichita	Caddoan	956 (including affiliated bands) in Oklahoma.
Winnebago	Siouan	1129 in Nebraska, 1447 in Wisconsin. Total 2576.
Wyandotte or Huron	Iroquoian	449 in Quebec, 6 in Ontario, 344 in Indian Territory. Total 799.
Yakima	Shahaptian	2000 (estimated) in Washington; includes about 950 Yakima proper and numerous small tribes.
Yavapai	Yuman	702 under the San Carlos agency, Arizona. Officially called Apache Mohaves.
Yellowknives (T'atsan-ottine)	Athapascan	About 500 north-east of Great Slave Lake, Canada.
Yuma	Yuman	707 under the Mission Tule agency, California; remainder under the San Carlos agency, Arizona.

(F. W. H.)

Indian Territory, situated in central southern United States, between 33° 25′ and 37° N. and 94° 25′ and 98° W., bounded on the N. by Kansas, on the E. by Missouri and Arkansas, on the S. by Texas, and on the W. by Oklahoma Territory. Without organized territorial form of government, it comprises for the most part the lands of the Cherokee, Creek, Seminole, Choctaw, and Chickasaw tribes of Indians, known as the Five Civilized Tribes, whose possessions occupy 31,060 square miles of the 31,400 square miles contained in the Territory. The balance, located in the north-east corner, is occupied by Indians of the Quapaw Agency, composed of remnants of eastern Shawnees, Miamis, Ottawas, Peorias, Quapaws, Senecas, Cayugas, and Wyandottes, and a few scattered members of other tribes. The Territory was originally much larger, and included all of Oklahoma and a portion of Arkansas. It is divided geologically into, first, the Wichita mountain region of Appalachian-like folds of Palæozoic strata, chiefly Carboniferous, with some older Palæozoic rocks on the southern border, including a field of granite rocks near Tishomingo. Within this field are found building stones of sand and granite and limestone, also Coal Measures on the northern side and asphalt on the southern. Secondly, there is the Ozark Plateau, a region of nearly horizontal and greatly dissected Carboniferous and Silurian rocks, containing limestone, zinc, and lead. Then, thirdly, there are the Prairie Plains, which are a continuation of similar plains in southern Kansas, being nearly horizontal Carboniferous rocks, which contain coal and evidence of petroleum. The fourth division comprises southern prairies, which are the northern edge of the Cretaceous rocks of the Texas region, a country of sands, limestones, and marls, containing agricultural lands and also evidences of artesian water. The topography is varied, the eastern part being mountainous and rugged, the middle part generally rolling or hilly, and the western part largely prairie, with the exception of a group of hills in the central portion of the Chickasaw Nation, known as the Arbuckle Mountains. Woodland, composed of many varieties of oak and (along streams) of cottonwood, elm, pecan, &c., is well scattered over the entire area; but the heaviest timber is confined to the eastern half, where, in addition to the trees mentioned, are found yellow pine and cedar on high ground, and walnut on streams, in sufficient quantity to make them of commercial value. The oaks are used only for fuel and railway ties. The principal streams are the Arkansas, Canadian, Grand, Verdigris, Illinois, Deep Fork, Washita, and Red, flowing through valleys which are generally broad and fertile, producing excellent crops. The highest elevation reached above sea-level is about 3000 feet, and the lowest about 350 feet. The climate is similar to that of northern Georgia, with a mean annual rainfall of about 36 inches. Of the wild animals and birds to be found may be mentioned black bear, cougar, wolf, coyote, fox, deer, squirrel, rabbit, prairie dog, turkey, prairie chicken, quail, eagle, hawk, and buzzard.

The first settlement of Indian Territory was by Creek Indians in 1827, and certain lands were set aside for their use in 1829. It formed a portion of the territory embraced in the Louisiana purchase in 1803. To enable the whites to obtain possession of the Indian lands in the southern states east of the Mississippi, these lands in what is now Indian Territory were set aside, and in 1830, under President Jackson, the removal of the Indians was ordered. The Cherokees, Creeks, Choctaws, and Chickasaws began their removal about 1833, but the Seminoles were not removed until 1845. The various tribes of the Quapaw Agency were removed at different times. Much of their original holdings has been sold to meet the demands of white settlement.

The Five Civilized Tribes are called Nations, and occupy separate land areas covered by patents. Each has an independent elective form of government, similar to that of the states of the United States, and they elect governors, legislators, judges, and minor officials. A United States judicial system is provided, divided into three districts; and under recent enactment by Congress these courts have entire jurisdiction, the Indian courts being set aside. Under United States law no alcoholic liquors are permitted to be sold in the Territory. The Indians of the Quapaw Agency are under the care of a United States agent, each tribe having its chief, and they have long since taken their lands in severalty. The Five Civilized Tribes are self-supporting, and they are in charge of a United States agent at Muscogee, his relations with the Five Tribes being regulated by the treaties, and by instructions from the Secretary of the Interior. Ample funds, derived from sale of lands, are held in trust for the several nations, upon which interest is paid to them annually.

There was a large increase in the acreage cultivated of all farm products during the closing years of the 19th century, but no statistics have been gathered. The principal products are cotton, corn, oats, wheat, potatoes, and hay. The extensive prairies furnish pasturage for a large number of cattle, some of which are raised in the Territory, but the larger portion is shipped in from Texas to fatten for northern markets. Some horses and swine are raised, and a few sheep. There are 1260 miles of railway in the Territory, traversing it in all directions, making nearly every section accessible by rail. In 1900 the number of manufacturing establishments in the Territory (excluding 348 having a product of less than $500 each) was 789, with a total invested capital of $2,624,265. There were 135 salaried employees, and an average number of 1714 wage-earners. The added values of the products in the different establishments amounted to $3,892,181. There were 187 cotton-ginning establishments, with a capital of $572,475 and a product of $345,751; 61 flouring and grist mills, with a capital of $478,241 and a product of $1,198,472; 6 lumber and planing mills, with a capital of $265,683 and a product of $424,399; and 6 cotton-seed oil and oil-cake establishments, with a capital of $394,850 and products of $451,656.

The total population of Indian Territory in 1900 was 392,060, including 51,393 Indians not taxed. In 1890 the total population was 180,182. The population of the principal towns is as follows: Ardmore, 5681; Muscogee, 4254; South McAlester, 3479; Chickaha, 3209; and Durant, 2969. The capital of the Cherokee Nation is Talequah; of the Creek Nation, Okmulgee; of the Seminole Nation, Wewoka; of the Choctaw Nation, Tuskahoma; of the Chickasaw Nation, Tishomingo. There is no capital for the Territory. Of the total population in 1900, 208,952 (53·3 per cent.) were males and 183,108 (46·7 per cent.) were females; 387,202 were native-born, and 4858 (1·2 per cent.) were foreign-born; 302,680 were white and 89,380 coloured (22·8 per cent.), of whom 27 were Chinese, 36,853 negroes, and 52,500 were Indians. The death-rate in 1900 was about 13·4 per cent. The number of persons of school age (5 to 20 years) was 159,125. Out of 97,361 males of voting age 15,473 were illiterate (unable to write), of whom 8477 were white, 3776 negroes, and 3220 Indians.

Many of the Indians still use the Indian language, and the Cherokees have an alphabet, and print their laws, books, and newspapers in the Cherokee language. The Indians are well housed, cultivate farms, raise cattle, horses, and hogs, and compare favourably with their white neighbours in the adjoining states. There is a large number of churches and schools, well

attended. Many of the traditional customs are still retained, and ball games, dances, and other amusements and ceremonials are held. Many freed negroes and their descendants speak only the Indian language. These freedmen will have a share in the allotment of lands which is in progress. They are industrious and fairly well advanced, and in some of the tribes have occupied high positions, while some of them are possessed of considerable wealth. The full-blood Indians live as far as possible from the white settlements; and as the whites are numerous, the Indians have been crowded back into the wooded and mountainous regions, but those of the mixed blood are generally progressive and quite able to take care of their interests in their contact with the "non-citizens" or "intruders."

Under Indian laws, Indian citizens hold as much land as they desire, as long as it is occupied or used by them or their lessees. White men, or non-citizens, can obtain no land by purchase, but under the Indian system of leasing and permits these non-citizens have obtained the use of lands under lease from individual Indians and by paying for a permit or tax to the Indian government. The holdings thus made to white men are immense, both for grazing and cultivation; and in the towns there are many expensive buildings, the owners of which have no valid title to the land. In the next few years there will probably be a division of land in severalty. The subdivision surveys have been made, and town site surveys are in progress. When they are completed the lots will be appraised and sold. This division, and in fact all changes, have been bitterly opposed by the Indians who have leased the holdings, as also by the full-blood Indians. (C. H. F.)

INDO-CHINA, FRENCH.

DURING the last twenty years of the 19th century important changes took place in the Far East and the peninsula of Indo-China. The principal European Powers considerably extended their influence and increased their possessions in this region. In Indo-China, more particularly, great alterations were effected. The political condition of the country was entirely changed. In many parts its frontiers were rearranged. New areas were added to the French possessions, and treaties and agreements concluded between France and China and France and Siam. A partition of influence between France and Great Britain was also agreed upon. Explorations and numerous more or less careful surveys have made us acquainted with regions hitherto imperfectly known. The governmental organization, greatly modified, has now taken definite, and probably final, form. Physical conditions have improved, owing partly to the restoration of order and security to the country and the consequent growth of conditions favourable to the settling and cultivation of long-abandoned districts, and partly to the construction of roads, bridges, canals, and railways, and the investigation and exploitation of mineral wealth.

Geography.—The geographical denomination of French Indo-China includes Annam and Tongking, Cochin-China, Cambodia, and part of the Laos country. In 1900 the newly-acquired territory of Kwang-Chow-Wan, on the coast of China, was placed under the authority of the governor-general of Indo-China. Cochin-China, a geographical definition which formerly included all the countries in the Annamese empire—Tongking, Annam, and Cochin-China—now signifies only the French colony, consisting of the "southern provinces" originally conquered from Annam, having Saigon as its capital. In its entirety French Indo-China, the eastern portion of the Indo-Chinese peninsula, lies between 8° 30′ and 23° 25′ N. and 100° and 109° 20′ E. It is bounded on the N. by China, on which side the frontiers have been delimited; on the E. and S.E. by the Gulf of Tongking and the China Sea; on the S.W. and W. by a conventional line between Cambodia and Siam, thence by the right bank of the Mekong, which divides it from Siam and Burma. The configuration of the country is determined by two rivers of unequal importance and a continuous chain of mountains, an offshoot of the great Chinese group of Yunnan, which, making a double curve, forms an immense S. To the north and north-east of this chain the valley of the Song-Koi, or Red river, constitutes almost the whole of Tongking, of which its delta represents the most fertile and populous if not the largest portion. The small mountainous provinces of Lang-son, That Ké, and Kao-bang belong, however, geographically to the Si-Kiang basin. On the east the small province of Monkai, on the borders of Kwangtung, forms a little basin enclosed between the mountains and the sea; on the south the province of Thanhhoa, although crossed by the small river Song-ma, forms the extremity of the Red river delta and belongs to it, the two rivers being united at some distance from the sea by a natural channel formed by the junction of a northern branch of the Song-ma with a southern branch of the Song-Koi. The Red river descends from the mountains of Yunnan, rising near Tali-fu between deep and inaccessible gorges, and becomes navigable only on its entry into Tongking territory. Means have been taken to render it available to steam launches, and in consequence of an agreement between the State and the Compagnie des Correspondances Fluviales a service of steamers is provided from its mouth to Laokai. Near Hung-hoa the Red river receives its two chief tributaries, the Black river from the plateaux of the west—the land of the Muongs—and the Clear river, one of the largest of whose tributaries issues from the Ba-be lakes. The Black river is navigable for a considerable distance, the Clear river only from Tuyen Kwang. Between the basins of the Song-Koi and the Mekong the chain of mountains, crowned by tolerably extensive plateaux, covers, with its ramifications and transverse spurs, a vast extent of country as yet little known, although several trade-routes traverse it, thus placing the Laos country in communication with Tongking and Annam. In about 19° N. the mountain-ridge approaches the sea and runs parallel to the coast, presenting on its eastern side a steep declivity which encloses a narrow littoral, in places only a mile or two broad, between the base of its cliffs and the shore. This coast-belt constitutes the habitable and cultivable portion of Annam proper, and consists of alluvial matter accumulated at the mouths of mountain streams, and marshes and swamps enclosed between land and sea by sand ridges heaped up by wind and tide. The high valleys and plateaux originally belonged to the empire, the limits of which, although invaded and occupied by Siamese, formerly extended to the banks of the Mekong. The western slopes now form part of the French Laos possessions. The Mekong valley includes Laos, Cambodia, and the greater part of Cochin-China. The Mekong is one of the largest rivers of south-eastern Asia, having a course 1900 miles in length. The conditions of navigation have been sufficiently improved to permit of a fairly regular service of boats between Saigon and Pnom-penh, Kratie, Stung-treng, Khong, Pak-mun, and Vien-tian. At Khong a transshipment by means of a railway (3½ miles) gives access to the latter portion (which extends from Khong to Pak-mun or Savanna-kek) of the river's first course. The second reach, 310 miles in length, extends from Savanna-kek to Vien-tian. From Vien-tian to Luang-Prabang the river is practicable only for canoes. The mouths of the Mekong, six in number, communicate by means of a navigable canal with the Saigon river (fed by

the Donnai and the two Vaico rivers), which is navigable by the largest warships, rendering Saigon the most important natural port of Indo-China.

Geology.—The low-lying portions of Indo-China consist of two deltas—that of the Mekong, which comprises the lower parts of Cambodia and southern Cochin-China, and the Red river delta, or eastern Tongking. These deltas are composed of alluvium (generally silicious clay) deposited by the rivers. The mountains from which this soil is derived are granitic in formation, the framework being almost always schists of ancient date, dislocated, folded, and occasionally rounded into hills 1000 to 1300 feet in height, belonging to the Devonian period. Above these schists lie—more especially in the north and south of Tongking—marbles and other highly crystalline limestones, upon which rest, unconformably in places (Nongson, Ke-bao, Hongai), Carboniferous formations. In the upper part of the Red river valley rich deposits of coal have been found between Yenbai and Bai-Duong, in a considerable tract of Tertiary rock. Limestone occurs also in the valley of the Mekong, forming an extensive *massif* in the district of Lakhon and in the basins of the Nam-ka-dinh and Nam-hin-bun. These limestones appear to be Carboniferous. In the region south of Lakhon the rock is Triassic, and gold has been observed in several districts. The natives collect it in very small quantities by a washing process. In the lateral valleys of the Mekong copper and tin are found. On the course of the Nam-paton, a tributary of the Nam-hin-bun, the natives work a moderately productive tin-mine. Layers of spiegeleisen, limonite, and other iron ores are numerous in the Laos states, in which also antimony occurs.

Climate.—The climate of Indo-China is that of an inter-tropical country, damp and hot. But the difference between the southern and northern regions is marked, as regards both temperature and meteorology. Cochin-China and Cambodia have very regular seasons, corresponding with the monsoons. The north-easterly monsoon blows from about the 15th of October to the 15th of April, within a day or so. The temperature remains almost steady during this time, varying but slightly from 78·8° to 80·6° F. by day to 68° F. by night. This is the dry season. From the 15th of April to the 15th of October the monsoon reverses, and blows from the south-west. The season of daily rains and tornadoes commences. The temperature rises from 80·6° to 84·2° F., at which it remains day and night. April and May are the hottest months (from 86° F. to 93·2° F.). The damp unwholesome heat sometimes produces dysentery and cholera. The climate of Annam is less regular. The north-easterly monsoon, which is "the ocean-wind," brings the rains in September. The north-easterly gales lower the temperature to below 59° F. September is the month in which the typhoon blows. During the dry season—June, July, and August—the thermometer oscillates between 86° F. and 95° F. The nights, however, are comparatively cool. Tongking has a winter season—October to May. The temperature, lowered by fog and the rains, does not rise above 75·2° F. and descends to 50° F. over the delta, and to 44·6° F. and even 42·8° F. in the highlands, where white frost is occasionally seen. The summer, on the other hand, is scorching. The wind veers to the south-east and remains there until October. The temperature rises to 82·4° F. to 86° F.; often it reaches, and continues for several days at, 95° F., 100·4° F., and even 104° F. The nights are distressingly airless. The Laos country in the interior and lying at a high altitude is cooler and drier. Its deep valleys and high hills vary its climate. Observations made of late years show its salubrity, the temperature varying in summer between 68° F. and 77° F., in winter between 34·4° F. and 37·4° F.

Fauna and Flora.—In the populous cultivated districts wild animals, once plentiful, have retired towards the wooded districts. The wild life of Laos includes fairly numerous herds of elephants, the rhinoceros (one- and two-horned; rhinoceros horn, employed as a "medicine," fetches about 55 piastres, 132 francs, per kilogram), tiger, panther, brown bear, tree bear, monkeys and rats, among which are the musk rat, the palm rat, and the *nu-khi*, or rat found in the rice-fields of the highlands, in which its ravages are considerable. In mountain districts the leopard, wild boar, and deer are found, and in the neighbourhood of habitations the tiger-cat and ichneumon. The buffalo is commonly found wild in Laos; as a domesticated animal it also holds a prominent place. The zebu bull is used for transport purposes. Attempts to acclimatize the Arab horse and to introduce sheep from Aden and China have failed. There is, however, an indigenous race of horses, excellent in spite of their small size—the horses of Phu-Yen. Among birds the woodcock, peacock, and numerous species of duck inhabit the woods and marshes. The goose and guinea-fowl appear, as also the turkey, to have become easily acclimatized. Reptiles (apart from the caymans of the Mekong, which attain a length of over 30 feet, and are much appreciated by the Annamese as food) are extremely numerous and varied in species. The rivers are rich in fish. The sole is found in the rivers of Tongking. The Mekong is fished for two species peculiar to it—the *pa-beuk* and the *pa-leun*, which attain a length of nearly 6 feet, and upon which the fishermen pay a tax of one piastre per fish into the royal treasury. This tax brings in 1000 piastres annually. All varieties of mosquitoes, ants, and leeches combine to render the forests bordering the Mekong impracticable. Peculiar species of grubs and caterpillars destroy the cotton and coffee plantations of Cochin-China. The silkworm may be said to be indigenous to Tongking, where there are 7450 acres of mulberry trees. The flora is inter-tropical, and comprises nearly all the trees known in China and Japan. Formerly the teak was believed not to exist in the forests of Indo-China, but it was found some years ago in considerable abundance, and plantations of it have been made. Certain hard woods are used for marqueterie and other ornamental work. New products have been introduced. Cotton, previously cultivated in Cochin-China and Cambodia, gives excellent results in Laos. Tea, of which there are a certain number of plantations in the highlands of Tongking and Annam, grows wild in Upper Laos, and in quality closely resembles the Pou-eurl or Pueul variety so noted in Yunnan. Cocoa, coffee, and cotton have been cultivated in Tongking and Cambodia. Cinnamon and cardamoms are gathered in Laos and Annam. The area under rice has been much extended. All European fruits and vegetables have been introduced into Tongking, and with certain exceptions—the grape, for example—succeed perfectly. Measures taken to secure the monopoly of opium have notably increased the cultivation of the poppy.

Ethnology.—The Annamese and Cambodian populations have long been known, but since they have been brought into touch with civilization they have developed new characteristics. Since, owing to the restored tranquillity of his country, the fruit of his labour has been secured to him the Annamese has become more active and more industrious. As a soldier he has displayed the valuable qualities of endurance, intelligence, and discipline. The race is capable of development. Independent populations, isolated and even savage, the names of which

were hardly known, have been brought into contact with civilization. It has been recognized that the races familiarly known by a certain name have also various others. It is generally believed that the yellow people from China and the brown people of Aryan stock from India have driven back the older Malay races into the interior of the country. The Khmer of Cambodia probably belong to the Brahminical race; the sculptures of Angkor, in which are to be recognized the primitive Indian deities, give colour to this belief. Driven into the interior, the vanquished races have mixed and blended with the peoples whom they found there. New tribes have arisen, intermingled with fugitives from China, Annam, and even Siam. The Laos folk have for the most part come to predominate in this mixture. However this may be, the savage tribes (a term no longer exact) fall into two categories. In the north of Tongking people of Laos origin occur—the Thôs round Kaobang, the Muongs in the mountains bordering the Red river. When mixed with Chinese the Muongs and the Thôs are known as the Hung-dans, Mâns, and Miens. The Muongs are bigger and stronger than the Annamese, their eyes often almost straight. They have square foreheads, large faces, and prominent cheek-bones. In the centre and south of the Indo-Chinese mountain chain are found, under a multiplicity of names—Phon-tays, Souis, Bah-nan, Bolovans, Stiengs, Mors, Kongs, &c.—people of Malayan origin mixed with all the races of Indo-China. Laos is inhabited by an essentially miscellaneous population—Laotians, Khâs, Phais, Yuns, Lus, Phou-thais, Meos, Hos, and Yaos—of which the Laotians, numbering 67,000, and the Khâs, 63,000, form the bulk. Although Laotian legends assign to these a common origin, the difference of types, languages, and religions is at variance with this hypothesis. The Khâs appear to have preceded the Laotians in the country, though it is probable that the Laotians of Dien-bien-Phu have conquered and subjected the former. The Laotians may be of Mongol origin. The Yuns are Laotians settled on the right bank of the Mekong at Xieng-Mai, Xieng-Sen, and Muong-Nam, and are only distinguished from their congeners by the parts of the body on which they are tattooed. They tattoo the body instead of the thighs and legs as do the Laotians, whom for this reason they call "*Lao-phung-kao*," "the white-bodied Laotians," terming themselves "*Lao-phung-dam*," or "black-bodied Laotians." The Khâs, Meos, Yaos, and Hos are probably aborigines, and cultivate rice, poppy, and maize. The first-named, settled on the mid-course of the Mekong, between Lakhon and Stung-treng, were at a comparatively recent date veritable savages, reduced to the lowest degree of misery.[1] To-day they are on the road to civilization. They trade with Cochin-China and Cambodia, and at Stung-treng there is a post office and a steamer service.

Area and Population.—The extent of the area of French Indo-China is not exactly known. It is estimated approximately at 250,000 square miles.[2] No census has been taken of the population except in Cochin-China. It is estimated at 20,000,000, of whom 11,000,000 are in Tongking, 4,000,000 in Annam, 2,300,000 in Cochin-China, 1,500,000 in Cambodia, about 450,000 to 500,000 in the Laos states. The population of this latter country was estimated at first at only 160,000, but the verifications made since the French occupation have modified this figure. The province of Stung-treng alone, formerly believed to be almost uninhabited, contains 60,000 inhabitants.

Religions.—The Annamese religion is a somewhat vague and very tolerant Buddhism, which in practice resolves itself chiefly into the worship of ancestors. Certain ceremonies performed in Cambodia resemble distantly the Brahminical cult. The Catholic religion has been introduced by missionaries. The course of its history has not been free from catastrophes and accidents. There is an apostolical vicariate in Cochin-China, one in Cambodia, and several mission stations in Tongking. Two of these missions are mainly conducted by Spanish priests. Public instruction, means of communication, roads, railways, are "localized," and will be found separately treated in the articles upon Tongking, Cochin-China, and the Laos states.

Government and Finance.—Before taking its present form the governmental organization of Indo-China underwent many changes. Originally Cochin-China, the only French possession in the peninsula, was a colony directly administered, like other colonies, by the ministry of marine, and its earliest governors were admirals. Later, as further conquests were effected,[1] Tongking and Cambodia were subjected to the *régime* of a protectorate somewhat ill-defined, and placed under the authority of a resident-general. The seat of the resident-general of Tongking was at Hanoi; of Cambodia, at Pnom-penh. The government of the colonies having been transferred from the ministry of marine to the ministry of commerce (by the decrees of 14th March 1889, 17th January 1893, and the law of 20th March 1894, which constituted a special ministry of the colonies), the control of the residencies passed gradually into the hands of civil agents. Cochin-China, which already by the decree of 8th February 1880 had been endowed with a colonial council, had a municipality, a chamber of commerce, and even a deputy in the French Parliament. There had been thus since 1817 three distinct states, each with its own ruler and government. But by the decrees of 17th October and 3rd November 1887 the unity of Indo-China was determined. By decree of October the post of director of the interior of Cochin-China was done away with and replaced by that of lieutenant-governor. Cochin-China thus ceased to be under the direct administration of the ministry of the colonies, and was placed under the immediate authority of the governor-general. The functions and powers of this official were, however, but vaguely defined before the decree of 21st April 1891, which conferred on M. de Lanessan, appointed governor-general, the most extensive powers. The residents-general and the lieutenant-governor of Cochin-China, as well as the military authorities, were placed under him. But this change of policy, which put an end to the system of expeditions and minor military operations, and restricted the power of the residents whilst restoring to the mandarins a share of authority, was unwelcome to numerous interests, which, combining, secured the abrupt recall of M. de Lanessan on 29th December 1894. The decree of 21st April 1891 was not, however, revoked, but the powers it conferred were restricted. After the appointment of M. Doumer, successor to M. Rousseau, who died 10th December 1896, this decree was again put in force on the former scale, and in 1898 it was supplemented by the decrees of 3rd and 31st July, which definitely established the political and financial unity of Indo-China. The unification of the budget has specially contributed to that of the government. The financial scheme is based on the political. Just as a single central government directs the various local governments, so in addition to the general budget comprising

[1] *Le Laos et les populations sauvages de l'Indo-Chine.* Harmand. 1880.

[2] This is claiming a large portion of country actually in the hands of Siam and administered by Siam.—ED. *E. B.*

[1] See TONGKING and COCHIN-CHINA in the earlier volumes of the *Ency. Brit.* (ninth edition).

the revenue and expenditure of the supreme government there are several local budgets, including the revenue and expenditure incidental to the individual provinces.

The revenue of this budget is provided by customs and excise duties, indirect taxes and contributions levied all over the country, and the opium monopoly formerly conceded, as regards the kingdom of Annam, to a company whose concession was revoked on 1st July 1893. Opium is taxed in Tongking. In Annam it is still farmed. The remaining resources belong to the local budgets, and are supplemented, when inadequate, by grants from the general budget. Since 1894 another budget, or rather several other budgets, have been created in Tongking, namely, those of the provinces or municipalities. Since the decree of 12th March 1882, Cochin-China has had municipal budgets; Tongking since 1894.

The customs tariff for Indo-China was fixed as regards imports by the law of 11th January 1892 and the decree of 29th November 1892; for exports, by the decree of 29th December 1898. Special taxes have been sanctioned by various orders or decrees from 1898 to 1899, as follows: upon salt, 25 francs per ton; upon alcohol, 2·50 francs per litre of pure alcohol; upon tobacco and cigars, 1·50 franc per kilogram of cigars, 0·75 franc of cigarettes, and 15 francs upon the half-*picul* (30 kilograms) native grown or introduced tobacco in leaf.

The sums assigned directly to the kings of Annam and Cambodia are chargeable upon the general budget. In consequence of agreements with the court of Annam, the king—or rather the council of ministers—nominates and directly pays the native officials in Annam, as distinct from Tongking. Hence the financial credit assigned to the court of Hué reaches a sum of 928,000 piastres, 533,000 of which are assigned to the expenses of the court and *comat* (council of ministers), 369,000 to the salaries of officials, and 26,000 to "unforeseen outlay." The allowance made to the court of Pnom-penh is a purely personal one. The king's civil list amounts to 372,000 piastres, that of the secondary king—the *obbarach*—to 25,200 piastres. The princes, sons of the king, are apportioned 15,000 piastres, not an excessive sum, King Norodom having fourteen sons and twenty-two daughters. The princes, sons of the *obbarach*, receive together 3000 piastres. In both 1898 and 1899 there was a considerable surplus balance both on the general budget and on the local budgets.

The following were the estimates for 1901:—Revenue, 22,998,000 piastres; expenditure, 22,982,000; surplus, 16,000 piastres. The principal receipts were classified as follows:—

Customs	5,940,000	piastres.
Indirect taxes and excise	15,060,000	,,
Registration of lands and stamp duties	807,000	,,
Posts and telegraphs	382,000	,,
Forests	247,000	,,
Interest on capital	200,000	,,

Any available surplus was, by decree of 20th October 1900, to be applied to the formation of a general reserve fund. Each of the local budgets has its own reserve, and official statements show that these reserves will enable Indo-China to contribute the sum of 12 million francs—more than half—to the military expenses chargeable on the mother country, and to appropriate about 20 million francs to railway construction.

Administration.—The government in its present form was organized by the decrees of 17th October and 3rd to 12th November 1887, and by those of 21st April 1891 and 31st July 1898. Indo-China financially and politically unified is, as we have seen, placed under the authority of a governor-general, assisted by a superior council of Indo-China, which, reorganized by the decree of 8th August 1898, is composed as follows: president, the governor-general; the general commanding as head of the troops; the rear-admiral commanding the naval squadron of the Far East; the lieutenant-governor of Cochin-China; the resident superiors of Tongking, Annam, and Cambodia; a representative (appointed by the governor-general) of the government of Laos; the chief of the *contrôle financier;* the head of the judicial service of Indo-China; the superintendent of the customs and excise of Indo-China; the president of the colonial council of Indo-China; the presidents of the chambers of commerce of Saigon, Hanoi, and Haiphong; the presidents of the united chambers of commerce and agriculture of Annam and Cambodia; the presidents of chambers of agriculture; two influential natives, and the chief of the governor-general's cabinet. A "permanent commission" of the council has been formed. The superior council meets annually to receive the budget, which "must be accepted by the governor-general at a session of the superior council." It must also be consulted on the distribution of military credits, and on the credits to be devoted to public works.

The governor-general is also assisted by a "council of defence." The general services of the customs, justice, public works, agriculture, and commerce are placed directly in the hands of the governor-general. He presides over the council of ministers—*comat*—of Annam. The protected governments of Annam and Cambodia are under his control, and, in reality, under his command. He therefore exercises sovereign power throughout Indo-China. He is answerable to the minister of the colonies. There is a *contrôle financier* in Indo-China, dependent upon the ministry of the colonies. Its returns have to be communicated to the governor-general.

The town of Saigon (*q.v.*) is officially the capital of Indo-China. The superior council, however, does not necessarily sit at Saigon. It is annually convoked in the capital of one of the local governments, as Hanoi, Pnom-penh, and Hué.

Justice.—The whole of Indo-China is, in principle, subject to French justice, represented by a court of appeal and a certain number of tribunals. As recently as 1898 the administration of justice was not centralized. There was a court of appeal at Hanoi, and another at Saigon. But the decree of 8th August 1898 suppressed the court of appeal at Hanoi, which ranks now only as "the third chamber of the court of appeal of Saigon." Three mixed tribunals of commerce are established at Saigon, Hanoi, and Haiphong. There are courts of first instance at Saigon (not classified), My-tho, Viah-Long, Hanoi (1st class), Bentre, Chaudoc, Cam-tho, Via-vinh, Long-Trang, Long Xuyen, and Pnom-penh, and several justices of the peace, from whose judgments there is no appeal. In Cochin-China no trace of Annamese justice now remains. All the inhabitants, without distinction of race, are amenable to French tribunals. The decree of 7th March 1895, on "the organization of justice" in Cochin-China and Cambodia, contained an almost complete code of civil and criminal procedure. The decree of 8th August 1898 extended over the whole of Indo-China the jurisdiction of the court of appeal at Saigon. In Annam-Tongking, however, the natives are still subject to Annamese justice, represented in each province by a mandarin, called the *An Sat.* At the same time, whenever a Frenchman, or a naturalized Frenchman, is a party in an affair, French justice only is competent.

Public Works.—The order of 9th September 1898 placed the public works of Indo-China under the "direct authority of the governor-general as regards works entered to the general budget account." There is a director of public works in Indo-China at Saigon, a director of engineering in the other countries. In 1895 a "special service" was created in Tongking to consider railway business.

Posts and Telegraphs.—The postal service of Cochin-China was reorganized by a decree of 7th October 1881, that of Tongking by a decree of 20th September 1883. A general management created in 1887 was suppressed by an order of 10th January 1889. At present there is no general management. The post and telegraph offices in Indo-China number 223, of which 60 are in Cochin-

China, 105 in Tongking, 22 in Annam, 18 in Cambodia, and 18 in Laos.

The Army—Land Force.—The military services are under the authority of a general of division commanding in chief. There is a *Direction d'Artillerie* in Tongking, and another in Cochin-China. The troops form three brigades of three regiments with seven batteries. The four military districts of Tongking are commanded by superior officers. In 1898 four regiments of Tongkingese *tirailleurs* (sharp-shooters), one of Annamese, a company of Cambodian *tirailleurs*, and a squadron of Annamese *chasseurs* or light horse were raised, and a mobile reserve of about 7500 men constituted. The pay of sub-officers has been raised, and 178,000 piastres are spent on the *gendarmerie*.

Sea Force.—Indo-China is protected by the naval division of the Far East, to which is also attached a certain number of iron-clad gunboats.

Navigation.—The general movement of the ports of Indo-China is shown in the following table :—

Year.	Steamers.		Sailing Vessels and Junks.		Total.	
	Number.	Tons.	Number.	Tons.	Number.	Tons.
1885	766	775,745	120	15,494	886	791,239
1895	766	764,444	1525	72,624	2291	837,068

Taking the movement country by country, the shipping figures for 1898 were as follows :—

		Number.	Tonnage.
Annam. Entries	French vessels	12	27,950
	Foreign vessels	135	38,345
	Total	147	66,295
Tongking. Entries	French vessels	132	132,827
	Foreign vessels	915	195,640
	Total	1047	328,467
Cochin-China. Entries	French vessels	221	305,500
	Foreign vessels	377	425,868
	Total	598	731,368
	General total	1792	1,126,130
Annam. Departures	French vessels	16	30,597
	Foreign vessels	135	36,821
	Total	151	67,418
Tongking. Departures	French vessels	130	130,315
	Foreign vessels	752	186,040
	Total	882	316,355
Cochin-China. Departures	French vessels	223	305,500
	Foreign vessels	356	424,281
	Total	579	729,781
	General total	1612	1,113,554

In 1899 there entered the port of Saigon 237 French vessels of 333,714 tons, and 435 foreign vessels—for the most part British—of 477,443 tons. For Annam the figures were, 124 French vessels of 156,256 tons, and 375 foreign vessels of 73,890 tons, besides 7194 Annamite junks of 94,705 tons.

Commerce.—The commercial movement of Indo-China notably increased during the last ten years of the 19th century, as is apparent from the following figures :—In 1888 Indo-China, as a whole, imported to the value of 56,086,752 francs, exported to the value of 71,026,683 francs ; general commercial total, 127,113,435 francs.

In 1892 commercial statistics were tabulated for each of the three countries separately :—

	Imports (Francs).	Exports (Francs).	Total General Commerce (Francs).
Cochin-China and Cambodia	35,546,628	80,706,856	116,253,484
Annam	4,671,473	3,513,688	8,185,161
Tongking	28,432,772	10,851,026	39,283,798
Totals	68,650,873	95,071,570	163,722,443

In 1898 the imports (excluding specie) from France and French colonies amounted to 44,415,786 francs ; from other countries to 58,028,560 francs; total, 102,444,346 francs; the exports to France and French colonies amounted to 29,592,742 francs ; to other countries to 97,918,237 francs ; total, 127,510,979 francs.

The chief articles of import were colonial commodities for consumption, valued at 4,583,927 francs (France supplied the value of 3,176,713) ; farinaceous foodstuffs, 1,517,958 francs (Hong Kong 1,149,785) ; textile fabrics, 15,731,000 francs (France 6,545,865, England 3,329,574, Hong Kong 3,304,348, Singapore 2,446,765) ; and metal-work, 33,369,772 francs (France 19,483,370, England 1,520,622, China and Japan 11,029,058). Special mention should be made of "Siamese paddy," which is benefiting by the temporary duty-free admission. In 1898, from August to December (inclusive) 6,240,875 kilograms entered, and from September to December 4,303,249 kilograms (2,699,476 white rice, 1,603,773 rice cargo or partially husked rice). Rice and its derivatives, which in 1898 reached a value of 88,113,033 francs, ranked first among the exports. Fishery products figured at 6,487,841 francs, pepper at 4,418,028 francs, raw hides at 1,747,586 francs, cotton-in-pod—which finds a market in Japan—at 1,621,697 francs, raw silk at 1,332,037 francs.

In 1899 the value of the imports amounted to 115,424,500 francs, of which France contributed 30,880,000, and the exports to 140,137,240 francs, of which 46,071,000 went to France. In 1900 the imports reached a value of 186,044,000 francs, of which France contributed 74,226,000 francs, and the exports 151,338,000 francs, of which 33,052,000 went to France.

Mines and Metals.—Tongking, in its mountainous districts, is rich in metals. Considerable quantities of coal are mined at Hongai, on Allong Bay, in the island of Kebao, situated in the same bay, and at Nongson near Tourane. The output of Hongai coal amounted in 1899 to 210,446 tons. Coal concessions have been made in the coal regions of the Red river, at Thuyen-Khan, and in the neighbourhood of Yenbai. Zinc mines are also worked. Gold-washing on the rivers of Tongking is still carried on by Chinese. Concessions have been applied for in Laos for gold and tin mining. A tin mine of rather small yield worked by natives exists on the river Pa-ten.

Weights and Measures.—A recent decree has introduced the French system of weights and measures into Cochin-China, but in the other four countries the ancient weights and measures are still in use.

Money.—Native money consists of *sapeks*, *ligatures*, and *piastres* of variable currency. The piastre, which formerly was equivalent to 4·50 francs, has now fallen in value to 2·40 francs. The "question of the piastre," with its bearings on administration on one hand and commerce on the other, is one of the most complicated problems which could be presented to the Government.

History.—From 1884 onwards the history of Indo-China may be divided into two distinct periods, characteristic of the political conception and governmental system adopted by the French Government. In the first period, 1884–91, the French agents in Tongking and Indo-China generally proceeded (under cover of the protectorate established by the treaty of 5th June 1884 between France and Annam) with the definite conquest and annexation of Tongking and also Annam. Cochin-China itself openly designed to seize the southern provinces of Annam, upon the borders of which it lay. This policy, momentarily checked by the war with China, was vigorously, even violently, resumed after the treaty of Tientsin, 9th June 1885. The citadel of Hué was occupied on 5th July 1885 by General de Courcy. The Annamese Government forthwith decided upon rebellion. An improvised attack upon the French troops was led by the ministers Thu-yêt and Thu-ong. The revolt was promptly suppressed. The regent Thu-yêt and the king Ham-N'ghi —Prince Ung-lich, crowned 12th August 1884 under the title of Ham N'ghi—fled. The germ of this policy is to be found in the treaty of 5th June 1884, which gave France the protectorate over Annam. The French Government, following a very widespread error, regarded Tongking and Annam as two distinct countries, inhabited by populations hostile to each other, and considered the Tongkingese as the oppressed vassals of the Annamese conqueror. To conquer Annam, it was said, would liberate Tongking. This misconception produced the worst consequences. With the flight of the king civil war commenced in Annam. The people of Tongking, whose submission the court of Hué had not dared to demand,

began to rise. Taking advantage of this state of anarchy, pirates of the Black Flag, Chinese deserters, and Tongkingese rebels devastated the country. The occupation of Tongking became a prolonged warfare, in which 25,000 French, compelled to guard innumerable posts, had to oppose an intangible enemy, appearing by night, vanishing by day, and practising brigandage rather than war. The military expenditure, met neither by commerce, which had become impossible, nor taxation, which the Annamese could not pay nor the French receive, resulted in heavy deficits. Paul Bert, who hoped to gain the confidence of the mandarins by kindness and goodwill, did not succeed in preventing, or even moderating, the action of the military *régime*. Under his governorship there was much fighting. Thanquan, Hon-Koi, Laokai, Pak-Lun, and Cao-Bang were occupied, but the troops were driven back to the delta and almost invested in the towns. Disappointed in his hopes and worn out rather by anxiety than work, Paul Bert succumbed to his troubles on 11th November 1886. His successors possessed neither the strength nor the insight necessary to grapple with the situation. M. Constans, however, appointed "provisional" governor-general after the death of M. Filippini, succeeded to a certain extent in reviving commerce in the towns of the delta. But after him MM. Richaud, Bihourd, and Piquet were all equally powerless to deal with the uninterrupted "bush-fighting" and the augmentation of the deficit, for no sooner was the latter covered by grants from the mother country than it began to grow again. At the close of the financial year in 1890 France had paid 13,000,000 francs. In April 1891 the deficit again approached the sum of 12,000,000 francs. The rebels held almost all the delta provinces, their capitals excepted, and from Hanoi itself the governor-general could see the smoke of burning villages at the very gates of his capital.

At this point a complete change of policy took place. M. de Lanessan, a Paris deputy sent on a mission in the course of 1887, made himself acquainted with the government and the court of Hué. He recognized the absolute falsity of the story which represented the Tongkingese as the oppressed subjects of the Annamese. He demonstrated the consanguinity of the populations, and after intercourse with the regents, or ministers, of Hué he realized that the pacification of the country depended upon harmonious relations being established between the general government and the court. Appointed governor-general with the fullest powers on 21st April 1891, he presented himself at Hué, concluded with the *comat* an agreement based on the principle of a "loyal protectorate," and reassured the court, up to this point uneasy under menace of annexation. The *comat* shortly issued a proclamation under the great royal seal, never hitherto attached to any of the public acts imposed upon the king by the governors, who had been unaware of its existence. In this proclamation the king ordered all his subjects to obey the governor-general and to respect him, and commanded rebels to lay down arms. The effect was immediate—disorders in the delta ceased. The pirates alone, in revolt against the king of Annam and all authority, continued their brigandage. But the governor-general instituted four "military districts," the commanders of which were commissioned to destroy the pirates. At the same time he placed a force of native police, the *linh co*, at the disposal of the mandarins, hitherto regarded with suspicion and intentionally deprived of all means of action. Order was restored within the delta. In the mountainous districts infested by pirates roads were opened and posts established. The chief haunts of the pirates, among others those of Yen-Thé, were demolished, and during 1893 the foremost pirate chiefs gave in their submission. The Indo-Chinese budget regained its balance. On the Chinese frontier agreements were concluded with Marshal Sou, in command of the Chinese forces, regarding the simultaneous repression of piracy in both countries. But on the Mekong difficulties arose with the Siamese. For centuries Siam had occupied the valley of the Mekong, and her troops had crossed the river and occupied the left bank. Luang-Prabang was in the hands of the Siamese, who had also established posts at Stung-treng and elsewhere. Friction occurred between the French agents and Siamese soldiery. After the death of Inspector Grorguin on 5th June 1893 the French Government occupied Stung-treng and Khong. France demanded explanations and redress at Bangkok, but the court refusing concessions, an ultimatum was presented to the king by M. Pavie, French minister to Siam. The terms of the ultimatum not having been complied with within the given time, the French flotilla, consisting of the gunboats *L'Inconstant* and *La Comète*, crossed the bar of the Menam on 13th July 1893, forced the entrance of the channel, and anchored at Bangkok, before the French legation. A second ultimatum was then presented. It contained the following conditions:—First, the occupation of Chantabun by the French until the Siamese should have entirely evacuated the left bank of the Mekong; secondly, the Siamese to be interdicted from maintaining military forces at Battambang, Siem-Rap, and generally from establishing fortified positions within 15½ miles of the right bank of the Mekong; thirdly, Siam to be interdicted from having armed boats on the great lake Tonle-Sap. This agreement was executed immediately, the Laotians being eager parties to it. On 29th September 1893 the king of Luang-Prabang (the "*Chau Sakkarine Tap Ritti Tamrong*") made his submission to the French Government, and besought it to use its influence with the court of Siam for the return to their families of the sons of princes and mandarins then in schools at Bangkok. The Siamese evacuated the left bank of the Mekong, and France took possession of Laos, a treaty, on the basis of the ultimatum, being signed on 1st October 1893. The disputes to which this affair with Siam had given rise between France and Great Britain were amicably settled by an agreement concluded 15th January 1896. This "declaration," virtually ratifying the treaty concluded in 1893 between France and Siam, settled the limits of the zones of influence of the two contracting Powers in the north of the Mekong regions and on the frontiers of Siam and Burma. Great Britain resigned to France the regions of the Muong-Sing which she had previously occupied. The great part of Siam included in the Menam basin was declared neutral, as also the Me-Ing basin in the north, Meklong Petchaburi and Bang Pa Kong rivers in the south. The neutral zone 15½ miles wide on the right bank of the Mekong was formally recognized.

During this period considerable changes were taking place in Indo-China. Bitterly attacked by the military authorities, who were irritated at being subordinated to a civil governor, and by the *bureaux* of the central administration, which had been compelled by the decree of 1891 to yield certain of their powers to the governor-general, M. de Lanessan was abruptly recalled on 29th December 1894. On the arrival of his successor, M. Rousseau, and before he was able fully to acquaint himself with the condition of the country, military expeditions recommenced, and the deficit soon reappeared. Tranquillity, however, being restored, attention was given to public works. On 12th October 1895 M. Rousseau left to ask Parliament to vote a loan of 100,000,000 francs. On 10th February 1896 a law was passed authorizing a loan of 80,000,000

francs, and on 14th March 1896 an office for the financial control of the government-general of Indo-China was established. In the interval a French company had obtained from China a concession to prolong the railway from Langson to Langchou on a tributary of the Canton river. M. Rousseau, who died on 10th December 1896, was replaced by M. Doumer, previously minister of finance, under whose government was realized, as has been before stated, the union of Indo-China. A great programme of public works was drawn up, and on 20th December 1898 M. Doumer obtained from Parliament authorization to contract a loan of 200,000,000 francs. A railway line between Hué and Tourane is in course of construction. In virtue of the powers granted for this loan, two issues each of fifty millions were successively floated, and the proceeds appropriated to the construction of the following railway lines:—(1) Hanoi to Haiphong (98 miles); (2) Hanoi to Ninh-binh (73 miles); (3) Saigon to Tan-lin (82 miles); (4, 5, 6) lines from Tourane to Hué (65 miles), from Yen-bai to Lao-kai (94 miles), and from Ninh-binh to Vinh (85 miles); (7 and 8) lines from Tan-lin to Lang-bian and Khan-hoa (321 miles), and from Lao-kai to Yunnan-sen (302 miles). The whole of these lines will constitute, with the lines already constructed, a complete network, bringing Saigon and Hanoi into direct communication with the Chinese frontiers of Kwang-li and Yunnan. The line from Hanoi to Kwang-si, constructed with the eighty million loan, is in operation. Finally a line is projected from Hué *viâ* Ailao towards the Mekong as high as Savanna-kek.

AUTHORITIES. — Since 1885 numerous official or semi-official periodical publications have been established; the two chief are *Revue Indochinois* (Hanoi), and the *Bulletin économique de l'Indo-Chine* (Saigon). Amongst standard works on the country may be mentioned:—BAUINAIS and PAULIS. *L'Indo-Chine: la Cochinchine contemporaine*, 1885.—DUPUIS. *La Conquête du Tonkin.*—MAT-GIOÏ. *Le Tonkin actuel.*—LECLÈRE. *Recherches sur la législation du Cambodge*, 1895.—DE LANESSAN. *L'Indo-Chine: l'Expansion coloniale de la France.* Various.—*La Mission Pavie*, 1899.—AUBARET. *Le Code Annamite.*—LEMIRE. *L'Indo-Chine.*—BONHOURE. *L'Indo-Chine*, 1900.—Colonel FAMIN. *Au Tonkin.*—PICANON. *Le Laos Français*, 1901. (J. M. A. DE L.)

Indore, a native state of India, in the Central India agency, with a total area of 8402 square miles. The population in 1881 was 1,055,217, and in 1891 it was 1,094,150, giving an average density of 130 persons per square mile. In 1901 the population of the Indore agency, which is not co-extensive with the state of Indore, was returned at 333,044, showing a decrease of 11 per cent., due to famine. The gross revenue is estimated at Rs.70,00,000. The Maharaja, Shivaji Rao Holkar, G.C.S.I., has visited England. The soil in the valley of the Narbada produces fine crops of wheat and poppy, yielding the Malwa opium of commerce; but drought prevailed in portions of the state in 1897, and again in 1900. The metre gauge railway from Khandwa to Mhow and Indore city (86 miles), continued to Neemuch and Ajmere, was constructed in 1876 at the cost of the state. About Rs.12,00,000 are coined annually at the mint. The city of INDORE is situated 1786 feet above the sea, on the left bank of the river Katki, near its junction with the Khan. It has a railway station. The population in 1881 was 83,091, and in 1891 it was 92,329. These figures include the residency, which is under British administration. The chief educational institutions are the Daly College, for the sons of the chiefs of Central India; the Holkar and Canadian Mission colleges, both affiliated to the University of Calcutta; and four high schools. There are two hospitals, maintained at a cost of about Rs.1,00,000, and a gaol, with an average of 300 prisoners. The Maharaja maintains a cotton mill, established in 1872, with 468 looms and 26,296 spindles, employing 1000 hands. In 1897–98 the number of chests of opium exported through the Indore agency was 4898, paying a duty of Rs.27,52,350.

Indre, a department in the centre of France, watered by the Creuse, the Vienne, and the Indre.

Area, 2666 square miles. From 296,147 inhabitants in 1886 the population decreased to 286,961 in 1901. Births in 1899, 5834, of which 420 were illegitimate; deaths, 5261; marriages, 2226. The department in 1896 had 546 schools, with 39,000 pupils, and the illiterate formed 5 per cent. of the population. The area under cultivation amounted in 1896 to 1,532,108 acres, 1,057,628 acres being plough-land and 37,066 acres vineyards. The wheat produce in 1899 amounted to the value of £1,175,000; rye, £87,000; barley, £151,000; oats, £655,000; vines, £39,000; the natural pastures and grass lands, £583,000. Indre in 1899 owned 26,230 horses, 13,480 asses, 138,920 cattle, 527,200 sheep, 96,200 pigs, and 39,700 goats. The production of iron maintains a fairly important industry in metals. Wool-spinning and pottery are likewise developed. Distillation produced in 1899 72,000 gallons of alcohol. Châteauroux, the capital, in 1901 contained 24,522 inhabitants.

Indre-et-Loire, a department in the centre of France, watered by the two rivers naming it.

Area, 2377 square miles. The population decreased from 340,921 in 1886 to 334,073 in 1901. Births in 1899, 5913, 424 of them illegitimate; deaths, 6316; marriages, 2384. In 1896 there were 648 schools, with 41,000 pupils, and 3 per cent. of the population was illiterate. The area under cultivation in 1896 amounted to 1,364,070 acres; 830,300 acres plough-land and 143,326 acres vineyards. The land in wheat yielded in 1899 the value of £1,323,000; rye, £54,000; barley, £88,000; oats, £40,000; vines, £1,004,000. Beetroot, hemp, and apples also yield important returns. Mangold-wurzel produced (1899) the value of £83,000. The live stock included 45,450 horses, 129,700 cattle, 165,920 sheep, and 54,200 pigs. Though destitute of coal and iron, the department in 1896 produced 108 metric tons of steel. Silk tissues constitute a thriving industry, as do also rope and paper manufacture. In 1898 96,000 gallons of alcohol were manufactured, and in 1901 the yield of wine amounted to 35,313,000 gallons. Tours, the capital, had in 1901 a population of 64,448.

Indus.—A considerable accession of exact geographical knowledge has been gained of the upper reaches of the river Indus and its tributaries by means of those military and political movements which have been so constant on the northern frontiers of India of recent years. The sources of the Indus are to be traced to the glaciers of the great Kailas group of peaks in 32° 20′ N. and 81° E., which overlook the Manasarowar Lake and the sources of the Brahmaputra, the Sutlej, and the Gogra to the south-east. Three great affluents, flowing north-west, unite in about 80° E. to form the main stream, all of them, so far as we know at present, derived from the Kailas glaciers. Of these the northern tributary points the road from Ladak to the Jhalung goldfields, and the southern, or Gar, forms a link in the great Janglam—the Tibetan trade route—which connects Ladak with Lhasa and Lhasa with China. Gartok (about 50 miles from the source of this southern head of the Indus) is an important point on this trade route. At Leh, the Ladak capital, the river is already some 300 miles in length, having pursued an almost even north-westerly course throughout that distance except for a remarkable divergence to the south-west which carries it across, or through, the Ladak range to follow the same course on the southern side that had been maintained on the north. This very remarkable instance of transverse drainage across a main mountain axis occurs in 79° E., about 100 miles above Leh. For another 230 miles, in a north-westerly direction, the Indus pursues a comparatively gentle and placid course over its sandy bed between the giant chains of Ladak to the north and Zaskar (the main "snowy range" of the Himalaya) to the south, amidst an array of mountain scenery which for the majesty of sheer altitude is unmatched by any in the world. Then the river takes up the waters of the Shyok from the north (a tributary

nearly as great as itself), having already captured the Zaskar from the south, together with innumerable minor glacier-fed streams.

The Shyok Affluent.—The Shyok is an important feature in Trans-Himalayan hydrography. Rising near the southern foot of the well-known Karakoram pass on the high road between Ladak and Kashgar, it first drains the southern slopes of the Karakoram range, and then breaks across the axis of the Muztagh chain (of which the Karakoram is now recognized as a subsidiary extension northwards) ere bending north-westwards to run a parallel course to the Indus for 150 miles before its junction with that river. The combined streams still hold on their north-westerly trend for another 100 miles, deep hidden under the shadow of a vast array of snow-crowned summits, until they arrive within sight of the Rakapushi peak which pierces the north-western sky midway between Gilgit and Hunza. Here the great change of direction to the south-west occurs, which is thereafter maintained till the Indus reaches the ocean.

The Gilgit Affluent.—At this point it receives the Gilgit river from the north-west, having dropped from 15,000 to 4000 feet (at the junction of the rivers) after about 500 miles of mountain descent through the independent provinces of northern Kashmir. (See GILGIT.) A few miles below the junction it passes Bunji, and from that point to a point beyond Chilas (50 miles below Bunji) it runs within the sphere of British interests. Then once again it resumes its "independent" course through the wild mountains of Kohistan and Hazara, receiving tribute from both sides (the Bunar contribution being the most noteworthy) till it emerges into the plains of the Punjab below Darband, in 34° 10′ N. All this part of the river has been mapped in more or less detail of late years. The hidden strongholds of those Hindustani fanatics who had found a refuge on its banks since Mutiny days have been swept clean, and many ancient mysteries have been solved in the course of its surveying. Amongst other interesting relics of the past the great "rock" Aornos of Alexandrian fame has been finally identified with Mahaban, and even the names of some of the contiguous villages of Greek story have been found in faint survival.

Indus of the Plains.—From its entrance into the plains of India to its disappearance in the Indian seas, the Indus of to-day is the Indus of the 'fifties—only modified in some interesting particulars. It has been bridged at several important points. There are bridges even in its upper mountain courses. There is a wooden pier bridge at Leh of two spans, and there are native suspension bridges of cane or twig-made rope swaying uneasily across the stream at many points intervening between Leh and Bunji; but the first English-made iron suspension bridge is a little above Bunji, linking up the highroad between Kashmir and Gilgit. Next occurs the iron girder railway bridge at Attok, connecting Peshawar with Rawal Pindi, at which point the river narrows almost to a gorge, only 900 feet above sea-level. Twenty miles below Attok the river has carved out a central trough which is believed to be 180 feet deep. Forty miles below Attok a bridge of boats carries the traffic from the railway terminus at Kushalgarh to the road which leads westwards to Kohat. At Mari, beyond the series of gorges which continue from Kushalgarh to the borders of the Kohat district, at the northern railway terminus of the Sind–Sagar line, there is a boat-bridge leading to Kalabagh (the Salt City) and northwards to Kohat. There is a boat-bridge opposite Dera Ismail Khan to connect that place with the railway; but there is nothing new in these southern sections of the Indus valley railway system except the extraordinary development of cultivation in their immediate neighbourhood. The Lansdowne bridge at Sukkur, whose huge cantilevers stand up as a monument of British enterprise visible over the flat plains for many miles around, is one of the greatest triumphs of Indian bridge-making and the most important of Indus bridges. Kotri will inevitably be connected with Haidarabad in Sind, and the Indus ere long will become the best-bridged river in India. The intermittent navigation which was maintained by the survivals of the Indus flotilla as far north as Dera Ismail Khan long after the establishment of the railway system has ceased to exist with the natural dissolution of the fleet, and the high-sterned flat Indus boats once again have the channels and sandbanks of the river all to themselves.

Lower Indus and Delta.—Within the limits of Sind the vagaries of the Indus channels have necessitated a fresh survey of the entire riverain. The results, however, indicate not so much a marked departure in the general course of the river as a great variation in the channel beds within what may be termed its outside banks. Collaterally much new information has been attained about the ancient beds of the river, the sites of ancient cities, and the extraordinary developments of the Indus delta. The changing channels of the main stream since those prehistoric days when a branch of it found its way to the Rann of Kutch, through successive stages of its gradual shift westwards—a process of displacement which marked the disappearance of many populous places which were more or less dependent on the river for their water supply—to the last and greatest change of all, when the stream burst its way through the limestone ridges of Sukkur and assumed a course which has been fairly constant for 150 years, have all been traced out with systematic care by modern surveyors till the mediæval history of the great river has been fully gathered from the characters written on the delta surface. That such changes of river bed and channel should have occurred within a comparatively limited period of time is the less astonishing if we remember that the Indus, like many of the greatest rivers of the world, carries down sufficient detritus to raise its own bed above the general level of the surrounding plains in an appreciable and measurable degree. At the present time the bed of the Indus is stated to be 70 feet above the plains of the Sind frontier, some 50 miles to the west of it.

Statistics.—The total length of the Indus, measured directly, is about 1500 miles. With its many curves and windings it stretches to about 2000 miles, the area of its basin being computed at 372,000 square miles. Even at its lowest in winter it is 500 feet wide at Iskardo (near the Gilgit junction), and 9 or 10 feet deep. The temperature of the surface water during the cold weather in the plains is found to be 5° colder than that of the air (64° and 69° F.). At the beginning of the hot weather, when the river is bringing down snow water, the difference is 14° (87° and 101° June). At greater depths the difference is still greater. At Attok, where the river narrows between rocky banks, a height of 50 feet in the flood season above lowest level is common, with a velocity of 13 miles per hour. The record rise (since British occupation of the Punjab) is 80 feet. At its junction with the Panjnad (the combined rivers of the Punjab east of the Indus) the Panjnad is twice the width of the Indus, but its mean depth is less, and its velocity little more than one-third. The discharge of the Panjnad at low season is 69,000 cubic feet per second, that of the Indus 92,000. Below the junction the united discharge in flood season is 380,000 cubic feet, rising to 460,000 (the record in August). The Indus after receiving the other rivers carries down into Sind, in the high flood season, turbid water containing silt to the amount of $\frac{1}{229}$ part by weight, or $\frac{1}{410}$ by volume—equal to 6480 millions of cubic feet in the three months of flood. This is rather less than the Ganges carries. The silt is very fine sand and clay. Unusual floods, owing to landslips or other exceptional causes, are not infrequent. The most disastrous flood of this nature occurred in 1858. It was then that the river rose 80 feet at Attok. The

most striking result of the rise was the reversal of the current of the Kabul river, which flowed backwards at the rate of 10 miles per hour, flooding Naoshara and causing immense damage to property.

See MACLAGAN. *Proceedings R.G.S.*, vol. iii.—HAIG. *The Indus Delta Country*. London, 1894.—GODWIN-AUSTEN. *Proceedings R.G.S.*, vol. vi. (T. H. H*.)

Industrial and Reformatory Schools.

—These two classes of institutions are frequently confounded in the public mind. In outward characteristics they are very similar; their system of management, their discipline, and the life led within their walls are alike. Nor is there much difference between the character of the inmates; the distinction is one not so much of criminality as of age. The senior schools or reformatories are schools to which are sent juveniles up to the age of 16 who have been convicted of an offence punishable with penal servitude or imprisonment; the junior or industrial schools, on the other hand, are designed, broadly speaking, for children up to the age of 14 who may not actually have committed an offence, but whose circumstances are such that if left in their surroundings they are likely to join the delinquent population. Thus the reformatories are for actual, the industrial schools for potential, delinquents, and the former contain juveniles some three years older on an average than the latter. The limit of detention in the former is the age of 19, and in the latter the age of 16. The two overlap to some extent, in that an actual delinquent, if under 12 and not previously convicted, may be committed to an industrial school.

Great Britain.

The origin and history of the two classes of schools are distinct. Reformatories derive from the voluntary institutions established by the Marine Society, founded in 1756, and the Philanthropic Society, founded in 1788, which occupied themselves in receiving and reforming the younger classes of criminals, particularly boys sentenced to transportation or long terms of imprisonment, and pardoned conditionally on their detention in such homes. In 1837 the Government itself made an effort to apply reformatory treatment to juveniles in Parkhurst Prison. Outdoor industrial employment was there combined with school instruction and religious teaching, with a view to the reformation of criminal boys; but the place remained technically a prison, and after a fluctuating career it was closed in 1864. The number of inmates had fallen from 536 in 1854 to 68 in 1864, no doubt owing to the passing in the interval of the first Reformatory Act. Thus reformatories have always had so much association with prisons that they have run parallel with them.

Origin of reformatories.

Industrial schools have never had any sort of association with prisons. They are the direct descendants of the "ragged schools," whose object was to provide education for destitute children, and so prevent them from falling into vagrancy and crime. The father of ragged schools was John Pounds, the Portsmouth shoemaker, who in the early years of the 19th century devoted himself to the improvement of the outcast children in his neighbourhood. By 1840 the ragged school movement had become an important one, and enlisted the powerful advocacy of such men as Lord Shaftesbury, Dr Guthrie, and Sheriff Watson of Aberdeen. There are industrial schools now in existence which actually occupy in part the primitive buildings in which they were housed as ragged schools.

Origin of industrial schools.

These preliminary remarks will render intelligible a brief history of legislation in regard to reformatory and industrial schools in Great Britain.

Before 1854 the only children legally detained in a reformatory were those sent there under conditional pardon (Parkhurst Prison Act, 1 and 2 Vict., c. 82, s. 11). The decade between 1840 and 1850 was marked by a powerful stirring of the public conscience with regard to the state of juvenile delinquency in the growing towns of the country, and a desire to check its growth by other than penal measures. Mr Monckton Milnes (afterwards Lord Houghton) introduced a Bill in 1846 for the establishment of reformatory schools. The Bill was rejected, but its introduction focussed the general interest, and in 1851 an important conference was held at Birmingham, the results of which were:—(1) The appointment of a committee by the House of Commons for the investigation of juvenile delinquency; (2) the introduction of a Bill by Mr Adderley (afterwards Lord Norton); (3) the establishment of reformatory schools in various districts by the independent efforts of individuals like Mr Adderley, Lord Leigh, Mr Barwick Baker, and Miss Mary Carpenter. A second conference was held at Birmingham in 1853, and resulted in the Government finally accepting Mr Adderley's Bill and carrying through in 1854 the first Reformatory Schools Act (17 and 18 Vict. c. 86). This Act was amended in 1855, 1856, and 1857. The Act of 1857 was important, in that it enabled for the first time local authorities, viz., Quarter-Sessions in counties and Councils of Quarter-Sessions in boroughs, to contribute towards the establishment of reformatories and the maintenance of children in them. Further, the power was given to grant licences to the inmates of reformatories. In the same year the Rev. Sydney Turner, who had been the superintendent of the Philanthropic Society's school, and was responsible for the establishment of the reformatory at Redhill on the lines of the agricultural colony of Mettray in France, was appointed her Majesty's inspector attached to the Home Office. In 1866 previous Acts were repealed, and the Consolidating and Amending Act now in force was passed. Amending Acts have been passed in 1872, 1874, 1891, 1893, and 1899, while by the Prison Act of 1877, which transferred local prisons to the state, the power of prison authorities to contribute to reformatories was expressly saved. The principal modifications which these amending Acts have effected are:—(1) The age up to which juvenile delinquents may be sent to industrial schools instead of to reformatories was raised to 12 (Acts of 1893, and Youthful Offenders Act, 1901); (2) imprisonment prior to committal to a reformatory school was abolished (Act of 1899); (3) the period of detention was to be not less than three nor more than five years—the offender in any case was not to be detained beyond 19 (Act of 1893); (4) extensive powers were given to managers to dispose of children without their parents' consent (Act of 1891).

Legislation as to reformatories.

The first Industrial Schools Act, introduced by Mr Dunlop, was passed in 1854, and applied to Scotland exclusively. It enabled a sheriff or magistrate to commit, up to 15, vagrant children, though not charged with any offence. Amending Acts were passed in 1855 and 1856, and in 1861 a consolidating statute was passed. The classes of children admissible were enlarged, so as to include not only mendicant and destitute children, but children under 12 charged with offences, and refractory children under 14. The powers of supervision, &c., which had by the original Act been given to the Committee of Council on Education, were transferred to the Home Secretary. The first English Act was passed in 1857. Amending Acts were passed in 1860 and in 1861. These early English Acts closely followed the lines of the Scottish ones, save as regards the admission of pauper children. In 1866 the English and Scottish Acts were consolidated by the

Legislation as to industrial schools.

principal Act now in force, the effect of which was, save again as regards pauper children, to place the industrial schools of both countries on the same footing. The local authority was to be the prison authority in England and the county board in Scotland, and the inspector of industrial schools and the inspector of reformatories were to be the same person, appointed by the Home Secretary. Amending Acts were passed in 1871 (the Prevention of Crimes Act), 1872, 1874, 1880, 1891, 1894, and in 1901 (the Youthful Offenders Act). The effect of these amending Acts has been in the main as follows:—(1) To increase the powers of local authorities to establish and maintain schools and contribute towards the establishment or maintenance of schools (Acts of 1872 and 1874); (2) to add to the classes of vagrant, mendicant, destitute, criminal, and refractory children already admissible to the schools (*a*) children under 14 of a woman twice convicted for crime, and (*b*) children under 14 found lodging in disorderly houses (Act of 1880); (3) greater powers were given to managers to dispose of children without their parents' consent (Act of 1891); (4) though children could not be detained in an industrial school after the age of 16, the period of supervision by the managers was extended to 18 (Act of 1894); (5) Courts of Assize were given the same powers as Courts of Summary Jurisdiction to commit children to industrial schools, and a previous conviction, resulting merely in a whipping or in the benefit of the First Offenders Act, was not to be a bar to the committal of a child under 12 to an industrial school (Youthful Offenders Act, 1901).

Elementary Education Acts.

But the effect of these amending Acts is small beside that of the parallel legislation affecting industrial schools to be found in the Elementary Education Acts. The English Elementary Education Act of 1870, providing for the establishment of school boards, gave them much the same powers in relation to industrial schools as had been in the hands of prison authorities. In 1871, by the Elementary Education (England) Act, school boards in England were enabled to establish and maintain industrial schools. The Elementary Education Act of 1876 carried the movement still further in England, making it obligatory on a school authority to take steps to send children to industrial schools who were liable to be sent, unless the school authority thought it inexpedient. Further, school authorities were required to apply to the justices for orders compelling the attendance at school of children over 5 and under 14 whose elementary education was habitually neglected, or who were found habitually wandering, &c. Justices were enabled, on the breach of such a school attendance order, to commit a child to a day industrial school, or, in default of that, to an ordinary industrial school; but a licence might be granted in Education Act cases after a lapse of one month instead of eighteen months, as in other cases. The effect of these provisions in the Education Acts has been a great increase in the number of children committed to the schools, and the establishment of two subsidiary classes of industrial schools—short detention or truant schools, and day industrial schools, in which children do not reside, but receive their meals, their elementary education, and a certain amount of industrial training. School boards in Scotland have been placed in almost precisely the same position as school boards in England by the Day Industrial Schools (Scotland) Act, 1893. Besides these public Acts, there are a few local Acts in force which should be mentioned—the Middlesex County Industrial Schools Acts, 1854 and 1875; the Glasgow Juvenile Delinquency Act, 1878; the Aberdeen Reformatory and Industrial Schools Act, 1885; the Reformatory and Industrial Schools (Manx Children) Act, 1884; the Reformatory and Industrial Schools (Channel Islands Children) Act, 1885.

Statistics.

At the close of 1900 there were in Great Britain 48 reformatory schools, 142 ordinary industrial schools, 15 truant schools, and 22 day industrial schools. Of the *schools for boys*, 26 reformatories and 48 industrial schools in England, with 4 reformatories and 13 industrial schools in Scotland, were under Protestant management; 4 reformatories and 13 industrial schools in England, with 1 reformatory and 3 industrial schools in Scotland, were under Roman Catholic management. Of the *schools for girls*, 7 reformatories and 32 industrial schools in England, with 2 reformatories and 12 industrial schools in Scotland, were under Protestant management; 2 reformatories and 12 industrial schools in England, with 1 reformatory and 3 industrial schools in Scotland, were under Roman Catholic management. In addition there were in England 3 and in Scotland 2 mixed schools with departments for both girls and boys; these were all under Protestant management. Of the boys' reformatories 2 were training-ships, and all but 3 or 4 of the remainder farm or country schools. Of the boys' industrial schools 8 were training-ships, and the remainder pretty equally divided between town and country schools. All the reformatories and the bulk of the industrial schools were managed by voluntary committees. Ten, however, of the latter (with all the truant and all save one of the day industrial schools) were managed by school boards, 8 by county councils, and 1 by the corporation of Birmingham. Affiliated with the industrial schools were 17 working boys' homes—a wholesome development of the licensing system which is likely to grow.

On the 31st December 1900 there were 4953 boys (England 4189, Scotland 764) and 658 girls (England 554, Scotland 104) *nominally* under sentence of detention in *reformatories*: 3786 Protestant, 1167 Roman Catholic boys; 498 Protestant, 160 Roman Catholic girls. But of these there were at large on licence 860 boys and 27 girls. On the same date there were under committment to *industrial schools* 14,384 boys (England 10,861, Scotland 3523) and 4719 girls (England 3302, Scotland 1417): 11,135 Protestant, 3249 Roman Catholic boys; 3042 Protestant, 1677 Roman Catholic girls. Of these there were at large on licence 1498 boys and 266 girls. Truants numbered 1332, with 4283 on licence, and children attending day industrial schools 3253, with 417 on licence.

If the figures for the period between 1876 and 1900 are studied, it will be seen that the number of juveniles sent to reformatories has positively diminished, while the number of those sent to industrial schools, after rapidly mounting up to 1893, has since that year remained practically stationary.

Finance.

The cost of the schools falls on the Treasury, local rates, and voluntary subscriptions. In addition, the schools to a certain extent earn, or save, money by the industries they practise. The Government grant is a weekly capitation fee; it varies from 6s. to 2s. a week. Reformatories and most of the training-ships get 6s. a week. In industrial schools the grant is varied in accordance with two considerations:—(1) Where a school was established prior to 1872, it gets for certain cases 5s. a week; later schools, 3s. 6d.; (2) whether the degree of criminality implied in the charge under which the child is committed is large or small, *e.g.*, for a child described as a thief the highest grant is given, for a child merely described as refractory 2s. is given. In all cases, however, both reformatory and industrial, the rates over 2s. are reduced after an individual has been for a certain time in the school. In the case of very young children nothing is paid by the Treasury up to six years of age, and the full grant only when the child attains ten years of age. In nearly all the English industrial schools the managers require the Government allowance to be made up to 7s. or 7s. 6d. a week by the local authority concerned. The total amount of the Treasury payments to reformatories in 1900 was, in England £62,053, Scotland £10,384. The contributions from county and borough rates were respectively £22,247 and £2652. Subscriptions, &c., came respectively to £1925 and £321. The profit on industrial departments was respectively £9384 and £1634. In the case of industrial schools during 1900 the Treasury grant was, for England £128,799, Scotland £54,413. Payments from the rates came respectively to £137,596 and £12,692; subscriptions to £15,819 and £9078; profits from industrial departments to £18,941 and £4935. It will be noticed that the share contributed by local authorities in Scotland is less than in England. As a matter of fact, there are several schools in Scotland which endeavour to struggle along on the Government grant, and receive practically no subvention from the rates. Speaking in round figures, it may be said that each inmate of a reformatory school costs £21 a year; of this £14 comes from the Exchequer, £5 from the rates, and £2 from voluntary subscriptions and payments made by the parents. Each

inmate of an industrial school costs £20 a year, of which £9, 10s. comes from the Exchequer, £9 from the rates, and £1, 10s. from subscriptions and parents' payments. In considering comparative tables from the years 1876, 1886, and 1896, it will be seen that while the share paid by the state has remained practically stationary, that of the rates has largely increased, and has to a considerable extent displaced voluntary subscriptions. The total cost per child has varied very little.

The death-rate for schools in Great Britain for 1900 was 4·47 per 1000.

Parental contributions. An important feature of the reformatory and industrial school system of Great Britain has been the recognition and enforcement of the duty of parents to contribute towards their children's maintenance. The contributions are collected by the inspector, and are paid in to the Exchequer in reduction of the Government grant. The work of gathering in this money presents serious difficulties, despite which, however, the amount realized is substantial. In the year 1900 it amounted to over £26,000. The Youthful Offenders Act, passed in 1901, places stringent powers in the hands of the department, and greatly simplifies the legal processes involved in the collection. It is fair to expect that in the future the amount collected will increase, and the moral effect on parents be correspondingly strengthened.

System at work in the schools. As has been explained above, the system at work in reformatory and industrial schools is very much the same. An effort is made to arouse in the schools something of the public school spirit, and as far as possible the size of the various institutions has been kept within reasonable limits. The ideal aimed at has been the avoidance of schools so big that the superintendent cannot know personally each of the children committed to his charge. Many successful boys' reformatories will be found with fewer than 100 inmates, and industrial schools with 150 or fewer inmates. The numbers in girls' schools are fewer, 50 in reformatories and from 60 to 80 in industrial schools being fair average numbers. Roman Catholic schools as a rule run to larger numbers than Protestant; this is probably due partly to the nature of their management, generally a religious community, and partly to motives of economy. Three girls' industrial schools and one boys' reformatory (Redhill) are on the system of a community of separate houses or cottages. One girls' industrial school (Maryhill, Glasgow) combines the advantages of the central home and the detached cottages.

The reformatory influences at work in both reformatory and industrial schools may be described under four heads:—

1. *Religious Instruction.*—In every school the superintendent is assisted by ministers of religion in the effort to inculcate the principles of religion and morality. Many of the Roman Catholic schools are actually under the management of religious communities. In accordance with the salutary tendency to allow children the utmost possible liberty, and to increase their opportunities of mixing with the outside world, it is considered more satisfactory, in Protestant schools at any rate, that children should attend divine service at outside churches than in a chapel of their own.

2. *Elementary Education.*—The scheme of elementary education is very much the same as obtains in the ordinary day-school. Most of the children only attend school half-time, but they attend regularly; and in a good industrial school it will be found that what a child loses in the schoolroom it more than gains in a workshop or needle-room, where educational methods are employed.

3. *Industrial Training.*—More variety in industrial training is to be found in boys' than in girls' schools. There are training-ships, with their nautical training; farm-schools, where agricultural work takes the principal place; town schools, where trades are practised; and suburban schools, where a training can be given in horticulture as well as in trades. In nearly all boys' schools great importance is attached to musical training, since an efficient school band affords an excellent means of disposing of boys in army bands. The industrial training in boys' schools is improving; the principles of technical education are better understood, and an attempt is made not only, by occupying children, to inculcate the habits of industry, but also, by explaining to them the theory of what they are practising, to develop the intelligence. The value, too, of drawing is now generally recognized. The main object in the case of girls is to prepare them for domestic service. Here also an effort is made to perfect their industrial training. In many schools not only do the girls assist in the school kitchen, needle-room, laundry, &c., but the older ones also attend definite courses of lessons in cookery, laundry work, cutting-out and dressmaking. Although the great majority of girls enter domestic service, a few are singled out for training as teachers, dressmakers, shop assistants, or other occupations for which they show a special aptitude.

4. *Physical Culture.*—Physical culture receives marked consideration, for it is recognized as a duty to do the utmost by a sound athletic and gymnastic training to repair the ill effects of early neglect. The report of the Anthropometric Committee of 1883 brought to light the fact that the children entering industrial schools are physically the lowest class of the population, and though statistics published in H.M. inspector's report for 1900 show an improvement, the relative position remains the same. Nevertheless, small though the boys are, they are good material to work upon, for in many cases it is the excess of qualities like enterprise and courage which has got them into trouble. The physical training of girls is largely designed to improve their figures and gait; the utter neglect from which many have suffered in early childhood renders the task a difficult one, but the results to be achieved by patient work in a girls' school are just as encouraging as in a boys'. Mention may be made of various athletic leagues, which introduce a healthy spirit of competition, and remove the feeling of isolation, and of the open-air camp life indulged in by many schools, girls' as well as boys', during the summer.

An important auxiliary in the maintenance of discipline in general use is a mark system, to which various rewards are attached. The object of these mark systems is to reduce punishment to a minimum, and to form character as much by encouraging industry and good conduct as by punishing idleness and misbehaviour.

Disposal of children, and results of the system. The managers of schools are placed by the law in *loco parentis*, but it is often a hard struggle to prevent the natural, however undesirable, parents from again getting hold of their children when they reach a wage-earning age. For three years after children have left a school the managers have to keep an eye on them, and to report to H.M. inspector their addresses, occupations, and characters. The report of H.M. inspector for 1900 describes the position at the end of that year of the children who left the schools in the years 1897, 1898, and 1899. The total number of boys was 13,390, of whom 1939 were in the army, 443 in the navy, 1204 in the mercantile marine or fishermen, 1028 in farm service, 678 in factories, 487 miners, 475 carters, 395 iron and steel workers. Other occupations, in which fewer were engaged, need not be specified, but the number described as in merely casual employment was 577, of re-convictions 970, or 7 per cent., and of those lost sight of 727, or 5 per cent. The total number of girls was 3005: of these more than half entered domestic service, 381, or 38 per cent., in households where more than one servant was kept; laundry-maids numbered 244. The number in casual employment was 202, of re-convictions 62, or 2½

per cent., and of those lost sight of 141, or nearly 6 per cent. It is when the difficult work of *disposal* is under review that the Rev. Sydney Turner's contention in favour of the voluntary management of schools carries conviction.

A discussion of the effect of the schools on crime would require a treatise in itself. We may be content here to quote the guarded judgment of the editors of the judicial statistics during recent years. They are clearly of opinion that crime in England has diminished, and the editor for 1899, reviewing the period 1893–99, says: "I am inclined to think that the tendency towards a decrease in crime generally during the period extends to juvenile crime as a whole, and that at all events there is no ground for believing that there has been any large increase." Of the credit for this happy state of things a fair share may reasonably be claimed by the reformatory and industrial schools.

The Irish reformatory and industrial schools are, so far as regards the central authority, under the Irish Government, and the headquarters of the inspector, appointed by the Lord-Lieutenant, are at Dublin Castle. A Reformatory Schools (Ireland) Act was passed in 1858, and amended by Acts of 1868, 1881, 1893, and 1899. The Irish Industrial Schools Act was passed in 1868, and amended by Acts of 1871 (Prevention of Crimes Act), 1880, and 1901 (Youthful Offenders Act). Though there are minor differences, the law in Great Britain and Ireland is very similar, but the practice appears to have differed considerably. The royal commission of 1884 reported that, owing perhaps to the facts that there were in Ireland no school boards or board schools, no compulsory education, no district workhouse schools—no refuge, in fact, for children of the destitute and deserted class save the ordinary workhouse schools and the industrial schools, the latter were regarded as institutions for poor and deserted children, rather than for those of a semi-criminal class. The commissioners had no doubt that many children were sent to industrial schools in Ireland who could not be so sent in England, while they apprehended that numbers who were proper subjects for these institutions were left on the streets as waifs and strays. Efforts have been made by the Irish Government, particularly by a circular issued in 1898, to redress the balance. The royal commission of 1884 called attention to the number of children committed for "begging," and stated that there was reason to believe that children were often sent out to beg in order to qualify for admission to schools. But in H.M. inspector's report for 1900 it will be found that the number committed for "begging" had dropped from 1204 in 1894 to 676 in 1898, and 160 in 1900.

Ireland.

At the close of 1900 there were in Ireland 6 reformatory and 70 industrial schools, the immense majority of them being under Roman Catholic management. On 31st December 1900 there were 559 boys and 65 girls nominally under sentence of detention in a reformatory, but of these there were at large on licence 26 boys. On the same date there were 3672 (535 Protestants) boys and 4549 (401 Protestants) girls under commitment to industrial schools, but of these there were at large on licence 235 boys and 189 girls. An outstanding feature of these figures, as compared with those for England, is the high proportion of girls; the absolute number is nearly as high as that for the whole of Great Britain, viz., 4719. On the whole, numbers in Irish schools show a tendency of late years to decrease. Finance is regulated very much as in Great Britain, but the capitation grant is not reduced as it is there after a certain period. Per contra, Ireland lacks some of the minor advantages (*e.g.*, licence grants in reformatory cases) enjoyed in Great Britain. The Treasury contributed in 1900 to Irish reformatories £8915; rates, £4198; other sources, £349; and profits were estimated at £1055. To industrial schools in 1900 the Treasury contributed £97,853; rates, £41,944; other sources, £8779; while profits were estimated at £10,546.

Statistics.

The death-rate in Irish industrial schools in 1900 was 8·39 per 1000. The system at work in the Irish schools is, with natural modifications, much the same as that which obtains in Great Britain.

[See the reports of the House of Commons Committee of 1853, of the Royal Commission of 1884, of the Departmental Committee of 1895, and the annual reports of H.M. Inspectors for Great Britain and Ireland.]

Though the idea of the reformatory school was indigenous in England, its realization owed much to foreign precept and example. The provision of the French Penal Code, by which offenders under 16 are held to have acted *sans discernement*, was prominent in the minds of those who fought from 1840 to 1850 for the passing of a Reformatory Schools Act. The leading reformatory in Great Britain to-day is the Philanthropic Society's farm-school at Redhill, which was avowedly modelled on the famous agricultural colony at Mettray, near Tours, founded by M. Demetz in 1839. Both at Redhill and Mettray the colony is divided into separate houses, each containing from forty to sixty inmates, and supervised, as in the case of an English public school, by a house-master; but the colony at Redhill is smaller, the arrangement of the houses is on a less formal plan, and the display of "uniform" among the officers is reduced to a minimum. Another foreign school which largely influenced public opinion in Great Britain, as in Germany, was the Rauhe Haus, near Hamburg, founded by Dr Wickern in 1833. This began with a single cottage, but had grown in twenty years to a hamlet of twenty houses, with from twelve to sixteen inmates in each. The establishment was a Lutheran one; both boys and girls were admitted, though to separate houses, and a marked feature of the place was the number of "brothers," young men of good character qualifying for rescue-work as superintendents of homes, prison officers, and schoolmasters, who took part in the work, and swelled to an unusual extent the proportion of officials to inmates. The character and aims of the Rauhe Haus seem to have changed somewhat in modern days.

Reformatories abroad.

There are schools or "colonies" analogous to reformatory and industrial schools in most European countries —France, Germany, Austria, Belgium, Sweden, Norway, Switzerland (where the influence of Pestalozzi is discernible), and Italy. In all the principle of voluntary management is admitted, but in France, Germany, Austria, Belgium, and Italy there are schools directly managed by the Government or State. It may be fairly claimed for the system and the schools of Great Britain, as compared with those of the Continent, that the system attempts more jealously to enforce the principle of parental responsibility, and that the schools have as a general rule two signal advantages: (1) they are less formal and institutional; (2) far more use is made of the healthy discipline of games and field-sports.

In the United States, as on the continent of Europe, schools corresponding to reformatory and industrial schools are to be found, the oldest, the New York House of Refuge, dating from 1824. But the unique interest of the United States is connected with the *adult* reformatories, the best known of which are the establishments at Elmira in New York and Concord in Massachusetts (see Prison Discipline). The character and the scale of these may in a measure be judged by the following particulars:—

United States adult reformatories.

The reformatory, the buildings of which are on an ambitious scale and ornamental in style, was opened in 1876 for the reception of youthful male felons who are committed there for the statutory term for their particular offence to undergo a process of training and reformation in place of the ordinary punishment.

The total number received during the seventeen years was 6551; the age of the inmates varied from 16 years to 30 years, the average age being 21 years. The average number in confinement during 1893 was 1470. There were 1378 inmates at the close of the year, with an average period of detention of seventeen months. The total cost of maintenance for 1893 was \$215,223. The trade earnings amounted to \$53,458, leaving a net cost of \$161,765.

The reformatory is provided with 1258 cells, so that about 400 were necessarily associated two in one room. To avoid still more

overcrowding it had been found necessary to transfer 150 of the least promising inmates to the state prisons. This course had been found to act as an incentive to troublesome conduct on the part of inmates in order to secure their transfer to the prison, where an abatement of their sentence might be earned with less exertion on their part.

The prisoners committed to the reformatory are felons; 45 per cent. of them had previously been in contact with the restraining agencies of the law; 68 per cent. were illiterate; 75 per cent. were without regular occupation; 92 per cent. were without the benefits of good home surroundings. The object of the reformatory is, as far as practicable, to place the prisoner in "conditions parallel with those of free life," there to work out his institutional career.

The moral inducements of reformation consist of (1) division into grades, with differing degrees of comfort and social standing; (2) a wage-earning mark system; (3) the personal influence of the reformatory staff. Between 70 and 80 per cent. are said to respond to the efforts made for their good. For the remainder compulsion is found necessary, either by means of forfeiture of marks, degradation of rank, or personal chastisement. Thirty-four different trades had been taught during the year, and it is claimed that 78 per cent. of the discharged inmates went straight to the trade learned in the reformatory. Two evenings a week are devoted to education, and twenty of the best educated amongst the inmates assist in this work. Lectures and concerts are given periodically. There is a gymnasium, and 1175 of the able-bodied inmates are formed into a regiment to go through a course of military drill and training. Prisoners can, at the discretion of the managers, be released on parole, to be brought back again if found to be drifting into crime, but the release is made absolute after six months' satisfactory trial. The total number "paroled" during the seventeen years was 3723. Of these 259 were brought back, 110 were paroled a second time, and 10 a third time. It is claimed that probably about 80 per cent. of the prisoners are reformed, that is, "the discharged inmate returns to society not more, but probably less, likely to fall into crime than the virtuous of the class to which he belongs."

Elmira and the kindred institutions of the United States have been keenly discussed of recent years among European penologists. The success of the system for adults has not been universally admitted, and its adaptability to the conditions of the more thickly populated countries of the Old World has been questioned. Critics have further been alarmed by the costliness of the system. An English account of these American adult reformatories, with observations upon them, will be found in a Report to the Home Secretary, published in 1897 by Mr Ruggles-Brise, C.B., chairman of the Prison Commissioners. (J. G. L.)

Ineboli, a town, with an open roadstead, on the north coast of Asia Minor. It is the port of Kastamúni, with which it is connected by a carriage road, and exports wool and mohair. The exports and imports are valued at £445,000 annually. The population is 9000 (Moslems 7000, Christians 2000). There are British and other consular officers.

Inebriety, Law of.—The legal relations to which drunkenness gives rise are partly civil and partly criminal. The law as to the civil capacity of the drunkard is practically identical with the law as to the civil capacity of a person suffering from mental disease (see INSANITY, LAW OF). He can enter into a valid marriage or make a valid will, or bind himself by a contract, if he is sober enough to know what he is doing, and no improper advantage of his condition is taken. The Sale of Goods Act, 1893, also provides that where necessaries are sold and delivered to a person who by reason of drunkenness is incompetent to contract, he must pay a reasonable price for them; and "necessaries" for the purposes of this provision mean goods suitable to the condition in life of such person and to his actual requirements at the time of the sale and delivery.

Drunkenness comes under the cognizance of the criminal law as a form of breach of the peace. The Licensing Acts and other statutes of a similar character also create various offences in connexion with the sale of intoxicating liquors. Neither of these subjects needs to be touched upon here. The law as to the criminal responsibility of drunkards must, however, be examined.

Drunkenness, unlike insanity, was at one time regarded as in no way an excuse for crime. According to Coke, a drunkard, although he suffers from acquired insanity, *dementia affectata*, is *voluntarius dœmon*, and therefore has no privilege in consequence of his state; "but what hurt or ill soever he doth, his drunkenness doth aggravate it." Sir Matthew Hale took a more moderate view, viz., that a person under the influence of this voluntarily contracted madness "shall have the same judgment as if he were in his right senses"; and admitted the existence of two "allays" or qualifying circumstances: (1) *temporary* frenzy induced by the unskilfulness of physicians or by drugging; and (2) *habitual* or fixed frenzy. Those early authorities have, however, undergone considerable development and modification in later years. It is settled law that where a particular intent is one of the constituent elements of an offence, the fact that a prisoner was intoxicated at the time of its commission is relevant evidence to show that he had not the capacity to form that intent. Drunkenness is also a circumstance of which a jury may take account in considering whether an act was premeditated, or whether a prisoner acted in self-defence or under provocation, when the question is whether the danger apprehended or the provocation was sufficient to justify his conduct or to alter its legal character. Moreover, *delirium tremens*, if it produce such a degree of madness as to render a person incapable of distinguishing right from wrong, relieves him from criminal responsibility for any act committed by him while under its influence; and in one case at *nisi prius* (*Reg.* v. *Baines*, *The Times*, 25th Jan. 1886) this doctrine was extended by Mr Justice Day to temporary derangement occasioned by drink. The law of Scotland accepts, if it does not indeed go somewhat beyond, the later developments of that of England in regard to criminal responsibility in drunkenness. Indian law on the point is similar to the English. In the United States the same liberal view is the prevalent legal doctrine.

Provision is made for the care of habitual drunkards by the Inebriates Acts of 1879, 1888, 1898, and 1899. Only an outline of the provisions of these statutes can here be attempted. They deal in the first place with non-criminal, and in the second place with criminal, habitual drunkards.

For the purposes of the Acts the term "habitual drunkard" means "a person who, not being amenable to any jurisdiction in lunacy, is notwithstanding, by reason of habitual intemperate drinking of intoxicating liquor, at times dangerous to himself or herself, or incapable of managing himself or herself and his or her affairs." A person would become amenable to the lunacy jurisdiction not only where habitual drunkenness made him a "lunatic" in the legal sense of the term, but where it created such a state of disease and consequential "mental infirmity" as to bring his case within section 116 of the Lunacy Act, 1890, the effect of which is explained in the article INSANITY, LAW OF. Any "habitual drunkard" within the above definition may obtain admission to a "licensed retreat" on a written application to the licensee, stating the time (the maximum period is two years) that he undertakes to remain in the retreat. The application must be accompanied by the statutory declaration of two persons that the applicant is a habitual drunkard, and its signature must be attested by a justice of the peace who has satisfied himself as to the fact, and who is required to state in part of the attestation that the applicant understood the nature and effect of his application. Licences (each of which is subject to a duty and is impressed with a stamp of £5, and 10s. for every patient above ten in number) are granted for retreats by the borough council and the town clerk in boroughs, and elsewhere by the County Council and the clerk of the County Council. The maximum period for which a licence

may be granted is two years, but licences may be renewed by the licensing authority on payment of a stamp duty of the same amount as on the original grant. When a habitual drunkard has once been committed to a retreat, he must remain in the retreat for the time that he has himself fixed in his application, subject to certain statutory provisions similar to those prescribed by the Lunacy Acts for asylums as to leave of absence and discharge; and he may be retaken and brought back to the retreat under a justice's warrant. The term of detention may be extended on its expiry, or an inebriate may be readmitted, on a fresh application, without any statutory declaration, and without the attesting justice being required to satisfy himself that the applicant is a habitual drunkard. Licensed retreats are subject to inspection by an inspector of retreats appointed by the Home Secretary, to whom he makes an annual report. The Home Secretary is empowered to make rules and regulations for the management of retreats, and "regulations and orders," not inconsistent with such rules, are to be prepared by the licensee within a month after the granting of his licence, and submitted to the inspector for approval. The rules now in force were made on 10th August 1888. There are also statutory provisions, similar to those of the Lunacy Acts, as to offences—(i.) by licensees failing to comply with the requirements of the Acts; (ii.) by persons ill-treating patients, or helping them to escape, or unlawfully supplying them with intoxicating liquor; (iii.) by patients refusing to comply with the rules. The Home Secretary may (i.) authorize the establishment of "State Inebriate Reformatories," to be paid for out of moneys provided by Parliament; and (ii.) sanction "Certified Inebriates' Reformatories" on the application of any borough or County Council, or any person whatever, if satisfied concerning the reformatory and the persons proposing to maintain it. An inspector of certified inebriate reformatories has been appointed.

Any person convicted on indictment of an offence punishable with imprisonment or penal servitude (*i.e.*, of any non-capital felony and of most misdemeanours), if the court is satisfied from the evidence that the offence was committed under the influence of drink, or that drink was a contributing cause of the offence, may, if he admits that he is, or is found by the jury to be, a habitual drunkard, in addition to or in substitution for any other sentence, be ordered to be detained in a state or certified inebriate reformatory, the managers of which are willing to receive him. Again, any habitual drunkard who is found drunk in any public place, or who commits any other of a series of similar offences under various statutes, after having within twelve months been convicted at least three times of a similar offence, may, on conviction on indictment, or if he consent, on summary conviction, be sent for detention in any certified inebriate reformatory. The expenses of prosecuting habitual drunkards under the above provisions are payable out of the local rates upon an order to that effect by the judge of assize or chairman of quarter-sessions if the prosecution be on indictment, or by a court of summary jurisdiction if the offence is dealt with summarily. The Inebriates Acts apply to Scotland and Ireland with adaptations.

AUTHORITIES.—As to the history of legislation on the subject see Parl. Paper No. 242 of 1872; 1893 C. 7008.—*The Annual Reports of the Inspector of Licensed Retreats.*—WYATT PAINE. *Inebriates Acts*, 1879–1898. London, 1899.—BLACKWELL. *Inebriates Acts*, 1879–1898. London, 1899.—WOOD RENTON. *Lunacy.* London and Edinburgh, 1896.—KERR. *Inebriety*, 3rd edition, London, 1894, in which an excellent account of the systems in force in other countries for the treatment of inebriates will be found.

Infantry.—This term, adopted into the English language from either Italian or French, implies men equipped and armed for fighting on foot. The Italian *fante*, Boccaccio's *fanteria*, the French *fantassin* and *infanterie*, are portions of the same stock, offshoots from the Latin *infans*, employed in the sense of "youth." During the days of chivalry, youths of good family, dependants, and servants all marched as infantry in rear of the knights. The development of infantry soldiers during the long period between the mythical dawn of history and the present time is a continuous narrative of war following war, with scant intervals of peace. Infantry formed the bulk of all early armies from the date of David's capture of Jerusalem or the uncertain date of the siege of Troy, through the eras of the Greek and Macedonian phalanx and of the Roman Legion. Franks from Germany marched and fought on foot during and after the conquest of Gaul; Charlemagne in the 8th century employed masses of infantry to keep order in a kingdom extending from the Elbe to the Ebro, from the Atlantic to the mountains of Bohemia, and diagonally from the British Channel to Naples. The institution of chivalry did little to diminish the numerical preponderance of foot-soldiers over the rest of the forces; but growing skill in metal-working, and its special application to arms and armour, increased the relative power of mounted men, for they alone could bear the weight of complete defence. The cost of armour was great, and on the continent of Europe the infantry service was relegated to slaves and to freed serfs, whilst in England, from the Conquest onwards, yeomen and dependants of the feudal tenants formed a numerous but ill-armed and unorganized mass of infantry. On the borderland of the 12th and 13th centuries, infantry militia was the principal force employed by Philip Augustus in his contests against the English king and the Flemish soldiers of the Emperor Otho IV. In the 14th century cavalry of the highest quality dismounted and fought on foot both at Creçy and Poictiers, and at Agincourt the English archers played havoc with the cavaliers of France. A century later Spanish infantry rose to formidable prominence synchronously with the introduction of muskets and standing armies. In 1494 Charles VIII. embarked on his Italian campaign at the head of an army consisting of 3600 men-at-arms, 20,000 native infantry, 8000 Swiss mercenaries, a considerable body of infantry raised in Germany and called Lansquenets (Landsknecht), together with a formidable train of artillery; and with these he fought his way to Naples and back, although the bulk of the native infantry were the refuse of society—"branded and ear-cropped" for various crimes. The well-organized and, for the period, well-armed Swiss infantry withstood the shock of the best cavalry furnished by the Pope, the Emperor Ferdinand of Spain, and the republic of Venice. The Swiss, during their long defence against the House of Austria, compelled by poverty to depend exclusively on infantry, had gained confidence in resisting cavalry, and European powers employed them as mercenaries; but being as exacting as Prætorian guards, and therefore dangerous to their employers, they were gradually discarded, and armies were raised from native races. In modern times, as of old, infantry form the main body of all armies in the field; they are self-containing to a greater extent than either cavalry or artillery, and although limited as to speed of movement, they are less hampered by accidents of the ground than either of the other arms, and less dependent on daylight for effective action. They have a special value to Great Britain, in that their sea transportation is a comparatively easy matter.

The proportion of infantry to cavalry in most modern armies is approximately 6 to 1, with perhaps 3 artillery guns to each 1000 men of the other two arms combined;

but this ratio is varied in practice according to the climate to be encountered and the nature of the field of campaign. A proportion of cavalry and artillery which would be suitable to action in the plains of India would ill befit operations on the Himalayan spurs, or in the tropical forests of West Africa.

A branch of infantry service has grown into prominence during Great Britain's unceasing small wars. Mounted infantry are foot-soldiers who ride for purposes of accelerated locomotion; their action in the field differs from that of cavalry, whose normal fighting formation and equipment are planned for mounted men, whereas the rifle and bayonet of the infantry soldier preclude him from mounted combat.

The varying formation adopted by commanders of infantry during successive centuries is in the strictest sense a question of tactics, but the quality of the infantry in courage, discipline, and armament has largely affected the subject. Up to the time of Epaminondas, in the 4th century B.C., contending forces faced one another along their whole front of battle, but he introduced what is now called an echelon formation: his infantry of the highest quality were placed in a massive column on one flank or other, and the less good, indifferently armed, lighter troops were kept diagonally "refused"; thus the advanced flank of the line gave the heavy blow, which was supported by the refused echelon gradually coming into contact with the enemy. The Macedonian phalanx of the next generation, under the consummate leadership of Philip, overthrew the Peloponnesian armies; and that massive formation with flanking cavalry held good till the development of the more mobile Roman legions. Similarly at a later date the stately and successful flanking movements of the Prussian king, when continued by unappreciative successors, yielded to the new-born reckless mobility of the French under Napoleon; but the latter, during his prolonged wars, was driven to adopt more massive formations, as the battle losses of successive years weakened the fighting qualities of his armies. Nemesis, however, was unrelenting, for the fire efficiency of thin lines, with ample working space for individual soldiers, destroyed for all time the validity of dense columns.

The armament of infantry has varied with the years; from short swords and slings, to javelins, bows, and spears; thence to pikes and matchlocks, to flint muskets with bayonets in the muzzles, percussion guns with bayonets outside, muzzle-loading rifles, breech-loading rifles, to the magazine rifles and smokeless powder of the present day. Defensive armour has gradually been abandoned under the stress of desired mobility, and during each succeeding war period the weight of accoutrements carried by a foot-soldier is reduced more and more to the barest necessity—the extreme weight under which he can march and work being made up by ammunition in ever-increasing quantity as the improved mechanism of his arm demands a more lavish supply.

The numbers of infantry in Europe are enormous on paper, and in some of the well-governed states the actual and the paper numbers approximate to one another. By the army returns of the latest dates Europe retains $2\frac{3}{4}$ millions of infantry on a peace establishment; this number might be increased to $15\frac{1}{2}$ millions in war, but both numbers are subject to some discount. In one state the war army is returned as a levy *en masse* of the male population, which means not an army, but a disorganized crowd of men with or without rifles and ammunition. On the other hand, Russia or Turkey might with comparative facility increase their numbers in Europe by transporting Asiatic troops, who could migrate westwards without impinging on foreign territory.

The formation of infantry into sections, companies, and battalions, these last growing in strength from 400 to 900, can be traced during the 700 years between the dates of Lycurgus and Polybius. Nestor recommended Agamemnon to accept a territorial system (*Iliad*, ii. 364) by which men and officers from the same district served together. The organization of infantry now generally holding is about 1000 men in each battalion, with either four or eight captain's companies in each; the papers and documents are compiled for the battalion, although large disciplinary power, varying in different countries, is placed in the hands of the company commanders. The range and accuracy of modern firearms enforce a thinner formation, and consequently a more extended one, as science increases the power of both artillery and rifles, and the full effect of smokeless propellants in war has yet to be learned; hence the responsibilities of captains of companies grow visibly, as those officers have command of the largest body that can certainly be influenced by the personality of a single commander under the stress of combat. The working unit of infantry is practically the company, commanded by its captain, and this seems to be common in all armies from Biblical times to the present; the centurion, or commander normally of 100 men, has been a recognized character since history began; sub-units, either half-companies or sections under lieutenants or other subaltern officers, and smaller bodies under sergeants or corporals, may have effective duties both in peace and war. Two, three, or four battalions form a regiment, generally of a territorial nature, and sometimes with some form of additional veteran battalions or militia, as reinforcing bodies in war. The largest pure unit of infantry is a brigade; divisions may contain two or three brigades, but have troops of other arms attached.

The infantry of all countries have at times shown brilliant courage and military qualities, but check or failure seems unduly to affect the troops of some nationalities. In the American Civil War troops of nationalities with high reputation in some portions of the Old World proved often to be broken reeds in times of stress. Since the days of Cæsar and his Xth Legion probably no infantry have deservedly held so dominating a reputation as the Light Division of the Duke of Wellington's army in the Peninsula; but they had a great literary artist as their historian, and he was a gallant member of their noble body. The foundation of war success for infantry, as with all troops, is confidence—well founded on long experience of the officers; Great Britain had, at times, to bear the bitter burden of the reverse, but, for the most part, a resilience supervened in changed circumstances, or the British Empire would not hold the position it now does on the scroll of civilizing powers. In the last Boer War the British infantry proved splendid fighters.

Literature on the subject is profuse; perhaps the best condensation is *Die Fechtweise aller Zeiten*, by Boguslawski. (J. B. S.)

Infants.—There have been various recent modifications in the law of the United Kingdom affecting infants. By the Sale of Goods Act, 1893, an infant liable on a contract for necessaries can be sued only for a reasonable price, not necessarily the price he agreed to pay. The same statute declares "necessaries" to mean "goods suitable to the condition in life of the infant and to his actual requirements at the time of the sale and delivery." In the case of goods having a market price, the market price is reasonable. In all other cases the question is one of fact for the jury. Recent decisions have explained and interpreted the Infants' Relief Act, 1874. For some years after the passage of that statute highly conflicting views were held as to the meaning of the part of section 2 whereby it was enacted that "no action shall be brought whereby to charge any person . . . upon any ratification made after full age of any promise or contract made during infancy." Some authorities were of opinion that the section only applied to the three classes of contract made void by the previous section, viz., for goods supplied, money lent, and on account stated. Others thought the effect to be that no contract, except for necessaries, made during infancy could be enforced after the infant came to full age. After several conflicting decisions it has been settled that both these views were wrong. Of the infant's contracts voidable at common law there were two kinds. The first kind became void at full age, unless expressly ratified. The second kind were valid, unless repudiated within a reasonable time after full age was attained by the infant. The Infants' Relief Act (section 2) strikes only at the first class, and leaves the second untouched. Thus a promise of marriage made during infancy cannot be ratified so as to become actionable; but an infant's marriage settlement, being of the second class, is valid, unless it is repudiated within a reasonable time after the infant attains full age. What is a reasonable time depends on all the circumstances of the case. In a case decided in 1893 a settlement made by a female infant was allowed to be repudiated thirty years after she attained full age, but the circumstances were exceptional.

The Guardianship of Infants Act, 1886, places the mother almost on the same footing as the father as to guardianship of infants. On the death of the father the mother becomes guardian under the statute, either alone when no guardian has been appointed by the father, or

jointly with any guardian appointed by him under 12 Chas. II. c. 24. A change of the law even more important is that whereby the mother may by deed or will appoint a guardian or guardians of her infant children to act after her death. If the father survives the mother, the mother's guardian can only act if it be shown to the satisfaction of the court that the father is unfitted to be the sole guardian. On the death of the father, the guardian so appointed by the mother acts jointly with any guardian appointed by the father. The Guardianship of Infants Act, 1886, also gives power to the High Court and to county courts to make orders, upon the application of the mother, regarding the custody of an infant, and the right of access thereto of either parent. The court must take into consideration "the welfare of the infant, and . . . the conduct of the parents, and . . . the wishes as well of the mother as of the father." The same statute also empowers the High Court of Justice, "on being satisfied that it is for the welfare of the infant," to "remove from his office any testamentary guardian or any guardian appointed or acting by virtue of this Act," and also to appoint another in place of the guardian so removed.

The same statute gives power to a court sitting in divorce practically to take away from a parent guilty of a matrimonial offence all rights of guardianship. When a decree for judicial separation or divorce is pronounced, the court pronouncing it may at the same time declare the parent found guilty of misconduct to be unfit to have the custody of the children of the marriage. "In such case the parent so declared to be unfit shall not, upon the death of the other parent, be entitled as of right to the custody or guardianship of such children." The court exercises this power very sparingly. When the declaration of unfitness is made, the practical effect is to give to the innocent parent the sole guardianship, as well as power to appoint a testamentary guardian to the exclusion of the guilty parent.

Another radical change has recently been made in the rights of parents as to guardianship of their children. In consequence of several cases where, after children had been rescued by philanthropic persons from squalid homes and improper surroundings, the courts had felt bound by law to redeliver them to their parents, the Custody of Children Act, 1891, was passed. It provides that when the parent of a child applies to the court for a writ or order for the production of the child, and the court is of opinion that the parent has abandoned or deserted the child, or that he has otherwise so conducted himself that the court should refuse to enforce his right to the custody of the child, the court may, in its discretion, decline to issue the writ or make the order. If the child, in respect of whom the application is made, is being brought up by another person ("person" includes "school or institution"), or is being boarded out by poor-law guardians, the court may, if it orders the child to be given up to the parent, further order the parent to pay all or part of the cost incurred by such person or guardians in bringing up the child.

A parent who has abandoned or deserted his child is, *primâ facie*, unfit to have the custody of the child. And before the court can make an order giving him the custody, the *onus* lies on him to prove that he is fit. The same rule applies where the child has been allowed by the parent "to be brought up by another person at that person's expense, or by the guardians of a poor-law union, for such a length of time and under such circumstances as to satisfy the court that the parent was unmindful of his parental duties."

The 4th section of the Custody of Children Act, 1891, carefully preserves the right of the parent to control the religious training of the infant. The father, however unfit he may be to have the custody of his child, has the legal right to require the child to be brought up in his own religion. If the father is dead, and has left no directions on the point, the mother may assert a similar right. But the court may, if the child appears capable of understanding the matter, consult the wishes of the child; and when an infant has been allowed by the father to grow up in a faith different from his own, the court will not, as a rule, order any change in the character of religious instruction. This is especially the case where the infant appears, on examination, to be settled in his convictions.

In the same direction as the Custody of Children Act, 1891, is the Prevention of Cruelty to Children Act, 1894, whereby considerable powers have been conferred on courts of summary jurisdiction. Magistrates are empowered to punish parents or other custodians of children for cruelty, to deprive them of the custody of the children, and to remove the children, until they attain the age of sixteen, to other custody.

The Guardianship of Infants Act, 1886, the Custody of Children Act, 1891, and the Prevention of Cruelty to Children Act, 1894, all apply to Scotland. (R. S. D.)

Influenza.—Like cholera and plague, influenza has reappeared, after an interval of many years, in epidemic or rather pandemic form, and has exhibited a far greater power of diffusion and a more generally destructive influence upon life and health than either cholera or plague. The previous severe visitations in Great Britain during the 19th century occurred in 1803, 1833, 1837–38, and 1847–48. After the year 1848, in which 7963 deaths were directly attributed to influenza in England and Wales, the disease continued more or less prevalent until 1860, with distinct but minor epidemic exacerbations in 1851, 1855, and 1858; but during the next decade the mortality dropped rapidly though not steadily, and the diminution continued down to the year 1889, in which only 55 deaths were ascribed to this cause. It is not clear whether the disease ever disappears wholly or not. Every year doctors meet with cases of illness which they call influenza, and the 55 deaths registered in 1889 are the lowest number recorded in any year since the Registrar-General's returns began. Occasionally also local outbreaks of illness resembling epidemic influenza have been observed during the period of abeyance, as, for instance, in Norfolk in 1878 and in Yorkshire in 1887; but whether such outbreaks and the so-called "sporadic" cases that occur every year are nosologically identical with epidemic influenza is open to some doubt. The relation seems rather to be similar to that between Asiatic cholera and "cholera nostras." Individual cases may be indistinguishable, but as a factor in the public health the difference between sporadic and epidemic influenza is quite as great and unmistakable as that between the two forms of cholera. This fact, which had been forgotten by some since 1847 and never learnt by others, was brought home forcibly to all by the visitation of 1889.

The disease began then, though it did not obtain a distinct hold of England until the very close of the year. According to the exhaustive report drawn up by Dr H. Franklin Parsons for the Local Government Board, the earliest appearances were observed in May 1889, and three localities are mentioned as affected at the same time, all exceedingly remote and widely separated from each other —namely, Bokhara in Central Asia, Athabasca in the North-West Territories of Canada, and Greenland. About the middle of October it was reported at Tomsk in

Siberia, and by the end of the month at St Petersburg. During November Russia became generally affected, and cases were noticed in Paris, Berlin, Vienna, London, and Jamaica (?). In December epidemic influenza became fully established over the whole of the continent of Europe, along the Mediterranean, in Egypt, and over a large area in the United States. It also appeared in several towns in England, beginning with Portsmouth, during December, but did not become generally epidemic until the commencement of the new year. In London the full onset of unmistakable influenza dated from 1st January 1890. Everywhere it seems to have exhibited the same explosive character when once fully established. In St Petersburg, out of a Government staff of 260 men, 220 were taken ill in one night, 15th November. During January 1890 the epidemic reached its height in London, and appeared in a large number of provincial towns throughout the British Islands, though it was less prevalent in the north and north-west than in the south. The experience of many Continental countries in the same month was very similar, though, generally speaking, they were somewhat in advance of England. January witnessed a great extension of the disease in Germany, Holland, Switzerland, Austria-Hungary, Italy, Spain, and Portugal; but in Russia, Scandinavia, and France it was already declining. On the whole, the period of greatest activity in Europe was the latter half of December and the earlier half of January, with the change of the year for a central point. Other parts of the world affected in January 1890 were Cape Town, Canada, the United States generally, Algiers, Tunis, Cairo, Corsica, Sardinia, Sicily, Honolulu, Mexico, the West Indies, and Montevideo. In February the provincial towns of England were most severely affected, the death-rate rising to 27·4, but in London it fell from 28·1 to 21·2, and for Europe generally the back of the epidemic was broken. On the other hand, it extended in the Far East at the same time, appearing in Ceylon, Penang, Japan, Hong Kong, and India; also in West Africa, attacking Sierra Leone and Gambia in the middle of the month; and finally in the west, where Newfoundland and Buenos Aires were invaded. In March influenza became widely epidemic in India, particularly in Bengal and Bombay, and made its appearance in Australia and New Zealand. In April and May it was epidemic all over Australasia, in Central America, Brazil, Peru, Arabia, and Burma. During the summer and autumn it reached a number of isolated islands, such as Iceland, St Helena, Mauritius, and Réunion. Eventually, towards the close of the year, it was reported from Yunnan in the interior of China, from the Shiré Highlands in Central Africa, Shoa in Abyssinia, and Gilgit in Kashmir. In the course of fifteen months, if we begin with its undoubted appearance in Siberia in October 1889, it had traversed the entire globe and visited every quarter, however remote.

The localities attacked by influenza in 1889–90 appear in no case to have suffered severely for more than a month or six weeks, the disease then ceasing to be epidemic, if it did not wholly disappear. Thus in Europe and North America generally the visitation had come to an end in the first quarter of 1890, though small local outbreaks were reported here and there later in the year and during the following winter. The earliest signs of an epidemic revival on a large scale occurred about the same time, namely, March 1891, in the United States and the north of England. In the former it was reported from Chicago and other large towns in the central states, whence it spread eastwards, reaching New York about the end of March. In England it began in the Yorkshire towns, particularly in Hull, and also independently in South Wales. In London influenza became epidemic for the second time about the end of April, and soon afterwards was widely distributed in England and Wales. The large towns in the north, together with London and Wales, suffered very much more heavily in mortality than in the previous attack, but the south-west of England, Scotland, and Ireland escaped with comparatively little sickness. The same may be said of the European continent generally, with the exception of parts of Russia, Scandinavia, and perhaps the north of Germany. This second epidemic coincided with the spring and early summer; it had subsided in London by the end of June. The experience of Sheffield is interesting. In 1890 the attack, contrary to general experience, had been undecided, lingering, and mild; in 1891 it was very sudden and extremely severe, the death-rate rising to 73·4 during the month of April, and subsiding with equal rapidity. During the third quarter of the year, while Europe was free, the Antipodes had their second attack, which was more severe than the first. As in England, it reversed the previous order of things, beginning in the provinces and spreading thence to the capital towns. The last quarter of the year was signalized by another recrudescence in Europe, which reached its height during the winter. All parts, including Great Britain, were severely affected. In England it began in the south and south-west in the month of October, and at the same time, or a little earlier, in Scotland at Dundee, and in Ireland at Londonderry. All these parts suffered heavily, together with Northumberland, Durham, and Cumberland, but those which had borne the brunt of the epidemic in the early part of the year escaped. In fact, these two revivals may be regarded as one, temporarily interrupted by the summer quarter.

The recrudescence at the end of 1891 lasted through mid-winter, and in many places, notably in London, it only reached its height in January 1892, subsiding slowly and irregularly in February and March. Brighton suffered with exceptional severity. The Continent seems to have been similarly affected. In Italy the notifications of influenza were as follows: 1891—January to October, 0; November, 30; December, 6461; 1892—January, 84,543; February, 55,352; March, 28,046; April, 7962; May, 1468; June, 223. Other parts of the world affected were the West Indies, Tunis, Egypt, Sudan, Cape Town, Tehran, Tongking, and China. In August 1892 influenza was reported from Peru, and later in the year from various places in Europe.

A fourth recrudescence, but of a milder character, occurred in Great Britain in the spring of 1893, and a fifth in the following winter, but the year 1894 was freer from influenza than any since 1890. In 1895 another extensive epidemic took place. In 1896 the enemy seemed to have spent its strength, and hopes were entertained that it was dying out, but these were falsified by an increased prevalence in 1897, which was repeated on a larger scale in 1898, and again in 1899, when 12,417 deaths were recorded in England and Wales. The experience of other countries has been very similar; they have all been subjected to periodical revivals of epidemic influenza at irregular intervals and of varying intensity since its original reappearance in 1889, but on the whole there has been a general though not a steady decline in its activity and potency. Its behaviour is, in short, quite in keeping with the experience of 1847–60, though the later visitation appears to have been considerably more violent and more fatal than the former. Its diffusion was also more rapid and probably more extensive.

The foregoing general summary may be supplemented by some further details of the incidence in Great Britain. The number of deaths directly attributed to influenza,

and the death-rates per million in each year in England and Wales, are as follows :—

	1890.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.
Deaths . .	4523	16,686	15,737	9669	6625	12,880	3753	6088	10,405
Death-rates per million	157	574	534	325	220	424	122	196	331

It is interesting to compare these figures with the corresponding ones for the previous visitation :—

	1847.	1848.	1849.	1850.	1851.	1852.	1853.	1854.	1855.
Deaths . .	4881	7963	1611	1380	2152	1359	1789	1061	3568
Death-rates per million .	285	460	92	78	120	76	99	58	193

The two sets of figures are not strictly comparable, because registration was in its infancy during the first period, and notification of the cause of death was not made compulsory until many years later; but it seems clear that, when all allowances have been made, the later wave was much the more deadly. The average annual death-rate for the nine years is 320 in the one case against 162 in the other, or as nearly as possible double. In both epidemic periods the second year was far more fatal than the first, and in both a marked revival took place in the ninth year; in both also an intermediate recrudescence occurred, in the fifth year in one case, in the sixth in the other. The chief point of difference is the sudden and marked drop in 1849–50, against a persistent high mortality in 1892–93, especially in 1892, which was nearly as fatal as 1891.

To make the significance of these epidemic figures clear, it should be added that in the intervening period 1861–89 the average annual death-rate from influenza was only fifteen, and in the ten years immediately preceding the 1890 outbreak it was only three. Moreover, in epidemic influenza the mortality directly attributed to that disease is only a fraction of that actually caused by it. For instance, in January 1890 the deaths from influenza in London were 304, while the excess of deaths from respiratory diseases was 1454 and from all causes 1958 above the average.

We have seen above that the mortality was far greater in the second epidemic year than in the first, and this applies to all parts of England, and to rural as well as to urban communities, as the following table shows :—

	Deaths from Influenza.	
	1890.	1891.
London	624	2302
24 Great Towns over 80,000 population .	439	2417
35 Towns between 20,000 and 80,000 .	186	765
21 Towns between 10,000 and 20,000 .	46	196
60 Towns under 10,000	62	196
85 Rural Sanitary Districts . . .	317	841

In spite of these figures, it appears that the 1890 attack, which was, generally speaking, much more sudden in its onset than that of 1891, also caused a great deal more sickness. More people were "down with influenza," though fewer died. For instance, the number of persons treated at the Middlesex Hospital in the two months' winter epidemic of 1890 was 1279; in the far more fatal three months' spring epidemic of 1891 it was only 726. One explanation of this discrepancy between the incidence of sickness and mortality is that in the second attack, which was more protracted and more insidious, the stress of the disease fell more upon the lungs, and so led to more fatal results. Another is that its comparative mildness, combined with the time of year, in itself proved dangerous, because it tempted people to disregard the illness, whereas in the first epidemic they were too decidedly ill to resist. It may also be that there was some change in the practice of medical men with regard to certifying, and more readiness on their part to record influenza as a cause of death in the second year, when they understood it better. On the whole, rural districts showed a higher death-rate than towns, and small towns a higher one than large ones in both years. This is explained by the age distribution in such localities; there are more old people, to whom influenza is particularly fatal. Certain counties were much more severely affected than others. The eastern counties, namely, Essex, Suffolk, and Norfolk, together with Hampshire and one or two others, escaped lightly in both years; the western counties, namely, North and South Wales, with the adjoining counties of Monmouth, Hereford, and Shropshire, suffered heavily in both years.

It will be convenient to discuss *seriatim* the various points of interest on which light has been thrown by the experience described above.

The bacteriology of influenza is discussed in its proper place under PATHOLOGY (*Parasitic Diseases*). The disease is often called Russian influenza, and its origin in 1889 suggests that the name may have some foundation in fact. According to information collected by Dr Parsons, it came to Europe by way of Siberia and Russia, having been first recognized in Central Asia. A writer, who saw the epidemic break out in Bokhara, is quoted by him to the following effect:—"The summer of 1888 was exceptionally hot and dry, and was followed by a bitterly cold winter and a rainy spring. The dried-up earth was full of cracks and holes from drought and subsequent frost, so that the spring rains formed ponds in these holes, inundated the new railway cuttings, and turned the country into a perfect marsh. When the hot weather set in the water gave off poisonous exhalations, rendering malaria general." On account of the severe winter, the people were enfeebled from lack of nourishment, and when influenza broke out suddenly they died in large numbers. Europeans were very severely affected, the entire household of the Russian Legation being in bed at one time. Russian officials and others, hurrying home, carried the disease westwards, and caravans passing eastwards took it into Siberia. One cannot but be struck by the similarity of the conditions described to those observed in connexion with outbreaks of other diseases, particularly typhoid fever and diphtheria, which have occurred on the supervention of heavy rain after a dry period, causing cracks and fissures in the earth. Assuming the existence of a living poison in the ground, we can easily understand that under certain conditions, such as an exceptionally dry season, it may develop exceptional properties and then be driven out by the subsequent rains, causing a violent outbreak of illness. Some such explanation is required to account for the periodical occurrence of epidemic and pandemic diffusions starting from an endemic centre. We may suppose that a micro-organism of peculiar robustness and virulence is bred and brought into activity by a combination of favourable conditions, and is then disseminated, more or less widely according to its "staying power," by human agency. Whether Central Asia is an endemic centre for influenza or not there is no evidence to show, but the disease seems to be undoubtedly more often prevalent in the Russian Empire than elsewhere. Extensive outbreaks occurred there in 1886 and 1887, and it is certain that the 1889 wave was active in Siberia at an earlier date than in Europe, and that it moved eastwards. The hypothesis that it originated in China is unsupported by any evidence. But whatever may be the truth with regard to origin, the dissemination of influenza

by human agency must be held to be proved. The establishment of this fact is the most important addition to our knowledge of the subject that has been contributed by recent research. We owe it to the investigations of Dr Parsons, who carefully traced the movements of the 1889–90 epidemic from place to place and examined the various conditions under which it prevailed. The upshot of his inquiry was to negative all theories of atmospheric influence, and to establish the conclusion that the disease was "propagated mainly, perhaps entirely, by human intercourse." He found that it prevailed independently of climate, season, and weather; that it moved in a contrary direction to the prevailing winds; that it travelled along the lines of human intercourse, and not faster than human beings can travel; that in 1889 it travelled much faster than in previous epidemics, when the means of locomotion were very inferior; that it appeared first in capital towns, seaports, and frontier towns, and only affected country districts later; that it never commenced suddenly with a large number of cases in a place previously free from disease, but that epidemic manifestations were generally preceded for some days or weeks by a succession of scattered cases; that conveyance of infection by individuals and its introduction into fresh places had been observed in many instances; that persons brought much into contact with others were generally the first to suffer in a household or establishment; that persons brought together in large numbers in enclosed spaces, as in public offices and institutions, suffered more in proportion than others, and that the rapidity and extent of the outbreak in institutions corresponded with the massing together of the inmates. These conclusions, based upon the 1889–90 epidemic, have been confirmed by subsequent experience, especially in regard to the complete independence of season and weather shown by influenza. It has appeared and disappeared at all seasons and in all weathers—warm, cold, wet, dry, changeable, windy, still, foggy, and clear—and only popular ignorance continues to ascribe its behaviour to atmospheric conditions. In Europe, however, it has prevailed more often in winter than in summer, which may be due to the greater susceptibility of persons in winter, or, more probably, to the fact that they congregate together more in buildings and are less in the open air during that part of the year. No doubt is any longer entertained of its infectious character, though the degree of infectivity appears to vary considerably. Many cases have been recorded of individuals introducing it into houses, and of all or most of the other inmates then taking it from the first case. In other instances it has failed to spread in large households, in spite of close and constant contact of other persons with the sick. This difference in behaviour may possibly be explained by differences in the type of illness, the "catarrhal" form, in which the air-passages are affected, being more infectious than those in which the stress falls on the nervous or intestinal systems, just as the "pneumonic" form of plague is more infectious than the other varieties. How far the infection of influenza is air-borne has not been determined, but the evidence tends to negative the hypothesis that it can be conveyed any considerable distance. On the other hand, cases have been recorded which go far to prove the dissemination by means of infected articles of clothing, letters, and the like. Of the lower animals, horses are liable to an inflammation of the mucous membrane, known as "pink eye," which has prevailed at the same time as influenza; but whether the two are connected has not been definitely ascertained. Other domestic animals seem to be free from any suspicion. Sanitary conditions, other than overcrowding, do not appear to exercise any influence on the spread of influenza.

Influenza has been clearly shown to be an acute specific fever, having nothing whatever to do with a "bad cold." There may be some inflammation of the respiratory passages, and then symptoms of catarrh are present, but that is not necessarily the case, and in some epidemics such symptoms are quite exceptional. This had been recognized by various writers before the 1889 visitation, but it had not been generally realized, as it has been since, and some medical authorities, who persisted in regarding influenza as essentially a "catarrhal" affection, were chiefly to blame for a widespread and tenacious popular fallacy. The "period of incubation" is indeterminate, as usual. The most common interval between exposure to infection and onset of symptoms seems to be two or three days, but it may be much less or much more. On this head it may be remarked that recent demonstrations of the capacity of some people to be infected with specific microbes for an indefinite time without showing any symptoms go far to explain the elasticity of "periods of incubation," and make any attempt at precision a little ridiculous. Susceptibility varies greatly, but the conditions that influence it are matters of conjecture only. It appears that the inhabitants of Great Britain are less susceptible than those of many other countries. Dr Parsons gives the following list, showing the proportion of the population estimated to have been attacked in the 1889–90 epidemic in different localities:—

Place.	Per Cent.	Place.	Per Cent.
St Petersburg	50	Portugal	90
Berlin	33	Vienna	30–40
Nuremberg	67	Belgrade	33
Grand-Duchy of Hesse	25–30	Antwerp	33
Grand-Duchy, other Districts	50–75	Gaeta	50–77
		Massachusetts	39
Heligoland	50	Peking	50
Budapest	50	St Louis (Mauritius)	67

In and about London he reckons roughly from a number of returns that the proportion was about 12½ per cent. among those employed out of doors and 25 per cent. among those in offices, &c. The proportion among the troops in the Home District was 9·3 per cent. The General Post Office made the highest return with 33·6 per cent., which is accounted for partly by the enormous number of persons massed together in the same room in more than one department, and partly by the facilities for obtaining medical advice, which would tend to bring very light cases, unnoticed elsewhere, upon the record. No public service was seriously disorganized in England by sickness in the same manner as on the Continent, though much inconvenience was caused at the height of the first epidemic. In subsequent ones, as has already been observed, there was less illness, though more mortality. Some individuals appear to be totally immune; others take the disease over and over again, deriving no immunity, but apparently greater susceptibility from previous attacks.

The symptoms were thus described by Dr Bruce Low from observations made in St Thomas's Hospital, London, in January 1890:—

The invasion is sudden; the patients can generally tell the time when they developed the disease; *e.g.*, acute pains in the back and loins came on quite suddenly while they were at work or walking in the street, or in the case of a medical student, while playing cards, rendering him unable to continue the game. A workman wheeling a barrow had to put it down and leave it; and an omnibus driver was unable to pull up his horses. This sudden onset is often accompanied by vertigo and nausea, and sometimes actual vomiting of bilious matter. There are pains in the limbs and general sense of aching all over; frontal headache of special severity; pains in the eyeballs, increased by the slightest movement of the eyes; shivering; general feeling of misery and weakness, and

great depression of spirits, many patients, both men and women, giving way to weeping; nervous restlessness; inability to sleep, and occasionally delirium. In some cases catarrhal symptoms develop, such as running at the eyes, which are sometimes injected on the second day; sneezing and sore throat; and epistaxis, swelling of the parotid and submaxillary glands, tonsilitis, and spitting of bright blood from the pharynx may occur. There is a hard, dry cough of a paroxysmal kind, worst at night. There is often tenderness of the spleen, which is almost always found enlarged, and this persists after the acute symptoms have passed. The temperature is high at the onset of the disease. In the first twenty-four hours its range is from 100° F. in mild cases to 105° in severe cases.

Dr J. S. Bristowe gave the following description of the illness during the same epidemic :—

The chief symptoms of influenza are, coldness along the back, with shivering, which may continue off and on for two or three days; severe pain in the head and eyes, often with tenderness in the eyes and pain in moving them; pains in the ears; pains in the small of the back; pains in the limbs, for the most part in the fleshy portions, but also in the bones and joints, and even in the fingers and toes; and febrile temperature, which may in the early period rise to 104° or 105° F. At the same time the patient feels excessively ill and prostrate, is apt to suffer from nausea or sickness and diarrhœa, and is for the most part restless, though often (and especially in the case of children and those advanced in age) drowsy. . . . In ordinary mild cases the above symptoms are the only important ones which present themselves, and the patient may recover in the course of three or four days. He may even have it so mildly that, although feeling very ill, he is able to go about his ordinary work. In some cases the patients have additionally some dryness or soreness of the throat, or some stiffness and discharge from the nose, which may be accompanied by slight bleeding. And in some cases, for the most part in the course of a few days, and at a time when the patient seems to be convalescent, he begins to suffer from wheezing in the chest, cough, and perhaps a little shortness of breath, and before long spits mucus in which are contained pellets streaked or tinged with blood. . . . Another complication is diarrhœa. Another is a roseolous spotty rash. . . . Influenza is by no means necessarily attended with the catarrhal symptoms which the general public have been taught to regard as its distinctive signs, and in a very large proportion of cases no catarrhal condition whatever becomes developed at any time.

Several writers have distinguished three main varieties of the disease—namely, (1) nervous, (2) gastric, (3) catarrhal, according to the predominant symptoms. Perhaps the most marked feature of influenza, and certainly the one which victims have learned to dread most, is the prolonged debility and nervous depression that frequently follow an attack. Other common after-effects are neuralgia, dyspepsia, insomnia, weakness or loss of the special senses, particularly taste and smell, abdominal pains, sore throat, rheumatism, and muscular weakness. The feature most dangerous to life is the special liability of patients to inflammation of the lungs. This affection, dangerous at all times, and particularly so in persons weakened by influenza, must be regarded as a complication rather than an integral part of the illness. No age is exempt, but the mortality is much greater among elderly persons than among the young, and it increases with advancing years. The following table shows the proportional mortality per 1000 living at different ages, and for each sex, in 1891 :—

Proportional Mortality per 1000 *Living*, 1891.

	All Ages.	0–5.	5–10.	10–15.	15–20.	20–25.	25–35.	35–45.	45–55.	55–65.	65–75.	75–85.	85– .
Males .	·61	·54	·07	·07	·17	·20	·32	·62	1·11	1·91	3·43	5·71	6·93
Females .	·54	·38	·09	·09	·14	·17	·26	·42	·79	1·54	3·12	5·17	7·91
Both Sexes	·57	·46	·08	·08	·15	·19	·29	·52	·94	1·73	3·27	5·40	7·60

This table shows that influenza is least fatal to children between five and fifteen years, that younger children suffer more, and that after fifteen the proportional mortality rises steadily and rapidly. With regard to sex, the disease is on the whole more fatal to males than to females; but this is obviously due to habits of life, and particularly to the greater exposure suffered by men in the period of greatest activity. The higher male mortality begins to assert itself just when boys first go out to earn a living, and the difference increases up to sixty-five, after which the two approximate again, and eventually the female mortality is the higher of the two, as it was in childhood.

The deaths directly attributed to influenza are few in proportion to the number of cases, though the aggregate mortality is large on account of its universal prevalence. In the milder forms it offers hardly any danger to life if reasonable care be taken, but in the severer forms it is a fairly fatal disease. In eight London hospitals the case-mortality among in-patients in the 1890 outbreak was 34·5 per 1000; among all patients treated it was 1·6 per 1000. In the army it was rather less.

There is no routine treatment for influenza except bed. In all cases bed is advisable, because of the danger of lung complications, and in mild ones it is sufficient. Severer ones must be treated according to the symptoms. Quinine has been much used, but its efficacy is doubtful. Modern "anti-pyretic" drugs have also been extensively employed, and when applied with discretion they may be useful, but patients are not advised to prescribe them for themselves. The chief lesson derived from experience is the need for care during convalescence and the danger of trying to resist the disease or underrating its seriousness.

The infectious character of influenza having been determined, suggestions were made for its administrative control on the familiar lines of notification, isolation, and disinfection, but this has not hitherto been found practicable. In March 1895, however, the Local Government Board issued a memorandum recommending the adoption of the following precautions wherever they can be carried out :—

1. The sick should be separated from the healthy. This is especially important in the case of first attacks in a locality or a household.

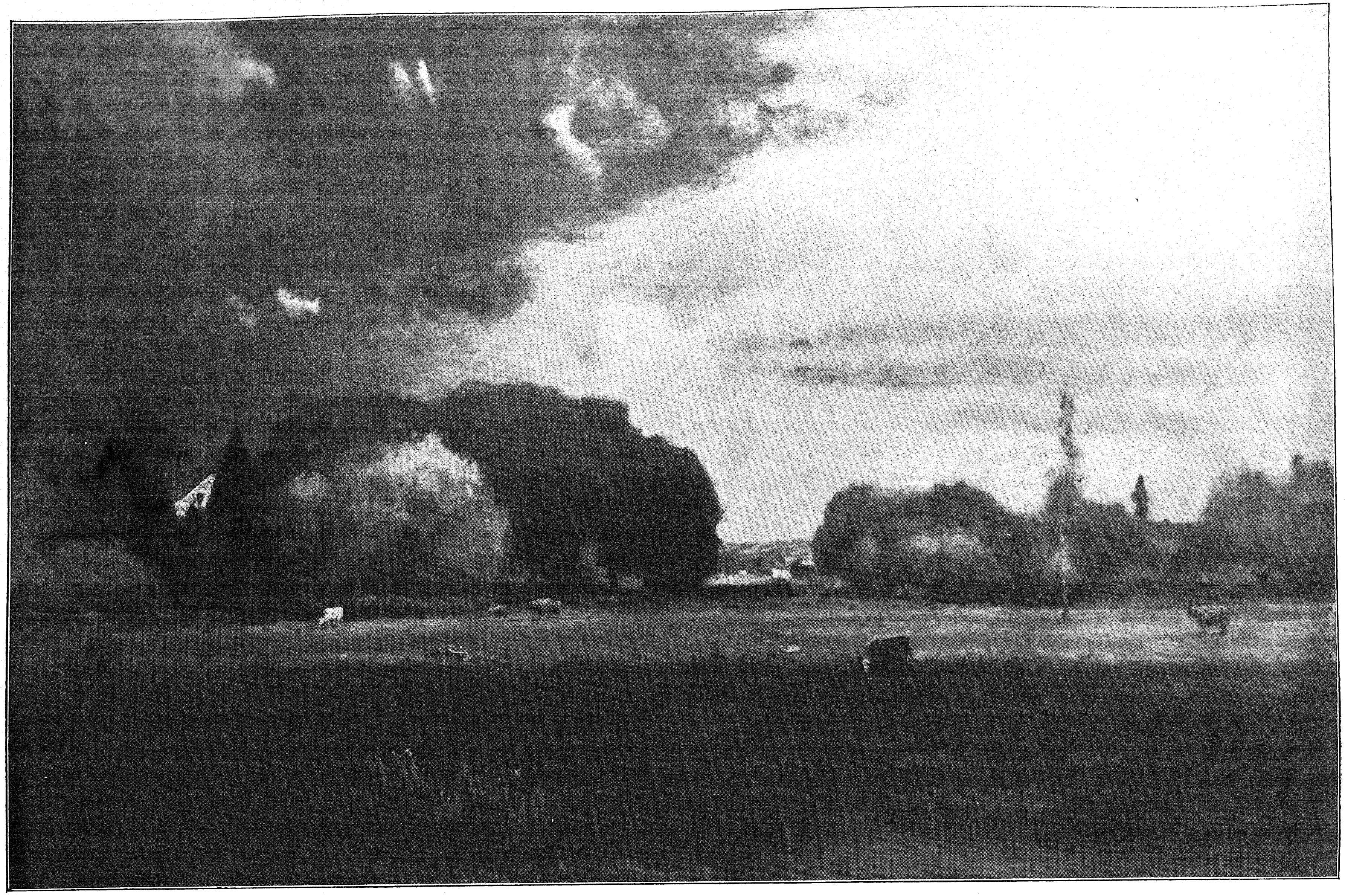
2. The sputa of the sick should, especially in the acute stage of the disease, be received into vessels containing disinfectants. Infected articles and rooms should be cleansed and disinfected.

3. When influenza threatens, unnecessary assemblages of persons should be avoided.

4. Buildings and rooms in which many people necessarily congregate should be efficiently aërated and cleansed during the intervals of occupation.

It should also be borne in mind that the liability to contract influenza, and the danger of an attack if contracted, are increased by depressing conditions, such as exposure to cold and to fatigue, whether mental or physical. Attention should therefore be paid to all measures tending to the maintenance of health, such as the use of clothing of suitable warmth and a sufficiency of wholesome food. Persons who are attacked by influenza should at once seek rest, warmth, and medical treatment, and they should bear in mind that the risk of relapse, with serious complications, constitutes a chief danger of the disease. It may be added that influenza is no respecter of persons. It levels all ranks, and nothing has been more striking in the visitations than the large number of prominent and exalted personages whom it has attacked with disabling or fatal results, among the victims being the heirs to two European thrones—those of the United Kingdom and Belgium. (A. SL)

Ingelow, Jean (1820–1897), English poet and novelist, was born at Boston, in Lincolnshire, in 1820, being the daughter of William Ingelow, a banker of that



"THE MEDFIELD MEADOWS." BY GEORGE INNESS.

(From a Copley Print of the Painting, copyright 1899 by Curtis and Cameron.)

town. As a girl she contributed verses and tales to the magazines under the pseudonym of "Orris," but her first (anonymous) volume, *A Rhyming Chronicle of Incidents and Feelings*, did not appear until her thirtieth year. This Tennyson said had "very charming things" in it, and declared he should "like to know" the author, who was later admitted to his friendship. Miss Ingelow followed this book of verse in 1851 with a story, *Allerton and Dreux*, but it was the publication of her *Poems* in 1863 which suddenly raised her to the rank of a popular writer. They ran rapidly through numerous editions, were set to music, and sung in every drawing-room, and in America obtained an even greater hold upon public estimation. In 1867 she published *The Story of Doom and other Poems*, and then gave up verse for a while and became industrious as a novelist. *Off the Skelligs* appeared in 1872, *Fated to be Free* in 1873, *Sarah de Berenger* in 1880, and *John Jerome* in 1886. In addition to these she wrote *Studies for Stories* (1864), *Stories told to a Child* (1865), *Mopsa the Fairy* (1869), and other stories for children—a form of literature in which she excelled. Her third series of *Poems* was published in 1885. She resided for the last years of her life in Kensington, and somewhat outlived her popularity as a poet. She died 20th July 1897. Her poetry has often the genuine ballad note, and as a writer of songs she was exceedingly successful. "Sailing beyond Seas," and "When Sparrows build" in *Supper at the Mill* were deservedly among the most popular songs of the day; but they share, with the rest of her work, the faults of affectation and stilted phraseology. Her best-known poem was the "High Tide on the Coast of Lincolnshire," which reached the highest level of excellence. The blemishes of her style were cleverly indicated in a well-known parody of Calverley's; a false archaism and a deliberate assumption of unfamiliar and unnecessary synonyms for simple objects were among the most vicious of her mannerisms. She wrote, however, in verse with a sweetness which her sentiment and her heart inspired, and in prose she displayed feeling for character and the gift of narrative; while a delicate underlying tenderness is never wanting in either medium to her sometimes tortured expression. Miss Ingelow was a woman of frank and hospitable manners, with a look of the Lady Bountiful of a country parish. She had nothing of the professional authoress or the "literary lady" about her, and, as with characteristic simplicity she was accustomed to say, was no great reader. Her temperament was rather that of the improvisatore than of the professional author or artist. (A. WA)

Ingersoll, a town and port of entry of Oxford county, Ontario, Canada, 19 miles east of London, on the river Thames and the Grand Trunk and Canadian Pacific railways. The principal manufactures are agricultural implements, furniture, pianos, and screws. There is a large export trade in cheese and farm produce. Exports in 1899–1900 were valued at $2,427,335. Population (1881), 4318; (1901), 4572.

Ingersoll, Robert Green (1833–1899), American lawyer and lecturer, was born in Dresden, New York, 11th August 1833. His father was a Congregational minister, who moved west when Robert was ten years old, and the latter entered the practice of law and politics in Illinois. During the Civil War he organized a cavalry regiment, of which for a short time he was colonel. He was appointed attorney-general of Illinois in 1866, and in 1876 his speech in the Republican National Convention, naming James G. Blaine for the Presidential nomination, won him a national reputation as a public speaker. He was most widely known, however, for his public lectures attacking the Bible, and his anti-Christian views were an obstacle to his political advancement. Ingersoll was an eloquent rhetorician rather than a logical reasoner. His principal lectures and speeches included *The Gods and other Lectures* (1876); *Some Mistakes of Moses* (1879); *Prose Poems* (1884); *Great Speeches* (1887); *The Bible; Ghosts; Foundations of Faith.* He died at Dobbs Ferry, New York, 21st July 1899.

Ingolstadt, a fortified town of Upper Bavaria, Germany, on the left bank of the Danube, 52 miles by rail north from Munich. Its newer public buildings embrace an Evangelical church, a civil hospital, an arsenal, and an orphanage. The industries are cannon-founding, manufacture of gunpowder and cloth, and brewing. Population (1885), 16,388; (1900), 22,206.

Innerleithen, a police burgh and health resort of Peeblesshire, Scotland, on the Leithen water, half a mile from its junction with the Tweed. It is arbitrarily identified with the St Ronans of Sir Walter Scott's novel. The stronger of its two medicinal springs contains 216·72 grains of chloride of sodium, 148·16 of chloride of calcium, 16·17 of magnesium, 1·15 of sulphate of magnesia, 5·03 of carbonate of lime per gallon of water. There are five woollen mills, turning out tweeds and fine yarns. The churches are Established, United Free, Congregational, and Roman Catholic. The public school had an average attendance of 452 in 1898–99. Population (1901), 2181.

Inness, George (1825–1894), American landscape painter, was born near Newburgh, N.Y., 1st May 1825. Before he was five years of age his parents had moved to New York and afterwards to Newark, N.J., in which latter city his boyhood was passed. He would not "take education" at the town academy, nor was he a success as a greengrocer's boy. He had a strong bent towards art, and his parents finally placed him with a drawing-master named Barker. At sixteen he went to New York to study engraving, but soon returned to Newark, where he continued sketching and painting after his own initiative. In 1843 he was again in New York, and is said to have passed a month in Gignoux's studio. What he learned from these masters no one knows. He was too impetuous, too independent in thought, to accept teaching; and, besides, the knowledge of his teachers must have been limited. Practically he was self-taught, and always remained a student. In 1851 he went to Europe, and in Italy got his first glimpse of real art. He was there two years, and naturally imbibed some traditions of the classic landscape, as his pictures of this period show. In 1854 he went to France, and there studied the Barbizon painters, whom he greatly admired, especially Daubigny and Rousseau. After his return to America he opened a studio in New York, then went to Medfield, Mass., where he resided for five years. A pastoral landscape near this town inspired the characteristic painting reproduced in the Plate—"The Medfield Meadows." Again he went abroad and spent six years in Europe. He came back to New York in 1876, and lived there, or near there, until his death, which took place at Bridge of Allan on 3rd August 1894 while travelling in Scotland. He was a National Academician, a member of the Society of American Artists, and had received many honours at home and abroad. He was married twice, his son, George Inness, jun., being also a painter. Inness was emphatically a man of temperament, of moods, enthusiasms, convictions. He was fond of speculation and experiment in metaphysics and religion, as in poetry and art. Swedenborgianism, symbolism, socialism, appealed to him as they might to a mystic or an idealist. He aspired to the perfect unities, and was impatient of structural

foundations. This was his attitude towards painting. He sought the sentiment, the light, air, and colour of nature, but was put out by nature's forms. How to subordinate form without causing weakness was his problem, as it was Corot's. His early education gave him no great technical facility, so that he never was satisfied with his achievement. He worked over his pictures incessantly, retouching with paint, pencil, coal, ink—anything that would give the desired effect—yet never content with them. In his latter days it was almost impossible to get a picture away from him, and after his death his studio was found to be full of experimental canvases. He was a very uneven painter, and his experiments were not always successful. His was an original—a distinctly American—mind in art. His point of view was his own. At his best he was often excellent in poetic sentiment, and superb in light, air, and colour. He had several styles: at first he was somewhat grandiloquent in Roman scenes, but sombre in colour; then under French influence his brush grew looser, as in the "Grey Lowering Day"; finally he broke out in full colour and light, as in the "Niagara" and the last "Delaware Water-Gap." Some of his pictures are in American museums, but most of them are in private hands. (J. C. VAN D.)

Innsbruck, the capital of Tirol, Austria, and one of the most beautifully situated towns in Europe. It is on the Brenner line and $109\frac{1}{2}$ miles by rail from Munich. Among the twenty-eight statues round the cenotaph of Maximilian is one of King Arthur of Britain. Hofer and his companions are actually buried beneath the monuments set up in their honour. The university is now attended by about 1000 students. Innsbruck has little commercial or industrial importance, being rather a political and military stronghold, and having a permanent garrison of about 2000 men. It stands at a height of 1880 feet above the sea-level. In 1890 its population (including the garrison) amounted to 23,320 souls, mainly Romanist and German-speaking; there were but 309 Protestants and 100 Jews, while 458 persons spoke Italian or Ladin, and 497 more persons languages other than German, Italian, or Ladin. In 1900 the population was 27,056.

Inowrazlaw, formerly JUNG-BRESLAU, a town of Prussia, province of Posen, 21 miles by rail south-west of Thorn. It has mines of rock-salt and iron pyrites, flour mills, distilleries, iron foundries, and manufactures of saltpetre and machinery; also, an active trade in agricultural produce. Population (1885), 13,548; (1900), 26,140.

INSANITY.

LEGAL DEVELOPMENTS.

IT is proposed in this article to deal with the changes in the law of lunacy since the article in the earlier volumes of the *Encyclopædia Britannica* (9th ed., vol. xiii. pp. 111–113) was published. For convenience sake the arrangement adopted in the original article has been followed. The only point in which the introductory remarks need to be supplemented is with regard to the chief legal terms respecting persons suffering under mental disabilities. The subject is now of less importance than formerly, because the modern tendency of the law is to determine the capacity or responsibility of a person alleged to be insane by considering it with reference to the particular matter or class of matters which brings his mental condition *sub judice*. But the literature of the law of lunacy cannot be clearly understood unless the distinctions between the different terms employed to describe the insane are kept in view. The term *non compos mentis* is as old as the statute *De Prærogativâ Regis* (17 Edw. II. cc. 9 and 10) and is used sometimes, as in that statute, to indicate a species contrasted with idiot, sometimes (*e.g.*, in Co. Litt. 246 (*b*)) as a genus, and afterwards, chiefly in statutes relating to the insane, in connexion with the terms "idiot" and "lunatic" as a word *ejusdem generis*. The word "idiot" (Greek, ἴδιος, a private person, one who does not hold any public office, and ἰδιώτης, an ignorant and illiterate person) appears in the statute *De Prærogativâ Regis* as *fatuus naturalis*, and it is placed in contradistinction to *non compos mentis*. The "idiot" is defined by Coke (4 *Rep.* 124 (*b*)) as one who from his nativity, by a perpetual infirmity, is *non compos mentis*, and Hale (*Pleas of the Crown*, i. p. 29) describes idiocy as "fatuity *a nativitate vel dementia naturalis.*" In early times various artificial criteria of idiocy were suggested. Fitzherbert's test was the capacity of the alleged idiot to count twenty pence, or tell his age, or who were his father and mother (*De Naturâ Brevium*, 233). Swinburne proposed as a criterion of capacity, *inter alia*, to measure a yard of cloth or name the days in the week (*Testaments*, 42). Hale propounded the sounder view that "idiocy or not is a question of fact triable by jury and sometimes by inspection" (*Pleas of the Crown*, i. p. 29). The legal incidents of idiocy were at one time distinct in an important particular from those of lunacy. Under the statute *De Prærogativâ Regis* the king was to have the rents and profits of an idiot's lands to his own use during the life of the idiot, subject merely to an obligation to provide him with necessaries. In the case of the lunatic the king was a trustee, holding his lands and tenements for his benefit and that of his family. It was on account of this difference in the legal consequences of the two states that on inquisitions distinct writs, one *de idiotâ inquirendo*, the other *de lunatico inquirendo*, were framed for each of them. But juries avoided finding a verdict of idiocy wherever they could, and the writ *de idiotâ inquirendo* fell into desuetude. A further blow was struck at the distinction when it came to be recognized even by the legislature (see the Idiots Act, 1886) as a scientific fact that idiots are capable of being educated and trained, and it was practically abolished when the Lunacy Regulation Act, 1862, in a provision reproduced in substance in the Lunacy Act, 1890, limited the evidence admissible in proof of unsoundness of mind on an inquisition (without special leave of the Master trying the case) to a period of two years before the date of the inquiry, and raised a uniform issue, viz., the state of mind of the alleged lunatic at the time when the inquisition is held.

The term "lunatic," derived from the Latin *luna* in consequence of the notion that the moon had an influence on mental disorders,[1] does not appear in the statute-book till the time of Henry VIII. (33 Hen. VIII. c. 20). Coke defines a lunatic as a "person who has sometimes his understanding and sometimes not, *qui gaudet lucidis intervallis*, and therefore he is called *non compos mentis* so long as he has not understanding" (Co. Litt. 247 (*a*), 4 *Rep.* 124 (*b*)). Hale defines "lunacy" as "interpolated" (*i.e.*, intermittent) *dementia accidentalis vel adventitia*, whether total or (a description, it will be observed, of

[1] The word for "lunatic" in several other languages has a similar etymology. Cp. Italian *lunatico*, Spanish *alunado*, Greek σεληνιακός (epileptic), German *mondsüchtig*.

"partial insanity") *quoad hoc vel illud* (*Pleas of the Crown*, i. p. 29). In modern times the word "lunacy" has lost its former precise signification. It is employed sometimes in the strict sense, sometimes in contradistinction to "idiocy" or "imbecility"; once at least—viz., in the Lunacy Act, 1890—as including "idiot"; and frequently in conjunction with the vague terms "unsound mind" (non-sane memory) and "insane." Section 116 of the Lunacy Act, 1890, has by implication extended the meaning of the term lunacy so as to include for certain purposes the incapacity of a person to manage his affairs through mental infirmity arising from disease or age. "Imbecility" is a state of mental weakness "between the limits of absolute idiocy on the one hand and of perfect capacity on the other" (see 1 Haggard *Eccles. Rep.* p. 401).

The law as to the criminal responsibility of the insane has pursued in England a curious course of development. The views of Coke and Hale give the best exposition of it in the 17th century. Both were agreed that in criminal causes the act and wrong of a madman shall not be imputed to him; both distinguished, although in different language, between *dementia naturalis* (or *a nativitate*) and *dementia accidentalis* or *adventitia;* and the main points in which the writings of Hale mark an advance on those of Coke are in the elaboration by the former of the doctrine of "partial insanity," and his adoption of the level of understanding of a child of fourteen years of age as the test of responsibility in criminal cases (*Pleas of the Crown*, i. pp. 29, 30; and see Co. 4 *Rep.* 124 (*b*)). In the 18th century a test, still more unsatisfactory than this "child of fourteen" theory, with its identification of "healthy immaturity" with "diseased maturity" (Steph. *Hist. Crim. Law*, vol. ii. p. 150), was prescribed. On the trial of Edward Arnold in 1723 for firing at and wounding Lord Onslow, Mr Justice Tracy told the jury that "a prisoner, in order to be acquitted on the ground of insanity, must be a man that is totally deprived of his understanding and memory, and doth not know what he is doing, no more than an infant, than a brute or wild beast." In the beginning of the 19th century a fresh statement of the test of criminal responsibility in mental disease was attempted. On the trial of Hadfield for shooting at George III. in Drury Lane Theatre on 15th May 1800, Lord Chief Justice Kenyon charged the jury in the following terms: "If a man is in a deranged state of mind at the time, he is not criminally answerable for his acts; but the material part of the case is whether at the very time when the act was committed the man's mind was sane." The practical effect of this ruling, had it been followed, would have been to make the question of the amenability of persons alleged to be insane to the criminal law very much one of fact, to be answered by juries according to the particular circumstances of each case, and without being aided or embarrassed by any rigid external standard. But in 1812, on the trial of Bellingham for the murder of Mr Perceval, the First Lord of the Treasury, by shooting him in the Lobby of the House of Commons, Sir James Mansfield propounded yet another criterion of criminal responsibility in mental disease, viz., whether a prisoner has, at the time of committing an offence, a sufficient degree of capacity to distinguish between good and evil. The objection to this doctrine, of course, consisted in the fact, to which the writings of Continental and American jurists soon afterwards began to give prominence, that there are very many lunatics whose general ideas on the subject of right and wrong are quite unexceptionable, but who are yet unable, in consequence of delusions, to perceive the wrongness of particular acts. Sir James Mansfield's statement of the law was discredited in the case of Daniel Macnaughton, who was tried in March 1843, before Chief Justice Tindal, Mr Justice Williams, and Mr Justice Coleridge, for the murder of Mr Drummond, the private secretary of Sir Robert Peel. Mr (afterwards Lord Chief Justice) Cockburn, who defended the prisoner, used Hale's doctrine of partial insanity as the foundation of the defence, and secured an acquittal, Chief Justice Tindal telling the jury that the question was whether Macnaughton was capable of distinguishing right from wrong *with respect to the act with which he stood charged.* This judicial approval of the doctrine of partial insanity formed the subject of an animated debate in the House of Lords, and in the end certain questions were put by that House to the judges, and answered by Chief Justice Tindal on behalf of all his colleagues except Mr Justice Maule, who gave independent replies. The answers to these questions are commonly called "The Rules in Macnaughton's case," and they still nominally contain the law of England as to the criminal responsibility of the insane. The points affirmed by the Rules that must be noted here are the propositions that knowledge of the nature and quality of the particular criminal act, at the time of its commission, is the test of criminal responsibility, and that delusion is a valid exculpatory plea, when, and only when, the fancies of the insane person, if they had been facts, would have been so. The Rules in Macnaughton's case are open to serious criticism. They ignore, at least on a literal interpretation, those forms of mental disease which may, for the present purpose, be roughly grouped under the heading "moral insanity," and in which the moral faculties are more obviously deranged than the mental—the affections and the will, rather than the reason, being apparently disordered. The test propounded with reference to delusions has also been strenuously attacked by medical writers, and especially by Dr Maudsley in his work on *Responsibility in Mental Disease*, on the ground that it first assumes a man to have a delusion in regard to a particular subject, and then expects and requires him to reason sanely upon it. It may be pointed out, however, that in thus localizing the range of the immunity which insane delusion confers, the criminal law is merely following the course which, *mutatis mutandis*, the civil law has with general acceptance adopted in questions as to the contractual and testamentary capacity of the insane.

Criminals.

Macnaughton's case.

The Rules in Macnaughton's case have, as regards moral insanity, undergone considerable modification. Soon after they were laid down, Sir (then Mr) James Fitz-James Stephen, in an article in the *Juridical Papers* (vol. i. p. 67) on the policy of maintaining the existing law as to the criminal responsibility of the insane, foreshadowed the view which he subsequently propounded in his *History of the Criminal Law* (vol. ii. p. 163), that no man who was deprived by mental disease of the power of passing a fairly rational judgment on the moral character of an act could be said to "know" its nature and quality within the meaning of the Rules; and it has in recent years been found possible in practice so to manipulate the test of criminal responsibility which they prescribed as to afford protection to the accused in the by no means infrequent cases of insanity which in its literal interpretation it would leave without excuse.

In Scotland the Rules in Macnaughton's case are recognized, but, as in England, there is a tendency among judges to adopt a generous construction of them. Mental unsoundness insufficient to bar trial, or to exempt from punishment, may still, it is said, be present in a degree which is regarded as reducing the offence from a higher to a lower category,—a doctrine first practically applied in Scotland, it is believed, in 1867 by Lord Deas; and the

fact that a prisoner is of weak or ill-regulated mind is often urged with success as a plea in mitigation of punishment. The Indian Penal Code (Act 45 of 1860, § 84) expressly adopts the English test of criminal responsibility, but the qualifications noted in the case of Scotland have received some measure of judicial acceptance (see Mayne, *Crim. Law Ind.* pp. 368–384; Nelson, *Ind. Pen. Code*, pp. 79–89). The Rules in Macnaughton's case have also been adopted in substance in those colonies which have codified the criminal law. The following typical references may be given: 55 and 56 Vict. (Can.) c. 29, § 11; 57 Vict. (N.Z.), No. 56 of 1893, § 23; No. 101 of 1888 (St Lucia), § 50; No. 5 of 1876 (Gold Coast), § 49 (*b*). The Rules were rapidly reproduced in the United States, but the modern trend of American judicial opinion is adverse to them (see Clevenger, *Med. Jur. of Ins.* p. 125). On the Continent moral insanity and irresistible impulse are freely recognized as exculpatory pleas (see the French *Code Penal*, § 64; Belgian *Code Penal*, § 71; German *Penal Code*, § 51).

Not only is insanity at the time of the commission of an offence a valid exculpatory plea, but supervening insanity stays the action of the criminal law at every stage from arrest up to punishment. High treason was formerly an exception, but the statute making it so (33 Hen. VIII. c. 20) was repealed in the time of Philip and Mary. The Home Secretary has power, under the Criminal Lunatics Act, 1884, to order by warrant the removal of a prisoner, certified to be insane, to a lunatic asylum, before[1] trial or after trial, whether under sentence of death or not. Prisoners dealt with under these provisions are styled "Secretary of State's lunatics." On the other hand, a prisoner who on arraignment appears, or is found by the jury to be unfit to plead, or who is found "guilty but insane" at the time of committing the offence—a verdict substituted by the Trial of Lunatics Act, 1883, for the old verdict of "acquitted on the ground of insanity," in the hope that the formal conviction recorded in the new finding might have a deterrent effect on the mentally unstable—is committed to a criminal lunatic asylum by the order of the judge trying the case, to be detained there "during the Sovereign's pleasure." Lunatics of this class are called "Sovereign's pleasure lunatics." There was no doubt at common law as to the power of the courts to order the detention of criminal lunatics in safe custody, but prior to 1800 the practice was varying and uncertain. On the acquittal of Hadfield, however, in that year for the attempted murder of George III., a question arose as to the provision which was to be made for his detention, and the Criminal Lunatics Act, 1800, part of which is still in force, was passed to affirm the law on the subject.

The Criminal Lunatics Act contains provisions similar to those of the Lunacy Act, 1890, as to the discharge (conditional or absolute) and transfer of criminal lunatics and the detention of persons becoming pauper lunatics. The expenses of the maintenance of criminal lunatics are defrayed out of moneys provided by Parliament (Crim. Luns. Act, 1884, and Hansard, 3rd series, vol. ccxc. p. 75; 139 Com. Jo., pp. 336, 340, 344). The Lunatics' Removal (India) Act, 1851, provides for the removal to a criminal lunatic asylum in Great Britain of persons found guilty of crimes and offences in India, and acquitted on the ground of insanity. Similar provisions with regard to colonial criminal lunatics are contained in the Colonial Prisoners' Removal Act, 1884; and the policy of this statute has been followed by No. 5 of 1894 (New South Wales), and Ordin. No. 2 of 1895 (Falkland Islands). Indian law (see Act 5 of 1898, §§ 464–475) and the laws of the colonies (the Cape Act No. 1 of 1897 is a typical example) as to the trial of lunatics are similar to the English. In Scotland all the criminal lunatics, except those who may have been removed to the ordinary asylums or have been discharged, are confined in the Criminal Asylum established at Perth in connexion with H.M.'s General Prison, and regulated by special Acts (23 and 24 Vict. c. 105, and 40 and 41 Vict. c. 53). Provision, similar to the English, has been made for prisoners found insane as a bar to trial, or acquitted on the ground of insanity, or becoming insane in confinement. In New York and Michigan there are criminal lunatic asylums. Elsewhere insane criminals are apparently detained in state asylums, hospitals, or prisons. The statutory rules as to the maintenance of criminal lunatic asylums, the treatment of the criminal insane, and the plea of insanity in criminal courts in America, closely resemble English practice. The only special point in Continental law calling for notice is the system by which official experts report for the guidance of the tribunals on questions of alleged criminal irresponsibility (see, *e.g.*, the German *Code of Penal Procedure*, § 293, and cp. § 81).

Civil capacity.

The law as to the civil capacity of the insane was for some time influenced in Great Britain by the view propounded by Lord Brougham in 1848 in the case of *Waring* v. *Waring*, and by Sir J. P. Wilde in a later case, raising the question of the validity of a marriage, that, as the mind is one and indivisible, the least disorder of its faculties was fatal to civil capacity. In the leading case of *Banks* v. *Goodfellow* in 1870, the Court of Queen's Bench, in an elaborate judgment delivered by Chief Justice Cockburn, disapproved of this doctrine, and in effect laid down the principle that the question of capacity must be considered with strict reference to the act which has to be or has been done. Thus a certain degree of unsoundness of mind is not now, in the absence of undue influence, a bar to the formation of a valid marriage, if the party whose capacity is in question knew at the time of the marriage the nature of the engagement entered into (but see 51 Geo. III. c. 37 as to the marriage of lunatics so found by inquisition). Again, a man whose mind is affected may make a valid will, if he possesses at the time of executing it a memory sufficiently active to recall the nature and extent of his property, the persons who have claims upon his bounty, and a judgment and will sufficiently free from the influence of morbid ideas or external control to determine the relative strength of those claims. So far has this rule been carried, that in 1893 probate was granted of the will of a lady who was a Chancery lunatic at the date of its execution, and died without the inquisition having been superseded. It is also now settled that the simple contract of a lunatic is voidable and not void, and is binding upon him, unless he can show that at the time of making it he was, to the knowledge of the other party, so insane as not to know what he was about. The test established by *Banks* v. *Goodfellow* is applied also in a number of minor points in which civil capacity comes into question, *e.g.*, competency of the insane as witnesses. The law implies on the part of a lunatic, whether so found or not, an obligation to pay a reasonable price for "necessaries" supplied to him; and the term "necessaries" means goods suitable to his condition in life and to his actual require-

[1] It has sometimes been stated in recent years that this power, which ought clearly, in the interests alike of prisoners and of the public, to be exercised with caution, is in fact exerted in an unduly large number of cases. The following figures, taken from the respective volumes of the *Criminal Judicial Statistics*, show the number of criminal lunatics certified insane before trial. In 1884–85, out of a total of 938 criminal lunatics, 169 were so certified; in 1885–86, 149 out of 890; in 1889–90, 108 out of 926; in 1890–91, 95 out of 900; in 1894, 78 out of 738; in 1895, 84 out of 757; in 1896, 88 out of 769; in 1897, 85 out of 764; in 1898, 17 out of 209.

ments at the time of sale and delivery (Sale of Goods Act, 1893).

The question of the liability of an insane person for tort appears still to be undecided (see Pollock on *Torts*, 5th ed. p. 51; Clerk and Lindsell on *Torts*, 2nd ed. pp. 39, 40; *Law Quart. Rev.* vol. xiii. p. 325). Supervening insanity is no bar to proceedings by or against a lunatic husband or wife for divorce or separation for previous matrimonial offences. It does not avoid a marriage nor constitute *per se* a ground either for divorce or for judicial separation. But cruelty does not cease to be a cause of suit if it proceeds from disorderly affections or want of moral control falling short of positive insanity; and possibly even cruelty springing from intermittent or recurrent insanity might be held a ground for judicial separation, since in such case the party offended against cannot obtain protection by securing the permanent confinement of the offending spouse. Whether insanity at the time when an alleged matrimonial offence was committed is a bar to a suit for divorce or separation is an open question; and in any event, in order that it may be so, the insanity must be of such a character as to have prevented the insane party from knowing the nature and consequences of the act at the time of its commission. The laws of Scotland, Ireland, India (see, *e.g.*, Act 9 of 1872, § 12), the colonies, and the United States, are substantially identical with English law on the subject of the civil capacity of the insane. The German Civil Code (§ 1569) recognizes the lunacy of a spouse as a ground for divorce, but only where the malady continues during at least three years of the union, and has reached such a pitch that intellectual intercourse between the spouses is impossible, and that every prospect of a restoration of such association is excluded. If one of the spouses obtains a divorce on the ground of the lunacy of the other the former has to allow alimony, just as a husband declared to be the sole guilty party in a divorce suit would have to do (§§ 1585, 1578).

Jurisdiction.

In order to effect a change in the status of persons alleged to be of unsound mind, and to bring their persons and property under control, the aid of the jurisdiction in lunacy must be invoked. Under the unrepealed statute *De Prœrogativâ Regis* (17 Edw. II. cc. 9 and 10) the care and custody of lunatics belong to the Crown. But the Crown has, at least since the 16th century, exercised this branch of the prerogative by delegates, and principally through the Lord Chancellor—not as head of the Court of Chancery, but as the representative and delegate of the sovereign. Under the Lunacy Acts, 1890 and 1891, the jurisdiction in lunacy is exercised first by the Lord Chancellor and such of the Lords Justices and other judges as may be invested with it by the sign-manual; and, secondly, by the two Masters in lunacy, appointed by the Lord Chancellor from members of the bar of at least ten years' standing, whose duties include the holding of inquisitions and summary inquiries, and the making of most of the consequential orders dealing with the persons and estates of lunatics. County court judges may also exercise a limited jurisdiction in lunacy, in the case of lunatics as to whom a reception order has been made, if their entire property is under £200 in value, and no relative or friend is willing to undertake the management of it; in partnership cases where the assets do not exceed £500; and upon application by the guardians of any union for payment of expenses incurred by them in relation to any lunatic.

Persons of unsound mind are brought under the jurisdiction in lunacy either by an inquisition *de lunatico inquirendo*, or, in certain cases which will be adverted to below, by proceedings instituted under § 116 of the Lunacy Act, 1890, which is now the great practice section in the Lunacy Office. Prior to 1853 a special commission was issued to the Masters in each alleged case of lunacy. But by the Lunacy Regulation Act of that year a general commission was directed to the Masters, empowering them to proceed in each case in which the Lord Chancellor by order required an inquisition to be held. This procedure is still in force. A special commission would now be issued only where both Masters were personally interested in the subject of the inquiry, or for some other similar reason. An inquisition is ordered by the judge in lunacy (a term which does not, for this purpose, at present include the Masters, although this is one of the points in regard to which a change in the law is (1901) contemplated) on the petition generally of a near relative of the alleged lunatic. The inquiry is held before one of the Masters, and a jury may be summoned if the alleged lunatic, being within the jurisdiction, demands it, unless the judge is satisfied that he is not competent to form and express such a wish; and even in that case the Master has power to direct trial by jury if he thinks fit on consideration of the evidence. Where the alleged lunatic is not within the jurisdiction the trial must be by jury; and the judge in lunacy may direct this mode of trial to be adopted in any case whatever.

A few points of general interest in connexion with inquisitions must be noted. In practice thirty-four jurors are summoned by the sheriff, and not more than twenty-four are empannelled. Twelve at least must concur in the verdict. Counsel for the petitioner ought to act in the judicial spirit expected from counsel for the prosecution in criminal cases. The issue to be determined on an inquisition is "whether or not the alleged lunatic is at the time of the inquisition of unsound mind, and incapable of managing himself and his affairs" (a special verdict may, however, be found that the lunatic is capable of managing himself, although not his affairs, and that he is not dangerous to others); and without the direction of the person holding the inquisition, no evidence as to the lunatic's conduct at any time being more than two years before the inquisition is to be receivable. This limitation, both of the issue and of the evidence, was imposed with a view to preventing the recurrence of such cases as that of Mr Windham in 1861–62, when the inquiry ranged over the whole life of an alleged lunatic, forty-eight witnesses being examined on behalf of the relations, and ninety-one on behalf of the respondents, while the hearing lasted for thirty-four days. For the purpose of assisting the Master or jury in arriving at a decision, provision is made for the personal examination of the alleged lunatic by them on oath or otherwise, and either in open court or in private, as may be directed. The proceedings on inquisition are open to the public. When a person has been found lunatic by inquisition he becomes subject to the jurisdiction in lunacy, and remains so (unless he succeeds in setting aside the verdict by a "traverse"—a proceeding which ultimately comes before and is determined by the King's Bench Division in London, or at the assizes, according to circumstances) until his recovery, when the inquisition may be put an end to by a procedure technically known as "supersedeas," or by his death. The results of the inquisition are worked out in the Lunacy Office. The control of the estate, and, except where he was found incapable of managing his property only, of the person of the lunatic is entrusted to committees of the estate and person, who are appointed by and accountable to the Master in Lunacy, and whose legal position corresponds roughly with that of the tutors and curators of the civil law. The committee of the estate in particular exercises over the property of the lunatic, with

the sanction or by the order of the Master, very wide powers of management and administration, including the raising of money by sale, charge, or otherwise, to pay the lunatic's debts, or provide for his past or future maintenance, charges for permanent improvements, the sale of any property belonging to the lunatic, the execution of powers vested in him, and the performance of contracts relating to property.

The alternative method of bringing a person of unsound mind under lunacy jurisdiction was created by § 116 of the Lunacy Act, 1890. The effect of that section briefly is to enable the Master, on a summons being taken out in his chambers and heard before him, to apply the powers of management and administration summarized in the last preceding paragraph, without any inquisition, to the following classes of cases: lunatics not so found by inquisition, for the protection or administration of whose property any order was made under earlier Acts; every person lawfully detained, within the jurisdiction of the English courts, as a lunatic, though not so found by inquisition; persons not coming within the foregoing categories, who are "through mental infirmity arising from disease or age" incapable of managing their affairs; persons of unsound mind whose property does not exceed £2000 in value, or does not yield an annual income of more than £100; and criminal lunatics continuing insane and under confinement. The effect of the introduction of this simple summary procedure on the number of inquisitions will be apparent from the following figures, which are taken from the *Civil Judicial Statistics*. The annual average of inquisitions executed was, from 1858 to 1862, 64; from 1863 to 1867, 75; from 1868 to 1872, 86; from 1873 to 1877, 116; from 1878 to 1882, 112; from 1883 to 1887, 93; from 1888 to 1892, 80; from 1894 to 1898, 41·0. No annual average of the proceedings under § 116 has yet been taken. But in 1895 there were subsisting 945 cases under the section; in 1896, 1274; in 1897, 1323; in 1898, 1440. During 1897 orders for administration and management under the section are stated to have been made in 327 cases, while in the same year only 42 inquiries were held. At the end of 1897 the number of subsisting cases under inquisition was 1016.

In Scotland the insane are brought under the jurisdiction in lunacy by alternative methods, similar to the English inquisition and summary procedure, viz., "cognition," the trial taking place before the Lord President of the Court of Session or any judge of that court to whom he may remit it, and a jury of twelve—see 31 and 32 Vict. c. 100, and Act of Sederunt of 3rd December 1868—and an application to the Junior Lord Ordinary of the Court of Session, or (43 and 44 Vict. c. 4, § 4) to the Sheriff Court, when the estate in question does not exceed £100 a year, for the appointment of a *curator bonis* or judicial factor.

The powers of the Lord Chancellor of Ireland with regard to lunatics are generally similar to those of the English Chancellor (see 34 Vict. c. 22 and Colles on *The Lunacy Regulations* (*Ireland*) *Act*).

The main feature of the French system is the provision made by the Civil Code (Arts. 489–512) for the interdiction of an insane person by the Tribunal of First Instance, with a right of appeal to the Court of Appeal, after a preliminary inquiry and a report by a family council (Arts. 407, 408), consisting of six blood relatives in as near a degree of relationship to the lunatic as possible, or, in default of such relatives, of six relatives by marriage. The family council is presided over by the *Juge de Paix* of the district in which the lunatic is domiciled. There are provisions, it may be noted, in Scots law for the interdiction of lunatics, either voluntarily or judicially (see Bell's *Principles*, § 2123). The German Civil Code provides for insane persons being made subject to guardianship (*vormundung*), on conditions similar to those of Scots and French law (see Civil Code, §§ 6, 104, 1896, 1906, 645–679). In the United States the fundamental procedure in an inquisition is conducted on practically the same lines as in England.

Asylum administration in England is now regulated by the Lunacy Acts, 1890 and 1891. Receptacles for the insane are divisible into the following classes: (i.) Institutions for lunatics, including asylums, registered hospitals, and licensed houses. The asylums are provided by counties or boroughs, or by union of counties or boroughs. Registered hospitals are hospitals holding certificates of registration from the Commissioners in Lunacy, where lunatics are received and supported wholly or partially by voluntary contributions or charitable bequests, or by applying the excess of the payments of some patients towards the maintenance of others. Licensed houses are houses licensed by the Commissioners, or, beyond their immediate jurisdiction, by justices; (ii.) Workhouses—see article POOR LAW; (iii.) Houses in which patients are boarded out; (iv.) Private houses (unlicensed) in which not more than a single patient may be received. A person, not being a pauper or a lunatic so found by inquisition, cannot, in ordinary cases, be received and detained as a lunatic in any institution for the insane, except under a "reception order" made by a county court judge, or stipendiary magistrate, or specially appointed justice of the peace. The order is made on a petition presented by a relative or friend of the alleged lunatic, and supported by two medical certificates, and after a private hearing by the judicial authority. The detention of a lunatic is, however, justifiable at common law, if necessary for his safety or that of others; and the Lunacy Act, 1890, borrowing from the lunacy law of Scotland, provides for the reception of a lunatic not a pauper into an asylum, where it is expedient for his welfare or the public safety that he should be confined without delay, upon an "urgency order," made if possible by a near relative, and accompanied by one medical certificate. The urgency order only justifies detention for seven days (the curtailment of this period to four days is proposed), and before the expiration of that period the ordinary procedure must be followed. "Summary reception orders" may be made by justices otherwise than on petition. There are four classes of cases in which such orders may be made, viz.: (i.) lunatics (not paupers and not wandering at large) who are not under proper care and control, or are cruelly treated or neglected; (ii.) resident pauper lunatics; (iii.) lunatics, whether pauper or not, wandering at large; (iv.) lunatics in workhouses. (As to pauper lunatics generally, see article POOR LAW.) A lunatic may also be received into an institution under an order by the Commissioners in Lunacy; and a lunatic so found by inquisition under an order signed by the committee of his person.

Asylum administration.

The chief features of English asylum administration requiring notice are these. Mechanical restraint is to be applied only when necessary for surgical or medical purposes, or in order to prevent the lunatic from injuring himself or others. The privacy of the correspondence of lunatics with the Lord Chancellor, the Commissioners in Lunacy, &c., is secured. Provision is made for regular visits to patients by their relatives and friends. The employment of males for the custody of females is, except on occasions of urgency, prohibited. Pauper lunatics may be boarded out with relatives and friends. Elaborate provision is made for the official visitation of every class of receptacle for the insane. The duties of visitation are divided between the Commissioners in Lunacy, the

Chancery Visitors, and various other visitors and visiting committees. There are ten Commissioners in Lunacy—four unpaid and six paid, three of the latter being barristers of not less than five years' standing at the date of appointment, and three medical. The Commissioners in Lunacy, who are appointed by the Lord Chancellor, visit every class of lunatics except persons so found by inquisition. These are visited by the Chancery Visitors. There are three Chancery Visitors, two medical and one legal (a barrister of at least five years' standing at the date of his appointment), who are appointed and removable by the Lord Chancellor. The Chancery Visitors (together with the Master in Lunacy) form a Board, and have offices in the Royal Courts of Justice. In addition to these two classes of visitors, every asylum has a Visiting Committee of not less than seven members, appointed by the local authority; and the justices of every county and quarter-sessions borough not within the immediate jurisdiction of the Commissioners in Lunacy annually appoint three or more of their number as visitors of licensed houses.

Provision is made for the discharge of lunatics from asylums, &c., on recovery, or by *habeas corpus*, or by the various visiting authorities. Any person who considers himself to have been unjustly detained is entitled on discharge to obtain, free of expense, from the secretary to the Lunacy Commissioners a copy of the documents under which he was confined.

The Irish and Scots asylum systems present no feature sufficiently different from the English to require separate notice, except that in Scotland "boarding out" is a regular, and not merely an incidental part of asylum administration. The "boarding out" principle has, however, received its most extended and most successful application in the Gheel colony. In the French (see laws of 30th June 1838 and 18th December 1839) and German (see *Journal of Comparative Legislation*, N.S. vol. i. at pp. 271, 272) asylum systems the main features of English administration are also reproduced. In America the different States of the Union have each their own lunacy legislation. The Government of the United States provides only for the insane of the army and navy, and for those residing in the District of Columbia. The various laws as to the reception, &c., of the insane into asylums closely resemble English procedure. But in several States the verdict of a jury finding lunacy is a necessary preliminary to the commitment of private patients.

AUTHORITIES.—The following references may be added to those appended to the original article: COLLINSON on the *Law of Lunatics and Idiots*, 2 vols., London, 1812; SHELFORD on the *Law of Lunatics and Idiots*, London, 1847. On all points relating to the history and development of the law these two treatises are invaluable. POPE on *Lunacy*, 2nd edit. London, 1890; ARCHBOLD'S *Lunacy*, 4th edit. London, 1895; ELMER on *Lunacy*, 7th edit. London, 1892; WOOD RENTON on *Lunacy*, London and Edinburgh, 1896; FRY'S *Lunacy Laws*, 3rd edit. London, 1890; PITT-LEWIS, SMITH and HAWKE, *The Insane and the Law*, London, 1895; HACK-TUKE, *Dictionary of Psychological Medicine*, London, 1892, and the bibliographies attached to the various legal articles in that work; CLEVENGER, *Medical Jurisprudence of Insanity*, 2 vols. New York, 1899; SEMELAIGNE, *Les Aliénistes Français*, Paris, 1849. (A. W. R.)

HOSPITAL TREATMENT.

The era of real hospitals for the insane properly belongs to the 19th century. There had been established here and there in different parts of the world, it is true, certain asylums or places of restraint before the beginning of the 19th century. We find mention in history of such a place established by monks at Jerusalem in the latter part of the 5th century. There is evidence that even earlier than this in Egypt and Greece the insane were treated as individuals suffering from disease. Egyptian priests employed not only music and the beautiful in nature and art as remedial agents in insanity, but recreation and occupation as well. A Greek physician protested against mechanical restraint in the care of the insane, and advocated kindly treatment, the use of music, and of some sorts of manual labour. But these ancient beneficent teachings were lost sight of during succeeding centuries. The prevailing idea of the pathology of insanity in Europe during the Middle Ages was that of demoniacal possession. The insane were not sick, but possessed of devils, and these devils were only to be exorcised by moral or spiritual agencies. Mediæval therapeutics in insanity adapted itself to the etiology indicated. Torture and the cruellest forms of punishment were employed. The insane were regarded with abhorrence, and were frequently cast into chains and dungeons. Milder forms of mental disease were treated by other spiritual means—such as pilgrimages to the shrines of certain saints who were reputed to have particular skill and success in the exorcism of evil spirits. The shrine of St Dymphna at Gheel, in Belgium, was one of these, and seems to have originated in the 7th century, a shrine so famed that lunatics from all over Europe were brought thither for miraculous healing. The little town became a resort for hundreds of insane persons, and as long ago as the 17th century acquired the reputation, which still exists to this day, of a unique colony for the insane. At the present time the village of Gheel and its adjacent farming hamlets (with a population of some 13,000 souls) provides homes, board, and care for nearly 2000 insane persons under medical and government supervision. Numerous other shrines and holy wells in various parts of Europe were resorted to by the mentally afflicted—such as Glen-na-Galt in Ireland, the well of St Winifred, St Nun's Pool, St Fillans, &c. At St Nun's the treatment consisted of plunging the patient backwards into the water and dragging him to and fro until mental excitement abated. Not only throughout the Middle Ages, but far down into the 17th century, demonology and witchcraft were regarded as the chief causes of insanity. And the insane were frequently tortured, scourged, and even burned to death.

Until as late as the middle of the 18th century, mildly insane persons were cared for at shrines, or wandered homeless about the country. Such as were deemed a menace to the community were sent to ordinary prisons, or chained in dungeons. Thus large numbers of lunatics accumulated in the prisons, and slowly there grew up a sort of distinction between them and criminals, which at length resulted in a separation of the two classes. In time many of the insane were sent to cloisters and monasteries, especially after these began to be abandoned by their former occupants. Thus "Bedlam" (the present Bethlehem Royal Hospital) was originally founded in 1247 as a priory for the brethren and sisters of the Order of the Star of Bethlehem. It is not known exactly when lunatics were first received into Bedlam, but some were there in 1403. Bedlam was rebuilt as an asylum for the insane in 1676. In 1815 a committee of the House of Commons, upon investigation, found it in a disgraceful condition, the medical treatment being of the most antiquated sort, and actual inhumanity practised upon the patients. Similarly the Charenton Asylum, just outside Paris, near the park of Vincennes, was an old monastery which had been given over to the insane. Numerous like instances could be cited, but the interesting point to be borne in mind is, that with a general tendency to improvement in the condition of imbeciles upon public charge, idiots

and insane persons came gradually to be separated from criminals and other paupers, and to be segregated. The process of segregation was, however, very slow. Even after it had been accomplished in the larger centres of civilization, the condition of these unfortunates in provincial districts remained the same. Furthermore, the transfer to asylums provided especially for them was not followed by any immediate improvement in the patients. The accounts of the state of the insane in various countries during the latter part of the 18th century and the beginning of the 19th are shocking to read.

Twenty-five years after Pinel had, in 1792, struck the chains from the lunatics huddled in the Salpêtrière and Bicêtre of Paris, and called upon the world to realize the horrible injustice done to this wretched and suffering class of humanity, a pupil of Pinel, Esquirol, wrote of the insane in France and all Europe, "These unfortunate people are treated worse than criminals, reduced to a condition worse than that of animals. I have seen them naked, covered with rags, and having only straw to protect them against the cold moisture and the hard stones they lie upon; deprived of air, of water to quench thirst, and all the necessaries of life; given up to mere gaolers and left to their surveillance. I have seen them in their narrow and filthy cells, without light and air, fastened with chains in these dens in which one would not keep wild beasts. This I have seen in France, and *the insane are everywhere in Europe treated in the same way.*" It was not until 1838 that the insane in France were all transferred from small houses of detention, workhouses, and prisons to asylums specially constructed for this purpose.

In Belgium, in the Middle Ages, the public executioner was ordered to expel from the towns, by flogging, the poor lunatics who were wandering about the streets. In 1804 the Code Napoleon "punished those who allowed the insane and mad criminals to run about free." In 1841 an investigation showed in Belgium thirty-seven establishments for the insane, only six of which were in good order. In fourteen of them chains and irons were still being used. In Germany, England, and America, in 1841, the condition of the insane was practically the same as in Belgium and France.

These facts show that no great advance in the humane and scientific care of the insane was made till towards the middle of the 19th century. Only then did the actual metamorphosis of asylums for detention into hospitals for treatment begin to take place. Hand in hand with this progress there has grown, and still is growing, a tendency to subdivision and specialization of hospitals for this purpose. There are now hospitals for the acutely insane, others for the chronic insane, asylums for the criminal insane, institutions for the feeble-minded and idiots, and colonies for epileptics. There are public institutions for the poor, and well-appointed private retreats and homes for the rich. All these are presided over by the best of medical authorities, supervised by unsalaried boards of trustees or managers, and carefully inspected by Government lunacy commissioners, or boards of charities—a contrast, indeed, to the gaols, shrines, holy wells, chains, tortures, monkish exorcisms, &c., of the past!

The statistics of insanity have nowadays been fairly well established. The ratio of insane to normal population is about 1 to 300 among civilized peoples. This proportion varies within narrow limits in different races and countries. It is probable that intemperance in the use of alcohol and drugs, the spread of venereal diseases, and the over-stimulation in many directions induced by modern social conditions, have caused an increase of insanity in the 19th as compared with past centuries. The amount of such increase is probably very small, but on superficial examination might seem to be large, owing to the accumulation of the chronic insane and the constant upbuilding of asylums in new communities. The imperfections of census-taking in the past must also be taken into account.

The modern hospital for the insane does credit to latter-day civilization. Physical restraint is no longer practised. The day of chains—even of wristlets, covered cribs, and strait-jackets—is past. Neat dormitories, cosy single rooms and sitting and dining rooms, please the eye. In the place of bare walls and floors and curtainless windows, we observe pictures, plants, rugs, birds, curtains, and in many asylums even the barred windows have been abolished. Some of the wards for milder patients have unlocked doors. Many patients are trusted alone about the grounds and on visits to neighbouring towns. An air of busy occupation is observed in sewing rooms, schools, shops, in the fields and gardens, employment contributing not only to economy in administration, but to improvement in mental and physical conditions. The general progress of medical science in all directions has been manifested in the department of psychiatry by improved methods of treatment, in the way of sleep-producing and alleviating drugs, dietetics, physical culture, hydrotherapy, and the like. There are few asylums now without pathological and clinical laboratories, in which work is going on with a view to unravelling some of the mysteries of disordered mind. While it is a far cry from the prisons and monasteries of the past to the modern hospital for the insane, it is still possible to trace a resemblance in many of our older asylums to their ancient prototypes, particularly in those asylums built upon the so-called corridor plan. It is always difficult to break away from established forms, and though each generation contributed something new, antecedent models were more or less adhered to. Progress in asylum architecture has hence advanced more slowly in countries where monasteries and cloisters abounded than in countries where fixed models did not exist. Architects have had a freer hand in America, Australia, and Germany, and even in Great Britain, than in the Catholic countries of Europe. At the present time Germany approaches nearest to an ideal standard of provision for the insane. The highest and best idea which has yet been attained is that of small hospitals for the acutely insane in all cities of more than 50,000 inhabitants, and of colonies for the chronic insane in the rural districts adjacent to centres of population.

The psychopathic hospital in the city gives easy and speedy access to persons taken suddenly ill with mental disease, aids in early diagnosis, places the patients within reach of the best specialists in all departments of medicine, and associated, as it should be, with a medical school or university, affords facilities not otherwise available for scientific research and for instruction in an important branch of medical learning. A feature of the psychopathic hospital should be the reception of patients for a reasonable period of time, as sufferers from disease, without the formality of legal commitment papers. Such papers are naturally required for the detention and restraint of the insane for long periods of time, but in the earlier stages they should be spared the stigma, delay, and complicated procedure of commitment for at least ten days or two weeks, since in that time many may convalesce or recover, and in this way escape the public record of their infirmities, unavoidable by present judicial procedures.

There should be associated with such hospitals for the acutely insane in our cities out-door departments or dispensaries, to which patients may be brought in still earlier stages of mental disorder, at a period when early diagnosis and preventive therapeutics may have their best opportunities to attain good results. In Germany a psychopathic hospital now exists in every university town, under the name of Psychiatrische Klinik. As far as the writer knows, there are no such institutions in Great Britain, France, or America.

Colonies for the chronic insane are established in the country, but in the neighbourhood of the cities having psychopathic hospitals, to receive the overflow of the latter when the acute stage has passed. The true colony is constructed on the principle of a farming hamlet, without barracks, corridored buildings, or pavilions. It is similar in most respects to any agricultural community. The question here is one of humane care and economical administration. Humane care includes medical supervision, agreeable home-life, recreation, and, above all things, regular manual and out-of-door occupation in garden, farm, and dairy, in the quarry, clay-pit, or well-ventilated shop. Employment for the patients is of immense remedial importance, and at the same time is of great value from the standpoint of economical administration. In the colony system the small cottage homes of the patients are grouped about the centres of industry. The workers in the farmstead live in small families about the farmstead group of buildings; the tillers of the soil adjacent to the fields, meadows, and gardens; the brickmakers, quarrymen, and artizans in still other cottages in the neighbourhood of the scenes of their activities. In addition to these groups of cottages, which constitute the majority of the buildings in the village, an infirmary for bedridden, excited, and crippled patients is required, and a small hospital for the sick. All the inhabitants of the colony are under medical supervision. A laboratory for scientific researches forms a highly important part of the equipment. The colony is not looked upon as a refuge for the incurable; it is still a hospital for the sick, where treatment is carried on under the most humane and most suitable conditions, and wherein the percentage of recoveries will be larger than in asylums and hospitals as now conducted. In respect of the establishment of colonies for the insane upon the plan outlined here, Germany has, as in the case of the psychopathic hospital, led the world. It has been less difficult for that country to set the example, because she had fewer of the conditions of the past to fight, fewer of the old-time models to contend against, and with her the progress of medical science and of methods of instruction in all departments of medicine has been more pronounced and rapid. As already stated, every university town in Germany has its psychopathic hospital, and in the matter of colonies for the insane many of the provinces have already established them. Among the colonies, that at Alt-Scherbitz, near Leipzig, is the oldest and most successful, and is pre-eminent in its close approach to the ideal village or colony system. Professor Kraeplin, of Heidelberg (*Psychiatrie*, 6th edition, 1899), states that the effort is made everywhere in Germany to give the exterior of asylums, by segregation of the patients in separate home-like villas, rather the appearance of hamlets for working-people than prisons for the insane, and says, further, that the whole question of the care of the insane has found solution in the colony system, which is the best and cheapest method of support. "I have myself," he writes, "had opportunity to see patients, who had lived for years in a large closed asylum, improve in the most extraordinary manner under the influence of the freer movement and more independent occupation of colony life."

There is no institution in England or America constructed on the village system, with the sole exception of the Craig Colony for Epileptics at Sonyea, where the colony scheme has been adopted by the State of New York, and is being carried out on a large and successful scale.

That the tendency nowadays, even outside of Germany, in the direction of the ideal standard of provision for the insane is a growing one, is manifested in all countries by a gradual disintegration of the former huge cloister-like abodes. More asylums are built on the pavilion plan, which is a step in the right direction. Many asylums have, as it were, thrown off detached cottages for the better care of certain patients. Some asylums have even established small agricultural colonies a few miles away from the parent plant, like a vine throwing out feelers. What is called the boarding-out system is an effort in a similar direction. Patients suffering from mild forms of insanity are boarded out in families in the country, either upon public or private charge. Gheel is an example of the boarding-out system practised on a large scale. But it is only a matter of time when the ideal system of psychopathic hospital and colony for the insane will be gradually adopted everywhere.

AUTHORITIES.—TUKE. *Dictionary of Psychological Medicine.* London and Philadelphia, 1892.—LETCHWORTH. *The Insane in Foreign Countries.* New York, 1899.—LETCHWORTH. *Care and Treatment of Epileptics.* New York, 1900.—PETERSON. *Mental Diseases.* Philadelphia, 1899.—PETERSON. "Annual Address to the American Medico-Psychological Association," *Proceedings*, 1899. (F. P*.)

[For the pathological discussion of Insanity see PATHOLOGY, *Neuropathology*.]

Inscriptions.—In addition to the account of this subject given in the earlier volumes of this encyclopædia (9th edition), the new information derived from the discovery of ancient inscriptions will be found, together with allied questions of interest, under PALÆOGRAPHY, WRITING, EGYPTOLOGY, BABYLONIA, and other headings in the new volumes. See also the topographical articles giving the results of modern excavation. The following recent works of authority should be consulted:—

Arabic.—I. J. L. BARGÈS. *Inscriptions arabes de Marseille.* London, 1889.—M. v. BERCHAM. *Materiaux pour un Corpus Inscriptionum Arabicarum.*

Assyrian and Babylonian.—R. E. BRÜNNOW. Classified List of cuneiform ideographs in texts hitherto published. Leyden, 1887.—L. ABEL and H. WINCKLER. *Keilschrifttexte.* Berlin, 1890.—E. A. BUDGE. *The History of Esarhaddon from Cuneiform Inscriptions.* 1880.—Ac. Cat., British Museum, London. Cuneiform texts from Babylonian tablets in the British Museum. London, 1896.—T. NOELDECKE. *Die Inschriften von Persepolis, Istakhe, &c.* Berlin, 1882.—H. WINCKLER. *Keilinschriftliches Textbuch zum Alten Testament.* Leipzig, 1892; *Sammlung von Keilinschrifttexten.* Leipzig, 1893.—J. OPPERT. *La plus ancienne inscription Sémitique.* Paris, 1894.

Egyptian.—H. BRUGSCH. *Thesaurus inscriptionum Ægyptiacarum.* Leipzig, 1883.

Etruscan.—ELIA LATTES. *Studi metrici intorno all' iscrizione etrusca della mummia.* 1895.—G. FREGNI. *Delle piu celebri izcrizioni etrusche edumbre.* Modena, 1897.

Greek.—C. F. W. DITTENBERGER. *Sylloge Inscriptionum Græcarum.* Leipzig, 1898.—E. L. HICKS. *A Manual of Greek Inscriptions.* Clarendon Press, 1882.—D. PEZZI. *La Grecità non Ionica nelle iscrizioni piu antiche.* Turin, 1883.—E. SCHWEIZER. *Grammatik der pergamenischen Inschriften.* Berlin, 1898.

Latin.—H. DESSAU. *Inscriptiones Latinæ selectæ.* Berlin, 1892.—D. COMPARETTI. *Iscrizione arcaica del Foro Romano.* Florence, 1900.—I. P. WALTZING. *Le Recueil des inscriptions latines (corpus inscriptionum latinarum) et l'épigraphie latine depuis 50 ans.* Louvain, 1892.

Persian.—F. H. WEISSBACH and W. BANG. *Die altpersischen Keilinschriften.* 1893.

INSECTS.

IN the following supplementary article the order of treatment is similar to that adopted in the earlier volumes of this encyclopædia (9th edition).

1. *Number of Species.*—It is now considered that 2,000,000 is a moderate estimate of the species of insects actually existing. Some authorities consider this total to be too small, and extend the number to 10,000,000. Upwards of 300,000 species have been collected and described, and at present the number of named forms increases at the rate of about 8000 species per annum. The greater part by far of the insects existing in the world is still quite unknown to science. Many of the species are in process of extinction, owing to the extensive changes that are taking place in the natural conditions of the world by the extension of human population and of cultivation, and by the destruction of forests; hence it is probable that a considerable proportion of the species at present existing will disappear from the face of the earth before we have discovered or preserved any specimens of them.

2. *Antiquity.*—A large number of species of fossil insects have been recently discovered in the Carboniferous measures of Commentry, in France. They have been described by the late M. Charles Brongniart, and indicate a much greater richness and variety of insect life in Palæozoic times than was formerly believed to exist. On the other hand, no greater extension of the absolute antiquity of insects has been found. It is true that a Silurian fossil—*Palæoblattina douvillei*—has been described as an insect relic, but this identification is probably erroneous. Some of the Carboniferous insects were of gigantic size, one form—apparently allied to the Odonata, or dragon-flies, of our own epoch—measuring more than 2 feet across the expanded wings. Blattidæ, or cockroaches, existed abundantly in Carboniferous times, and were apparently not very different from those now extant. The insects of the Palæozoic epoch have been combined in a great group, called Palæodictyoptera by Scudder. This classification is apparently chiefly justified by the fact that many Palæozoic insects cannot be satisfactorily placed in the same divisions as existing insects.

3. *Geographical Distribution.*—Recent discoveries induce the belief that islands, even when remote from continents, possess a greater number of species peculiar to them than was formerly supposed. More extensive investigation of island-life is, however, urgently needed.

4. *Duration of Life.*—The flour-moth (*Ephestia kuhniella*) sometimes passes through five or six generations in a single year. Although one of the characteristics of insects is the brevity of their adult lives, a considerable number of exceptions to the general rule have been discovered. These exceptions may be briefly summarized as follows: (1) Certain larvæ, provided with food that may be adequate in quantity but deficient in nutriment, may live and go on feeding for many years; (2) certain stages of the life that are naturally "resting stages" may be in exceptional cases prolonged, and that to a very great extent; in this case no food is taken, and the activity of the individual is almost *nil;* (3) the life of certain insects in the adult state may be much prolonged if celibacy be maintained; a female of *Cybister rœselii* (a large water-beetle) has lived five and a half years in the adult state in captivity. In addition to these abnormal cases, the life of certain insects is naturally more prolonged than usual. The females of some social insects have been known to live for many years. In *Cicada septendecim* the life of the larva extends over from thirteen to seventeen years. The eggs of locusts may remain for years in the ground before hatching; and there may thus arise the peculiar phenomenon of some species of insect appearing in vast numbers in a locality where it has not been seen for several years.

5. *Economic Entomology.*—The influence of insects on the prosperity of man, and practical work in connexion therewith, have attracted great attention, and there are now various countries in which experts are employed by the State to study this subject and give advice thereon. (See ECONOMIC ENTOMOLOGY, MOSQUITO, TSETSE FLY.)

J. B. Smith estimates that in New Jersey insects diminish the value of the crop annually to the extent of at least 20 or 25 per cent.; and Osborn considers that, in ordinary pasture, insects take a toll of about one-half the produce. As the multiplication of animals of this class is sometimes both great and rapid, it happens not infrequently that crops are totally destroyed. Official statistics show that in the island of Cyprus more than 1300 tons of locusts' eggs were collected and destroyed in the year 1881. The regions that suffer most are lands in which cultivation is proceeding in proximity to large districts still in a wild state. Islands to which new forms of cultivated vegetation are introduced sometimes suffer severely. The undue multiplication of insects destructive to vegetation is, in lands in a state of nature, checked by other insects that feed on, or in, the injurious kinds. When foreign plants are introduced to a region it often happens that insects injurious to them are sooner or later found to be present, while the natural enemies of the destroyers may be totally absent. A remedy for this has been sought by introducing the beneficial insects into the region devastated, a proceeding that is sometimes followed by satisfactory results. The orange and lemon trees of California ten years ago were in immediate danger of total extermination owing to the attacks of *Icerya purchasi*, a scale-insect. *Vedalia cardinalis*, a lady-bird or beetle of the family Coccinellidæ, was brought from Australia to California, and checked the ravages of the Icerya in a most rapid and successful manner. The Coccidæ, or scale-insects, are amongst the most injurious; they are minute creatures, with extremely limited faculty of locomotion, that fix themselves on plants, and are endowed with great powers of multiplication. Aphidæ, or plant-lice, are allied to Coccidæ, and in some countries are very injurious. Many other kinds of insects have been found to be injurious, and the treatment necessary to counteract their ravages varies in accordance with the habits and nature of the ravagers. Countries in which cultivation has long been predominant do not as a rule suffer severely from insect depredations, a kind of fluctuating natural balance existing between depredators and their destroyers. Artificial forests (under which we include forests the natural conditions of which have been much interfered with) appear, however, to be everywhere liable to destruction.

Mosquitoes and Malaria.—Increase of knowledge as to the minute organisms that are the causes of certain diseases in man (and the fact that an extremely minute quantity of matter is adequate for the transference of germs) has led to the belief that various diseases may be disseminated by insects. In the case of malaria it is now established that it is conveyed by mosquitoes of the genus *Anopheles*, and that these insects are essential to its existence. The organism that gives rise to the symptoms of malaria exists in the blood, where it attacks the corpuscles, and may increase greatly in numbers. There are several forms of these parasites, and the generic name Hæmamœba is now applied to them. Ross calls the form that gives rise to quartan fever in man Hæmamœba malariæ. It was formerly supposed that malaria was communicated by infected water or air, but the parasite has now been found to live in the body of the Anopheles. When a mosquito bites a person it injects a minute quantity of its saliva into the wound, and the malarial parasite is thus introduced. The parasite multiplies in the blood, so that if the patient be again bitten and blood sucked from him by another mosquito the insect becomes thereafter an inoculatory agent. It would appear to be probable that negroes, who in many cases are themselves nearly immune to the pathological symptoms of malaria, serve to keep the mosquitoes supplied with the malarial organism. The parasite is taken into the alimentary canal of the mosquito, passes into the body cavity of the fly, and thence into the salivary glands, and undergoes an important part of its development in the insect. The mosquito is essential to the existence of the disease, because it is in the body of the fly that an important part of the series

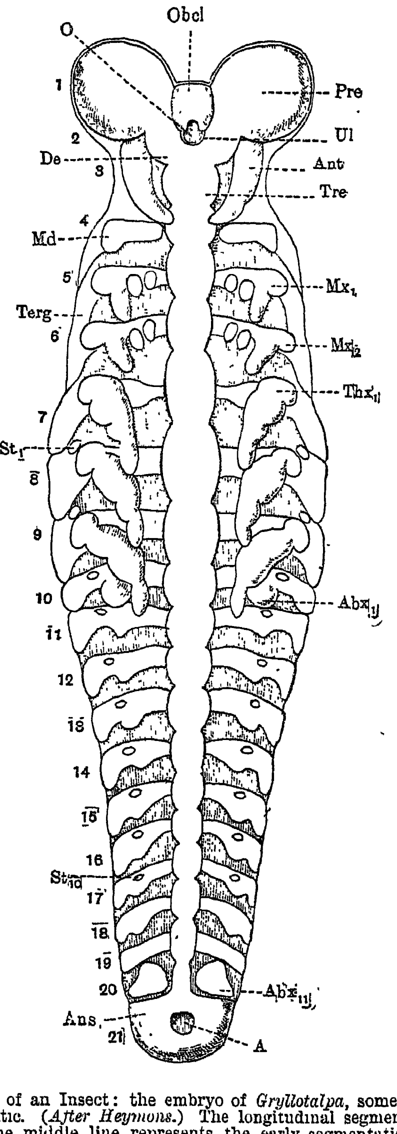
of life-changes of the parasite is passed through. (See also MOSQUITO and SPOROZOA.)

6. *Fertilization of Plants.*—Bombi, or bumble-bees, have been successfully introduced into New Zealand, with the result that clover produces plenty of seed there, and that seedlings of various other plants are much augmented. But in Australia the introduction has not been successful.

7. *Luminosity.*—This subject has received considerable attention, but is still a difficult one. In some of the light-giving forms the eggs have been found to be luminescent before any development takes place in them, it being thus proved that the property is not dependent on the existence of a special organ. The view that the light is due to phosphorus in any form has not been sustained. It is affirmed by Dubois that luminescence is due to the reactions of two special substances, luciferase and luciferine. In a luminous organ light is produced by the entry of hæmolymph, or blood containing luciferine, to the area containing luciferase. The light given by insects has been shown to be highly economical, and if a similar illuminating agent can be produced artificially it will be a great boon.

8. *Galls.*—A great variety of deformations and growths produced by insects and mites as well as by fungi has been described. They are in some cases very slight, and in others form remarkably large and definite structures. The whole are now included under the term Cecidia; a prefix gives the name of the organism to which the attacks are due, *e.g.*, Phytoptoccidia are the galls formed by Phytoptid mites. Simple galls are those that arise when only one member of a plant is involved; compound galls are the result of attacks on buds. Amongst the most remarkable galls recently discovered we may mention those found on Eucalyptus, Casuarina, and other trees and plants in Australia. They are remarkable for their variety, and are due to small scale-insects of the peculiar subfamily Brachyscelinæ. As regards the mode of production of galls, the most important distinction is between galls that result from the introduction of an egg, or other matter, into the interior of the plant, and those that are due to an agent acting externally, the gall in the latter case frequently growing in such a manner as ultimately to enclose its producers. The form and nature of the gall are the result of the powers of growth possessed by the plant. It has long been known, and is now generally recognized, that a gall can only be produced when the tissue of a plant is interfered with during, or prior to, the actual development of the tissue. Little more than this is known. The power that gall-producers possess of influencing by direct interference the growth of the cells of the plant that affords them the means of subsistence is an art that appears to be widely spread among animals, but is at the same time one of which we have little knowledge. The views of Adler as to the alternation of generations of numerous gall-flies have been fully confirmed, it having been ascertained by direct observation that the galls and the insects produced from them in one generation are entirely different from the next generation; and it has also been rendered certain that frequently one of the alternate generations is parthenogenetic, no males being produced. It is supposed that these remarkable phenomena have gradually been evoked by difference in the nutrition of the alternating generations. When two different generations are produced in one year on the same kind of tree it is clear the properties of the sap and tissues of the tree must be diverse so that the two generations are adapted to different conditions. In some cases the alternating generations are produced on different species of trees, and even on different parts of the two species.

9. *Anatomy—Morphology.*—Much work has been devoted to ascertaining the structure of the insect during the period of development in the egg. The addition of this embryological knowledge to the results yielded by study of the comparative anatomy of the perfect insect is enabling



Morphology of an Insect: the embryo of *Gryllotalpa*, somewhat diagrammatic. (*After Heymons.*) The longitudinal segmented band along the middle line represents the early segmentation of the nervous system and the subsequent median field of each sternite; the lateral transverse unshaded bands are the lateral fields of each segment; the shaded areas indicate the more internally placed mesoderm layer. The segments are numbered 1–21; 1–6 will form the head, 7–9 the thorax, 10–21 the abdomen. *A*, anus; Abx_1 Abx_{11}, appendage of 1st and of 11th abdominal segments; *Ans*, anal piece = telson or 12th abdominal segment; *Ant*, antenna; *De*, deuterencephalon; *Md*, mandible; Mx_1, first maxilla; Mx_2, second maxilla or labium; *O*, mouth; *Obcl*, rudimentary labrum and clypeus; *Pre*, protencephalon; St_1, St_{10}, stigmata 1 and 10; *Terg*, tergite; Thx_1, appendage of first thoracic segment; *Tre*, tritencephalon; *Ul*, a thickening at hinder margin of the mouth.

us to interpret the structure of the latter correctly, and to form an opinion as to what are the most important of the similarities and distinctions we observe. Our knowledge relates at present chiefly to the lower insects. The higher members of the class undergo at the penultimate stages of their life a metamorphosis so complete and rapid as to render the correct interpretation of their structures a matter of very great difficulty. (For details see § 10 below, under *Metamorphosis.*)

Segments.—One of the most constant features of insect structure is the segmentation (see Fig.). The segments are perceptible at a very early stage of the development

as a number of transverse bands arranged in a linear sequence. The first segmentation of the ventral plate—the minute part of the blastoderm that ultimately develops into the embryo—is not, however, very definite, and the segmentation does not make its appearance simultaneously throughout the whole length of the plate; the anterior parts are segmented before the posterior. In Orthoptera and Thysanura, as well as some others of the lower insects, it may be said that twenty-one of these divisions—not, however, all similar—may be distinguished, six of which subsequently enter into the formation of the head, three going to the thorax and twelve to the abdomen. In Hemiptera only eleven, and in Collembola only six, abdominal segments have been detected. The first and last of these twenty-one divisions are so different from the others that they can scarcely be considered true segments.

Head Segments.—In the adult insect the head is insignificant in size compared with the thorax or abdomen, but in the embryo it forms a much larger portion of the body than it does in the adult. Its composition has been the subject of prolonged difference of opinion. Formerly it was said that the head consisted of four divisions, viz., three segments and the procephalic or præ-oral lobes. It is now ascertained that the procephalic lobes consist of three divisions, so that the head may be said to be formed from six divisions. The first of these, according to the nomenclature of Heymons, is the mouth, or oral, piece; the second, the antennal segment; the third, the intercalary or præ-mandibular segment; while the fourth, fifth, and sixth are respectively the segments of the mandibles and of the first and second maxillæ. These six divisions of the head are diverse in kind, and subsequently undergo so much change that the part each of them takes in the formation of the head-capsule is not finally determined. The labrum and clypeus are developed as a single prolongation of the oral piece, not as a pair of appendages. The antennal segment apparently entirely disappears, with the exception of a pair of appendages it bears; these become the antennæ; it is possible that the original segment, or some part of it, may even become a portion of the actual antennæ. The intercalary segment has no appendages, or rudiments thereof, and probably subsequently entirely disappears. The appendages of the posterior three, or trophal, segments become the parts of the mouth. The appendages of the two maxillary segments arise as treble, instead of single, projections, thus differing from other appendages. From these facts it appears that the anterior three divisions of the head differ strongly from the posterior three, which greatly resemble thoracic segments; hence it has been thought possible that the anterior divisions may represent a primitive head, to which three segments and their leg-like appendages were subsequently added to form the head as it now exists. This is, however, very doubtful, and an entirely different inference is possible. In reference to the structure of the head-capsule in the imago, it appears that the clypeus and labrum represent, as already said, an unpaired median outgrowth of the oral piece; that immediately behind them comes the "frons," formed by the junction in the median line of the sides of the oral piece, but without suture there, because the junction takes place early and before any process of chitinous excretion occurs; that the "vertex" is formed by the tergites—or lateral growths—of the posterior three head segments, the mandibular segment contributing also the genæ.

Hypopharynx.—Great difference of opinion exists as to this structure, which is extremely different in the various kinds of insects; it may be briefly described as a fold forming the floor, or a part thereof, of the mouth. It has even been thought that it represents a distinct segment, or the pair of appendages of a distinct segment. Heymons considers that it represents the sternites of the three trophal segments, and that the "gula" is merely a secondary development. Folsom looks on the hypopharynx as a secondary development, but considers that some lateral parts in connexion with it represent an additional or seventh segment, which he calls superlingual, and considers as situate between the mandibular and first maxillary segments. The ganglia of the nervous system offer some important evidence as to the morphology of the head, and are alluded to below.

Thoracic Segments.—These are always three in number. The three pairs of legs appear very early as rudiments. Though the thoracic segments bear the wings, no trace of these appendages exists till the close of the embryonic life, nor even, in many cases, till much later. The thoracic segments, as seen in an early stage of the ventral plate, display in a well-marked manner the essential elements of the insect segment. These elements are, a central piece or sternite, and a lateral field on each side bearing the leg-rudiment. The external part of the lateral field subsequently grows up, and by coalescence with its fellow forms the tergite or dorsal part of the segment.

Abdominal Segments and Appendages.—We have already seen that in numerous lower insects the abdomen is formed from twelve divisions placed in linear fashion. Eleven of these may perhaps be considered as true segments, but the twelfth or terminal one is different, and is called by Heymons a telson; in it is placed the anal orifice, and the mass subsequently becomes the upper and lower laminæ anales. In Hemiptera this telson is absent, and the anal orifice is placed quite at the termination of the eleventh segment. Moreover, in this Order the abdomen shows at first a division into only nine segments and a terminal mass, which last subsequently becomes divided into two. The appendages of the abdomen are called cerci, styles, and gonapophyses. They differ much according to the kind of insect, and in the adult according to sex. Difference of opinion as to the nature of the abdominal appendages prevails. The cerci, when present, appear in the mature insect to be attached to the tenth segment, but according to Heymons they are really appendages of the eleventh segment, their connexion with the tenth being secondary and the result of considerable changes that take place in the terminal segments. It has still to be shown that any true cerci exist in the higher insects. In those insects in which a median terminal appendage exists between the two cerci this is considered to be a prolongation of the eleventh tergite. The styles, when present, are placed on the ninth segment, and in some Thysanura exist also on the eighth segment; their development takes place later in life than that of the cerci. The gonapophyses are the projections near the extremity of the body that surround the sexual orifices, and vary extremely according to the kind of insect. They have chiefly been studied in the female, and form the sting and ovipositor, organs peculiar to this sex. They are developed on the ventral surface of the body, and are six in number, one pair arising from the eighth ventral plate and two pairs from the ninth. This has been found to be the case in insects so widely different as Orthoptera and Aculeate Hymenoptera. The genital armature of the male is formed to a considerable extent by modifications of the segments themselves. The development of the armature has been little studied, and the question whether there may be present gonapophyses homologous with those of the female is open.

In the adult state no insect possesses more than six legs, and they are always attached to the thorax; in many Thysanura there are, however, processes on the abdomen that, as to their position, are similar to legs. In the embryos of many insects there are projections from the segments of the abdomen similar, to a considerable extent, to the rudimentary thoracic legs. The question whether these projections can be considered an indication of former polypody in insects has been raised. They do not long persist in the embryo, but disappear, and the area each one occupied becomes part of the sternite. In some embryos there is but a single pair of these rudiments (or vestiges) situate on the first abdominal segment, and in some cases they become invaginations of a glandular nature. Whether cerci, styles, and gonapophyses are developed from these rudiments has been much debated. It appears that it is possible to accept cerci and styles as modifications of the temporary pseudopods, but it is more difficult to believe that this is the case with the gonapophyses, for they apparently commence their development considerably later than cerci and styles and only after the apparently complete disappearance of the embryonic pseudopods. The fact that there are two pairs of gonapophyses on the ninth abdominal segment would be fatal to the view that they are in any way homologous with legs, were it not that there is some evidence that the division into two pairs is secondary and incomplete. The pseudopods that exist on the abdomen of numerous caterpillars may possibly arise from the embryonic pseudopods, but this also is far from being established.

Nervous System.—The nervous system is ectodermal in origin, and is developed and segmented to a large extent in connexion with the outer part of the body, so that it affords important evidence as to the segmentation thereof. The continuous layer of cells from which the nervous system is developed undergoes a segmentation analogous with that we have described as occurring in the ventral plate; there is thus formed a pair of contiguous ganglia for each segment of the body, but there is no ganglion for the telson. The ganglia become greatly changed in position during the later life, and it is usually said that there are only ten pairs of abdominal ganglia even in the embryo. In Orthoptera, Heymons has demonstrated the existence of eleven pairs, the terminal pair becoming, however, soon united with the tenth. The nervous system of the embryonic head exhibits three ganglionic masses, anterior to the thoracic ganglionic masses; these three masses subsequently amalgamate and form the sub-œsophageal ganglion, which supplies the trophal segments. In front of the three masses that will form the sub-œsophageal ganglion the mass of cells that is to form the nervous system is very large,

and projects on each side; this anterior, or præ-oral, mass consists of three lobes (the prot-, deut-, and tritencephalon of Viallanes and others), each of which may represent a segmental ganglion. They subsequently form the supra-œsophageal ganglion, or brain proper. Thus the evidence afforded by the great ventral chain of nerves supports the view that the number of divisions of the body in the lower insects is twenty, plus a terminal piece or telson. The telson and the anterior segment, or head-piece, at the other extremity exhibit considerable distinctions from the other segments. There are other ganglia in addition to those of the ventral chain, and Ch. Janet supposes that the ganglia of the sympathetic system indicate the existence of three other head-segments; the remains of the segments themselves are, in accordance with this view, to be sought in the stomodæum (to which we allude below). Folsom considers that there are seven sets of cephalic ganglia, and thus supports his view as to the composition of the head.

Alimentary Canal.—The anterior and posterior parts of the alimentary canal have for long been known to have their origin in ectoderm, and to be thus, as it were, parts of the exterior of the body; they are called respectively the stomodæum and proctodæum. The middle portion of the alimentary canal—the stomach or mesenteron—has until recently been considered to be endodermal. Heymons has shown that it is of secondary ectodermal origin in several insects, and his views have been confirmed, from study of other Orders, by various authorities. It appears, therefore, to be established that in the majority of insects the mesenteron is formed by cells from the stomodæum and proctodæum that subsequently unite, and not from endodermal rudiments in close proximity with these two parts, as Graber and others believed, and as is usually the case in other animals. Heymons has also found that in Lepisma the mesenteron arises in a different manner, and is of endodermal origin, being developed from the yolk-cells.

10. *Metamorphosis.*—A great deal of investigation has been devoted to this remarkable feature of insect life. The outer layer—or embryonic ectoderm—of an insect consists of a layer of cells forming a continuous structure; the orifices in it—mouth, spiracles, anus, and terminal portions of the genital ducts—being invaginations of the outer wall. This cellular layer is called the hypodermis; it is protected externally by a cuticle, a layer of matter it itself excretes, or in the excretion of which it plays, at any rate, an important part. The cuticle is a dead substance, and is composed in large part of chitin. The cuticle contrasts strongly in its nature with the hypodermis it protects. It is different in its details in different insects and in different stages of the life of the same insect. The "sclerites" that make up the skeleton of the insect (which skeleton, it should be remembered, is entirely external) are made up of this chitinous excretion. The growth of an insect is usually rapid, and as the cuticle does not share therein, it is from time to time cast off by moulting or ecdysis. Before a moult actually occurs the cuticle becomes separated from its connexion with the underlying hypodermis. Concomitant with this separation there is commencement of the formation of a new cuticle within the old one, so that when the latter is cast off the insect appears with a partly completed new cuticle. The new instar—or temporary form—is often very different from the old one, and this is the essential fact of metamorphosis. Metamorphosis is, from this point of view, the sum of the changes that take place under the cuticle of an insect between the ecdyses, which changes only become externally displayed when the cuticle is cast off. The hypodermis is the immediate agent in effecting the external changes.

The study of the physiology of ecdysis in its simpler forms has unfortunately been somewhat neglected, investigators having directed their attention chiefly to the cases that are most striking, such as the transformation of a maggot into a fly, or of a caterpillar into a butterfly. The changes have been found to be made up of two sets of processes: histolysis, by which the whole or part of a structure disappears; and histogenesis, or the formation of the new structure. By histolysis certain parts of the hypodermis are destroyed, while other portions of it develop into the new structures. The hypodermis is composed of parts of two different kinds, viz., (1) the larger part of the hypodermis that exists in the maggot or caterpillar and is dissolved at the metamorphosis; (2) parts that remain comparatively quiescent previously, and that grow and develop when the other parts degenerate. These centres of renovation are called imaginal discs or folds. The adult caterpillar may be described as a creature the hypodermis of which is studded with buds that expand and form the butterfly, while the parts around them degenerate. In some insects (*e.g.*, the maggots of the blowfly) the imaginal discs are to all appearance completely separated from the hypodermis, with which they are, however, really organically connected by strings or pedicels. This connexion was not at first recognized and the true nature of imaginal discs was not at first perceived, even by Weismann, to whom their discovery in Diptera is due. In other insects the imaginal discs are less completely disconnected from the superficies of the larval hypodermis, and may indeed be merely patches thereof. The number of imaginal discs in an individual is large, upwards of sixty having been discovered to take part in the formation of the outer body of a fly. With regard to the internal organs, we need only say that transformation occurs in an essentially similar manner, by means of a development from centres distributed in the various organs. The imaginal discs for the outer wall of the body, some of them, at any rate, include mesodermal rudiments (from which the muscles are developed) as well as hypodermis. The imaginal discs make their appearance (that is, have been first detected) at very different epochs in the life; their absolute origin has been but little investigated. Pratt has traced them in the sheep-tick to an early stage of the embryonic life.

Histolysis and Histogenesis.—The process of destruction of the larval tissues was first studied in the forms where metamorphosis is greatest and most abrupt, viz., in the Muscid Diptera. It was found that the tissues were attacked by phagocytic cells that became enlarged and carried away fragments of the tissue; the cells were subsequently identified as leucocytes, or blood-cells. Hence the opinion arose that histolysis is a process of phagocytosis. It has, however, since been found that in other kinds of insects the tissues degenerate and break down without the intervention of phagocytes. It has, moreover, been noticed that even in cases where phagocytosis exists a greater or less extent of degeneration of the tissue may be observed before phagocytosis occurs. This process can therefore only be looked on as a secondary one that hastens and perfects the destruction necessary to permit of the accompanying histogenesis. This view is confirmed by the fate of the phagocytic cells. These do not take a direct part in the formation of the new tissue, but it is believed merely yield their surplus acquisitions, becoming ordinary blood-cells or disappearing altogether. As to the nature of histogenesis, nothing more can be said than that it appears to be a phenomenon similar to embryonic growth, though limited to certain spots. Hence we are inclined to look on the imaginal discs as cellular areas that possess in a latent condition the powers of growth and development that exist in the embryo, powers that only become evident in certain special conditions of the organism. What the more essential of these conditions may be is a question on which very little light has been thrown, though it has been widely discussed.

Much consideration has been given to the nature of metamorphosis in insects, to its value to the creatures, and to the mode of its origin. Insect metamorphosis may be briefly described as phenomena of development characterized by abrupt changes of appearance and of structure, occurring during the period subsequent to embryonic development and antecedent to the reproductive state. It is, in short, a peculiar mode of growth and adolescence. The differences in appearance between the caterpillar and the butterfly, striking as they are to the eye, do not sufficiently represent the phenomena of metamorphosis to the intelligence. The changes that take place involve a revolution in the being, and may be summarized under three headings:—(1) The food-relations of the individual are profoundly changed, an entirely different set of mouth-organs appears, and the kind and quantity of the food taken is often radically different. (2) A wingless, sedentary creature is turned into a winged one with superlative powers of aërial movement. (3) An individual in which the reproductive organs and powers are functionally absent becomes one in which these structures and powers are the only reason for existence, for the great majority of insects die after a brief period of reproduction. These changes are in the higher insects so extreme that it is difficult to

imagine how they could be increased. In the case of the common drone-fly, the individual, from a sedentary maggot living in filth, without any relations of sex, and with only unimportant organs for the ingestion of its foul nutriment, changes to a creature of extreme alertness, with magnificent powers of flight, living on the products of the flowers it frequents, and endowed with highly complex sexual structures.

In connexion with the question whether metamorphosis has been gradually acquired we have to consider two aspects, viz., the bionomic nature of metamorphosis, and to what extent it existed in primitive insects. Bionomically, metamorphosis may be defined as the sum of adaptations that have gradually fitted the larva (caterpillar or maggot) for one kind of life, the fly for another. So that we may conclude that the factors of evolution would favour its development. With regard to its occurrence in primitive insects, our knowledge of the geological record is most imperfect, but so far as it goes it supports the conclusion that holometabolism (*i.e.*, extreme metamorphosis) is a comparatively recent phenomenon of insect life. None of the groups of existing Holometabola have been traced with certainty farther back than the Mesozoic epoch, and all the numerous Palæozoic insect-fossils seem to belong to forms that possessed only imperfect metamorphosis. The only doubt arises from the existence of insect remains, referred to the order Coleoptera, in the Silesian Culm of Steinkunzendorf. The oldest larva known, *Mormolucoides articulatus*, is from the New Red Sandstone of Connecticut; it belongs to the Sialidæ, one of the lowest forms of Holometabola. It is now, in fact, generally admitted that metamorphosis has been acquired comparatively recently, and Scudder in his review of the earliest fossil insects states that "their metamorphoses were simple and incomplete, the young leaving the egg with the form of the parent, but without wings, the assumption of which required no quiescent stage before maturity."

The Pupa.—A brief digression must be devoted to this peculiar instar. If we admit that the larva has, in the phylogeny of insects, gradually diverged from the imago, and if we recollect that in the ontogeny the larva has always to become the imago (and of course still does so) notwithstanding the increased difficulty of the transformation, we cannot but recognize that a period of helplessness in which the transformation may take place is to be expected. It is generally considered that this is sufficient as an explanation of the existence of the pupa. This, however, is not the case, because the greater part of the transformation precedes the disclosure of the pupa, which, as Miall remarks, is structurally little other "than the fly enclosed in a temporary skin." Moreover, in many insects with imperfect metamorphosis the change from larva or (as the later stage of the larva is called in these cases) nymph to imago is about as great as the corresponding change in the Holometabola, as the student will recognize if he recalls the histories of Ephemeridæ, Odonata, and male Coccidæ. But in none of these latter cases have the wings to be changed from a position inside the body to become external and actively functional organs. The difference between the nymph or false pupa and the true pupa is that in the latter a whole stadium is devoted to the perfecting of the wings and body-wall after the wings have become external organs; the stadium is one in which no food is or can be taken, however prolonged may be its existence. Amongst insects with imperfect metamorphosis the nearest approximations to the true pupa of the Holometabola are to be found in the subimago of Ephemeridæ and in the quiescent or resting stages of Thysanoptera, Aleurodidæ, and Coccidæ. A much more thorough appreciation than we yet possess of the phenomena in these cases is necessary in order completely to demonstrate the special characteristics of the holometabolous transformation. But even at present we can correctly state that the true pupa is invariably connected with the transference of the wings from the interior to the exterior of the body. It cannot but suggest itself that this transference was induced by some peculiarity as to formation of cuticle, causing the growth of the wings to be directed inwards instead of outwards. We may remark that the flea possesses no wings, but is understood to possess a true pupa. This is a most remarkable case, but unfortunately very little information exists as to the details of metamorphosis in this group.

It has been incidentally remarked that the phenomena of holometabolism are connected with the development of wings inside the body (except in the case of the flea, where there are no wings in the perfect insect). The term Endopterygota has been proposed for those insects in which the early stages of development of the wing occur inside the body, and the term Exopterygota for those in which the wing development is entirely external. Of existing insects 90 per cent. belong to the Endopterygota. At the same time we have no evidence that any Endopterygota existed amongst Palæozoic insects, so that the phenomena of endopterygotism are comparatively recent, and we are led to infer that the Endopterygota owe their origin to the older Exopterygota. In Endopterygota the wings commence their development as invaginations of the hypodermis, while in Exopterygota the wings begin—and always remain—as external folds or evaginations. The two modes of growth are directly opposed, and at first sight it appears that this fact negatives the view that Endopterygota have been derived from Exopterygota.

Only three hypotheses as to the origin of Endopterygota can be suggested as possible, viz.:—(1) That some of the Palæozoic insects, though we infer them to have been exopterygotous, were really endopterygotous, and were the actual ancestors of the existing Endopterygota; (2) that Endopterygota are not descended from Exopterygota, but were derived directly from ancestors that were never winged; (3) that the predominant division—*i.e.*, Endopterygota—of insects of the present epoch are descended from the predominant—if not the sole—group that existed in the Palæozoic epoch, viz., the Exopterygota. The first hypothesis is not negatived by direct evidence, for we do not actually know the ontogeny of any of the Palæozoic insects; it is, however, rendered highly improbable by the modern views as to the nature and origin of wings in insects, and by the fact that the Endopterygota include none of the lower existing forms of insects. The second hypothesis—to the effect that Endopterygota are the descendants of apterous insects that had never possessed wings (*i.e.*, the Apterygogenea of Brauer and others, though we prefer the shorter term Apterygota)—is rendered improbable from the fact that existing Apterygota are related to Exopterygota, not to Endopterygota, and by the knowledge that has been gained as to the morphology and development of wings, which suggest that—if we may so phrase it—were an apterygotous insect gradually to develop wings, it would be on the exopterygotous system. From all points of view it appears therefore probable that Endopterygota are descended from Exopterygota, and we are brought to the question as to the way in which this has occurred.

It is almost impossible to believe that any species of insect that has for a long period developed the wings outside the body could change this mode of growth directly for an internal mode of development of the organs in question, for, as we have already explained, the two modes of growth are directly opposed. The explanation has to be sought in another direction. Now there are many forms of Exopterygota in which the creatures are almost or quite destitute of wings. This phenomenon occurs among species found at high elevations, among others found in arid or desert regions, and in some cases in the female sex only, the male being winged and the female wingless. This last state is very frequent in Blattidæ, which were amongst the most abundant of Palæozoic insects. The wingless forms in question are always allied to winged forms, and there is every reason to believe that they have been really derived from winged forms. There are also insects (fleas, &c.) in which

metamorphosis of a holometabolous character exists, though the insects never develop wings. These cases render it highly probable that insects may in some circumstances become wingless, though their ancestors were winged. Such insects have been styled anapterygotous. In these facts we have a clue to the change from exopterygotism to endopterygotism, namely, by an intermediate period of anapterygotism.

Although we cannot yet define the conditions under which exopterygotous wings are suppressed or unusually developed, yet we know that such fluctuations occur. There are, in fact, existing forms of Exopterygota that are usually wingless, and that nevertheless appear in certain seasons or localities with wings. We are therefore entitled to assume that the suppressed wings of Exopterygota tend to reappear; and speaking of the past, we may say that if after a period of suppression the wings began to reappear as hypodermal buds while a more rigid pressure was exerted by the cuticle, the growth of the buds would necessarily be inwards, and we should have incipient endopterygotism. The change that is required to transform Exopterygota into Endopterygota is merely that a cell of hypodermis should proliferate inwards instead of outwards, or that a minute hypodermal evaginated bud should be forced to the interior of the body by the pressure of a contracted cuticle.

If it should be objected that the wings so developed would be rudimentary, and that there would be nothing to encourage their development into perfect functional organs, we may remind the reader that we have already pointed out that imperfect wings of Exopterygota do, even at the present time under certain conditions, become perfect organs; and we may also add that there are, even among existing Endopterygota, species in which the wings are usually vestiges and yet sometimes become perfectly developed. In fact, almost every condition that is required for the change from exopterygotism to endopterygotism exists among the insects that surround us.

11. *Classification.*—The application of morphological (including developmental) studies to the classification of insects necessarily renders the perfection of a natural system a slow process. So far as it has been carried out, it has not resulted in a tendency to reduce the number of Orders, but rather to increase them. Twenty-two primarily different kinds of insects must at present be recognized, viz.: (1) Collembola, (2) Thysanura, (3) Mallophaga, (4) Anoplura (or Pediculidæ), (5) Aphaniptera (now frequently called Siphonaptera), (6) Orthoptera, (7) Perlidæ (or Plecoptera), (8) Psocidæ, (9) Termitidæ (or Platyptera), (10) Embiidæ, (11) Ephemeridæ, (12) Odonata, (13) Thysanoptera, (14) Hemiptera (or Rhynchota), (15) Neuroptera, (16) Panorpatæ (or Mecaptera), (17) Trichoptera, (18) Lepidoptera, (19) Coleoptera, (20) Strepsiptera, (21) Diptera, (22) Hymenoptera. These groups are of most unequal extent, some of them numbering a score or two of species, and some of them scores of thousands. Although various attempts have been made to combine these twenty-two groups into a smaller number of divisions, they have none of them received general assent. We may, however, mention that groups 1–5 are purely apterous insects; that the members of groups 6–14 have the wings placed outside the body on the back during development, and form the Exopterygota; while groups 15–22 form the Endopterygota, the wings during development being quite invisible externally. Great difficulty is experienced in classifying the purely apterous divisions. 1 and 2, Collembola and Thysanura, are usually separated from the others under the name Apterygogenea, or that of Apterygota or Aptera; and it is supposed by many that not only are they themselves wingless, but that their ancestors were always in the same state of winglessness. Groups 3–5 are, on the contrary, supposed to be descended from winged forms, and have been termed Anapterygota. The Anapterygota consist entirely of epizoic forms (*i.e.*, creatures dwelling on the bodies of other living animals), and are of two very distinct kinds. In Mallophaga and Anoplura the parasitic, or epizoic, life is complete and there is no metamorphosis, while in the fleas (Aphaniptera) metamorphosis is strongly developed and the epizoic life is but partial.

12. *Ethology.*—Recent observation of the habits and instincts of insects has resulted in accentuating the great difference that exists between the intelligence of the insect and that of the vertebrate. The subject is much obscured by the difficulty that exists in agreeing as to the terms that are used in discussing it. In making use of the words reason and intelligence in connexion with insects we are met by the difficulty that we know but little of the nervous actions, and nothing of the consciousness that may or may not accompany them in insects, while in ourselves we form our conclusions as to reason and intelligence largely by the nature of the consciousness that accompanies the nervous processes. Some naturalists deny any intelligence to insects, and contend that their actions are merely reflex. It is, however, impossible to compare the insect mind with any one set of the categories in which we class our own actions. In short, the proceedings of insects must be judged by the results the species attains, and not by a comparison with the methods we ourselves should use for attaining similar results. If we view the subject in this light, we find a thorough harmony to exist between the main peculiarities of the insect's life and what we must perforce style its mental characteristics. There are, however, great distinctions in the lives of the different kinds of insects, so that it is impossible for us here to pursue this subject in detail.

The most surprising of all the discoveries in entomology are those that have been made as to *social insects.* The number of kinds of these is comparatively small. They are all included amongst the termites, wasps, bees, and ants. All these social insects exhibit a more or less considerable departure from the biological characters of the non-social insects. The generations are not isolated, but overlap; the life of the individual is unusually long, and, what is more to the point, it is the adult or perfected stage of the life that is prolonged. The young are fed from the mouths of the nurses, and the food is modified by the processes of the feeder's body. Most remarkable is the fact, that though the communities of social insects often include a countless number of individuals, the work of reproduction is limited to an extremely small number of them, and in the highest developments of insect socialism to a single mother. This individual is thus, in some cases, the immediate progenitor of scores of thousands of individuals, all living with her and assisting in her work, inasmuch as they feed and care for her young. This social system is therefore a highly perfected form of family life.

Perhaps the most remarkable fact as regards the higher societies of insects is that though the individuals composing a community are the offspring of one mother, and (in the case of the social Hymenoptera) of a single copula, yet they do not resemble their parents, and, moreover, exhibit a good deal of difference among themselves, consisting of soldiers of different grades, as well as of workers and nurses, each kind being formed so as to adapt it to its special duties. The way in which these castes are produced has been much debated. There is much variety in social insects; in the Hymenoptera all the castes are composed of the altered females (sometimes called

neuters). One set of *savants* contends that the whole of these castes are directly due to food. It is not supposed that there is a particular kind of food for producing each caste, but rather that the nutritive powers of the foods supplied are different, and affect the growth of the larvæ, and possibly the growth of the eggs in the ovaries; variations in the moment of the development at which a change of food is made, and the fact that the food may affect the development of some organs more than others may be important, and, combined with the correlation of organs, may be adequate to produce the results. This has been supported by Grassi and Herbert Spencer. A very different view has been maintained by Weismann. He considers that the various castes may be accounted for by supposing each egg to contain a variety of rudiments (to an uncertain extent) for each organ, and that the food merely excites the development of one set of rudiments rather than another. Individuals intermediate between the various castes, and others of anomalous developments, are occasionally found; and as it is not possible to believe in special rudiments as their cause, it is clear that we must admit some amount of plasticity in the development of the rudiments. Hence the existence of a variety of rudiments need not be invoked, and can only be admitted when the rudiments are actually demonstrated.

AUTHORITIES.—The works and papers published on insects at present number annually more than 1000. It is impossible to give here a list of even the more important of those published since 1880. In the following list we mention one or two of the more recent in several departments; these will be found in most cases to include references to earlier works. **General Works**:—A. S. PACKARD. *Text-Book of Entomology*. London, 1898.—D. SHARP. "Insects," the *Cambridge Natural History*, vol. v., 1895; vol. vi., 1899. London. —C. JANET. A series of papers in various French periodicals under the title of "Études sur les Fourmis, les Guêpes et les Abeilles," 1893-1900.—S. H. SCUDDER. "Review of Fossil Insects," *Bull. U.S. Geol. Survey*, No. 71, 1886.—**Luminosity**:—R. DUBOIS. "Leçons de Physiologie Générale et Comparée." Paris, 1898.—**Galls**:—J. W. H. TRAILL. *Ann. Scott. Nat. Hist.*, p. 171, 1897.—RUBSAAMEN. "Australian Brachyscelid-galls," *Berlin. Ent. Zeitschr.*, xxxix., 1894. — **Morphology and Embryology**:—Dr R. HEYMONS. "Beiträge zur Morphologie und Entwicklungsgeschichte der Rhynchoten," *Acta Ac. German.*, lxxiv., No. 3, 1899.—J. PANTEL. "Essai monographique sur les caractères extérieurs, la biologie et l'anatomie d'une larve parasite du groupe des Tachinaires," *La Cellule*, xv., 1898.—L. C. MIALL and A. DENNY. *The Structure and Life-History of the Cockroach.* London, 1886. — **Parthenogenesis**:—L. F. HENNEGUY. "Les modes de reproduction des Insectes," *Bull. Soc. Philom.* (9), i. p. 41, 1899.—**Metamorphosis**:—DE BRUYNE. "Sur l'intervention de la phagocytose dans le développement des Invertébrés," *Mem. Cour. Ac. Belgique*, 4to, lvi., 1899.—J. GONIN. "Recherches sur la métamorphose des Lépidoptères," *Bull. Soc. Vaudoise*, xxx., p. 89, 1894.—A. L. MIALL. *The Structure and Life-History of the Harlequin Fly.* London, 1900.—**Ethology**:—J. H. FABRE. *Souvenirs Entomologiques*, 7 vols. Paris, 1882–1900.—**Mimicry**: —E. HAASE. "Untersuchungen über die Mimicry," *Bibl. Zool.*, iii., 1891. (D. S*.)

Insomnia.—Inability to sleep is a common and troublesome feature of most illnesses, both acute and chronic. It may be due to pain, fever, or cerebral excitement, as in *delirium tremens*, in which the patient sometimes does not obtain a moment's sleep for several days and nights together, or it may be due to organic changes in the brain. The treatment, when failure to sleep occurs in connexion with a definite illness, is part of the treatment of that illness. But there is a form of sleeplessness not occurring during illness to which the term "insomnia" is commonly and conveniently applied. It must not be confounded with mere occasional wakefulness caused by some disturbance or irritation or minor discomfort, such as indigestion, nor with the "bad nights" of the valetudinarian, who complains of not having "closed an eye" all night, after several hours of sound sleep during the day. Real insomnia consists in the prolonged inability to obtain sleep sufficient in quantity and quality for the maintenance of health. It is a condition of modern urban life, and may be regarded as a malady in itself. It is a very troublesome and serious condition, and probably the most potent factor in causing those nervous breakdowns which are ascribed to "overwork." It may occur as a sequel to some exhausting illness, notably influenza, which affects the nervous system long after convalescence. But it very often occurs without any such cause. The patients are usually men of mature age, though youth may suffer from insomnia also, brought on by work for examinations, for instance, or some other over-stimulation of the brain. But in youth the cause is easily removed as a rule, and the tissues quickly regain their normal tone. Continued deprivation of sleep, however, produces the most serious effects even in the young. Later in life the cause is less easily removed and the recuperative powers are less vigorous. Professional and business men are the most frequent sufferers, because the strain of mental work and anxiety falls more heavily upon them than upon any other class. Insomnia is comparatively rare among the poor, who do little or no brain work, and, living always from hand to mouth, with nothing to lose, never feel the same anxiety. It may be brought on by some exceptional strain, by long-continued worry, or by sheer overwork. The broad pathology is simple enough. It has been demonstrated by exact observations that in sleep the blood leaves the brain automatically. The function is rhythmical, like all the vital functions, and the mechanism by which it is carried out is no doubt the vaso-motor system, which controls the contraction and dilation of the blood-vessels. In sleep the vessels in the brain automatically contract. When the brain is working actively, on the contrary, a plentiful supply of blood is required, and the vessels are dilated. If the activity is carried to great excess the vessels become engorged, the mechanism does not act, and sleep is banished. Hence the common phenomenon of children being unable to sleep "for excitement." In insomnia this condition has become fixed. It seldom produces absolute sleeplessness. What happens is that a man goes to bed and cannot get to sleep for hours. He is turning things over in his head. Eventually he falls asleep towards morning, and after a brief period of unconsciousness he is awakened to the day's work again. Or it may be that he falls asleep on going to bed and wakes up not long afterwards, to lie broad awake for the rest of the night. In either case he has not had sufficient cerebral rest, and returns heavy and dull to his work, which once more goads the tired brain into excitement and renews the evil. *Crescit indulgens sibi dirus hydrops.* The longer it goes on the more fixed becomes the condition of cerebral engorgement, until the brain gives way and a touch of paralysis, loss of memory, mental aberration, or complete collapse follows.

When such a breakdown has happened or is pending the only treatment is complete rest, combined, if possible, with change of air and scene; but if the mischief has gone far it will take very long to repair, and may never be repaired at all. In no matter of health is the importance of "taking it early" more pronounced. Delay is the worst economy. A few days' holiday at the commencement of trouble may save months or years of enforced idleness. Sea-air sometimes acts like a charm. But if it is impossible, as it sometimes is, to give up work and leave worry behind, even for a short time, sleep should be carefully wooed by every possible means. In the first place, plenty of time should be devoted to it, and no chance should be missed. That is to say, the night

should not be curtailed at either end, and if sleepiness approaches in the daytime, as it often does, it should be encouraged. It is better to lie still at night and try to sleep than to give way to restlessness, and a few minutes snatched in the daytime, when somnolence offers the opportunity, has a restorative effect out of all proportion to the time occupied. Then all accidental causes of disturbance should be avoided. Lights and sounds should be excluded, comfort studied, and digestion attended to. Very often the trouble might be cut short if the patient and the other people in the house realized the seriousness of the condition and took pains to ameliorate it in little things. If a hypochondriacal tendency is present conversation should be sympathetic, but cheerful and encouraging. Fresh air is a great help. As much time should be spent out of doors as possible, and exercise, even to the point of fatigue, may be found helpful. But this requires watching: in some cases bodily exhaustion aggravates the malady, and in particular bicycle exercise, which has a peculiarly exhausting effect on some people, should be used with care. In abstemious persons a little alcohol often acts as a complete restorative. The following case is instructive. Mr X., a professional man, carrying a great responsibility upon his shoulders, was subjected to a specially severe strain of anxiety, work, and worry. Though a strong man, he was always "a bad sleeper," and under the strain insomnia came on; his health completely gave way, a slight attack of paralysis supervened, and he had to spend months in the south of Europe. Two years later the same strain recurred, but more severe and more prolonged; yet he slept quite well, and went through it with ease. The sole difference was that he had been induced to take a glass of wine every day. Its effect was immediate; he slept better and felt better than he had done for years. A little hot food with some stimulant immediately before going to bed is useful in inducing sleep, and persons who are apt to wake in the night and lie awake for hours may obtain relief by the same means. A little light reading, or the recalling of pleasant experiences, is sometimes a useful way of disengaging the mind from oppressive thought on going to bed. Hypnotic drugs, which have greatly multiplied of late years, should only be taken under medical advice. They have their use, but the principle of obtaining sleep by such means is not a sound one. The real end to aim at is the restoration of the natural function, and the substitution of artificial sleep, which differs in character and effect, tends rather to prevent than to promote that end.

Like many other morbid conditions, insomnia is more easily prevented than cured. It is really the penalty exacted by Nature for a long course of systematic defiance. When a man's sleeping apparatus is in good working order it may be thrown out of gear for a short time by some great strain, but it will recover in the course of a few days at most, and will not inflict upon him the horrors of insomnia. But when it has been ruined by prolonged interference it stops work altogether under the strain. Habits of life interfere with it by curtailing the time required for the due fulfilment of the rhythmical cycle of this vital function. It may be said with confidence that in modern town life men habitually sleep too little, and this is even more injurious to them than the other habit of eating too much. They "burn the candle at both ends." They get up in the morning and go to their work, but in the evening instead of going to bed they go out to dinners and parties and theatres and other distractions. Time which should be given to sleep is devoted to something else. A little of it does no great harm, but regular and prolonged interference with the mechanism gradually destroys it. The adaptability of the human organism is great, and no effects may be observed for years; but Nature is not mocked, and when a special strain comes she manifests her resentment in insomnia. If no such occasion arises, the penalty is still exacted in the form of premature death. Thus the time robbed is paid back again. The premature death of hard-working professional and business men, which is so common a feature of modern life, is probably due more to insufficiency of sleep than to any other cause, though they may never develop actual insomnia. The lesson is the same, namely, the importance of taking sufficient sleep as a regular habit. What constitutes sufficient sleep depends upon the individual. Persons differ so much that it is no more possible to lay down a fixed amount for every one than it is to prescribe a fixed quantity of food. Besides, the requirements of the same persons vary under different conditions; one needs more sleep in cold weather than in hot, in winter than in summer, when tired than when not. The only rule to go by is to have one's sleep out, so as to feel thoroughly refreshed on awaking, as children do. Less than that is insufficient.

Insterburg, a town of Prussia, province of East Prussia, 57 miles by rail east of Königsberg. It has manufactures of machinery and bricks, iron foundries, flax-spinning mills, bone mills, sawmills, distilleries and breweries, and an active trade in agricultural produce. It is an important railway junction. Population (1885), 20,914; (1900), 27,787.

Instinct.—There is little to add in general to the treatment of this subject by Romanes in the earlier volumes of this Encyclopædia (ninth edition), but a good deal of interesting work has been done in the way of detailed inquiry into the problems raised by the application of the doctrine of heredity (*q.v.*) to its explanation, mainly by Lloyd Morgan and Lord Avebury in biology, and by Wundt, W. James, and Stout in psychology. While it is generally conceded that instinct in animals covers "congenital characters," and intelligence "acquired characters," it is frequently difficult to decide how far intelligence modifies instinct or instinct stimulates intelligence. The actual part, too, played by natural selection is disputed, the genesis of instinct being attributed by Wallace to natural selection alone, by Spencer to inherited habit, by Romanes to both. Lloyd Morgan, the chief authority at the present time, regards the direct transmission of acquired modes of behaviour as non-proven. Heredity, the latter points out (*Proc. Roy. Inst.*, 1899), plays a double part:—

> It provides, through natural selection or otherwise, an outline sketch of relatively definite behaviour, racial in value; it provides also that necessarily indefinite plasticity which enables an animal to acquire and to utilize experience, and thus to reach adaptation to the circumstances of its individual life. It becomes, therefore, a matter of practical inquiry to determine the proportion which the one kind of hereditary legacy bears to the other. Observation seems to show that those organisms in which the environing conditions bear the most uniform relations to a mode of life that is relatively constant are the ones in which instinct preponderates over intelligent accommodation; while those in which we see the most varied interaction with complex circumstances show more adaptation of the intelligent type. The growth of individual plasticity of behaviour in race development would seem to be accompanied by a disintegration of the definiteness of instinctive response, natural selection favouring rather the plastic animal capable of indefinitely varied accommodation than the more rigid type, whose adaptations are congenitally defined.

See Lloyd Morgan. *Habit and Instinct.* London, 1896.—Romanes. *Natural History of Instinct.* London, 1886.—Sir J. Lubbock [Lord Avebury]. *On the Instincts of Animals.* 1889.—Marshall. *Instinct and Reason.* New York, 1898.—Mills. *Nature of Animal Intelligence.* London, 1898.

INSURANCE.

I. General History.

During the years since the article "Insurance" in the ninth edition of this work was written, the practice of insurance has extended with unprecedented rapidity, partly in novel forms. While its several branches, such as life insurance, casualty insurance, and others, have each had an independent and characteristic development, it should be observed that all these together form an institution peculiar to the modern world, the origin and growth of which attest a remarkable change in men's ideas and habits of thought—a change the character and extent of which, if fully traced, would fill an impressive chapter in the history of civilization. Some sketch of it will fittingly introduce a brief account of the recent growth and present condition of each branch of the business, especially in Great Britain and America.

The simplest and most general conception of insurance is a provision made by a group of persons, each singly in danger of some loss, the incidence of which cannot be foreseen, that when such loss shall occur to any of them it shall be distributed over the whole group. Its essential elements therefore are foresight and co-operation; the former the special distinction of civilized man, the latter the means of social progress. But foresight is possible only in the degree in which the consequences of conduct are assured, *i.e.*, it depends on an ascertained regularity in the forces of nature and the order of society. To the savage, life is a lottery. In hunting, rapine, and war, all his interests are put at hazard. The hopes and fears of the gambler dominate his impulses. As nature is studied and subdued, and as society is developed, the element of chance is slowly eliminated from life. The measure of civilization is the degree in which men rely on the future, in which foresight guides conduct, and life, ceasing to be a series of hazards, becomes a series of actions planned with the reasonable expectation of definite results. The gambling spirit survives, indeed, often assuming new and refined forms in the most advanced communities, but it is always the foe of civilization. In a progressive society, education, science, invention, the arts of production, with regular government and civil order, steadily work together to narrow the realm of chance and extend that of foresight. But after they have done their best to conquer the forces of nature and regulate human passions, so that achievement shall follow purpose with uniformity, there remain certain events which may disturb all anticipations, and in spite of any man's best wisdom and effort may deprive him of the fruits of his labour. These are mainly of two classes: (1) damage to property by the great forces of nature, such as lightning and hail, by the perils of the sea, and by fire; (2) premature death. A useful life has an economical value. But no skill can make certain its continuance to its normal close, and in each individual case its duration is indeterminate. In the reasonable expectation that it will last until a competence is gained or the family ceases to be dependent, young men marry; but some will die too soon, and in the aggregate multitudes are left destitute. Both classes of loss are alike, in that they fall on individuals in the mass who are not known beforehand nor selected by any traceable law. But the sufferers are ruined, while the same pecuniary loss, if distributed over the whole number, would be little felt. Wherever the sense of community has existed this has been discerned, and some effort made to act upon it. Thus in feudal Europe it was customary for the houses of vassals to be restored after fire at the cost of the estate. In England in the 17th century the Government practised a method of relief after accidental fires. When such a loss was proved to the king in council, the chancellor sent a king's brief to churches, sheriffs, and justices, asking contributions, and trustees for the sufferers administered the funds collected. But under the last two Stuarts gross frauds resulted, and the system fell into disrepute and disuse. At best, the voluntary relief provided by charity after losses are incurred is but sporadic and irregular. Insurance begins when the liability to loss is recognized as common, and provision is made beforehand to meet it from a common fund. The efficient organization of communities or groups for this purpose is an essentially modern achievement of social science, and has become one of the chief commercial and moral factors of civilization. But the history of the conception in its formative stages is extremely obscure.

Its first appearance in business life is often sought in the marine loans of the ancient Greeks, fully described by Demosthenes. Money was advanced on a ship or cargo, to be repaid with large interest if the voyage prosper, but not repaid at all if the ship be lost, the rate of interest being made high enough to pay not only for the use of the capital, but for the risk of losing it. Loans of this character have ever since been common in maritime lands, under the name of bottomry and respondentia bonds. (See below, *Marine Insurance*.) But the direct insurance of sea-risks for a premium paid independently of loans began, as far as is known, in Belgium about A.D. 1300. During the next century the risks of insurance for the usual voyages between London and Continental ports were carefully considered, and customary rates became established. Ordinances and legislation for the regulation of marine insurance grew up, and show that the practice was recognized as a legitimate business. In his address in opening Elizabeth's first Parliament in 1559, Sir Nicholas Bacon said, "Doth not the wise merchant in every adventure of danger give part to have the rest assured?" In 1601 Parliament created a commission to decide disputes under contracts for marine insurance, and the preamble of the Act (43 Eliz. ch. 12) expresses the best thought of the British mind in that day upon the subject. Thus the business of marine insurance was intelligently and wisely practised three centuries ago. The ratio of losses to voyages, the varying hazards of particular seas and seasons, and the seaworthiness of different classes of vessels, must have been roughly studied to yield a recognized basis for rates. But the underwriters were private persons, acting independently, so that the insured lacked the benefit of large aggregations of capital to make his contract safe; while the insurer, who took one or a few risks, was without the security of large averages, and might be crushed by an exceptional loss. A partial remedy was gradually reached in London. Men who had capital to employ in this hazardous business used to meet at fixed hours when shipowners and merchants could negotiate with them. The higgling of the open market, in view of all the circumstances of each risk—as the character and condition of the ship, its crew and cargo, the length and route of the voyage, the season, the current rate of interest and profits—determined the rate of premium; and when this obtained general assent, the written agreement was signed by each underwriter for that part of the risk which he assumed. Towards the end of the 17th century these meetings were held in Lloyd's Coffee-house,

and their simple practice gradually grew into the complete and complicated system of marine insurance now general. The underwriters together evolved rules and improved methods, but continued for generations to insure severally, without corporate powers or common responsibility, so that the name Lloyd's became throughout the commercial world the symbol of marine insurance. More recently the name has been adopted in the United States by associations of private or individual underwriters as distinguished from insurance corporations.

Although the underwriters at Lloyd's often considered and assumed other than marine risks, and made contracts some of which were merely wagers on public or private events, there is no record of insurances by them against fire on land. But fire insurance, it is vaguely known, had previously been practised, in a crude form, in several European cities. In 1635, and again in 1638, citizens of London petitioned Charles I. for a patent of monopoly to insure houses at the rate of one shilling yearly for each £20 of rent, the association to repair or rebuild those burned, to maintain a perpetual fire-watch in the streets, and to pay £200 yearly towards rebuilding St Paul's Cathedral until finished. The attorney-general approved the project, but in the disorders of the kingdom it was forgotten. The Great Fire of 1666 revived interest in the subject, and the discussion of it soon led to definite views and practical measures. In May 1680 a private Fire Office was opened "at the back side of the Royal Exchange" to insure houses in London, by assuming the risk of loss to a fixed amount for a fixed premium, namely, 2½ per cent. of the yearly rent for brick houses and 5 per cent. for frame houses, the rent being always assumed to be one-tenth of the value of the fee. The estimates of the promoters are interesting. In the fourteen years since the Great Fire 750 houses had been burned in London, with an average loss of £200. A fund of £40,000 subscribed as guaranty was to be increased by £20,000 for every 10,000 houses insured, and the interest of the fund alone, therefore, might be expected to meet all losses and leave a surplus. Thus the security was perfect and the promise of profit great. Meagre as was the basis of facts for the calculations, and crude as was the statistical method employed, the insurance offered met a general want, and the business grew rapidly. Within a year a strong demand was heard that the City of London should itself insure the houses of its citizens, and the Common Council voted to do so at lower rates than the Fire Office. But the courts put a speedy end to this movement, holding that the charter conferred on the City no power to transact such business. Thus the socialistic theory that insurance is properly a branch of government is almost as old as the business itself, though it has never found favour or been practically tested on a large scale in Great Britain or America.

The next notable step in the evolution of modern methods was the organization of mutual insurance associations. In 1684 the Friendly Society was organized. Each member paid a small entrance fee for expenses, made a cash deposit as a reserve for emergencies, to be returned at the end of his term, and agreed to meet equitable assessments for current losses. Payments were computed on the assumption that one house in 200 is burned every fifteen years. The rivalry between the proprietary and the mutual systems began at once, and has continued till now. In 1686 "the Fire Office at the back side of the Royal Exchange" petitioned for a patent of the fire insurance policy, and a monopoly of its issue for thirty-one years. The Friendly Society opposed the grant. The most eminent lawyers for both were heard by the king in council, and on 30th January 1687 King James II. decided the case. No charter was granted, but the Fire Office might continue its business, having a monopoly for one year. Thereafter the Friendly Society might for three months sell policies, but must then suspend for three months, and so on for alternate quarters. But the Fire Office must pay the ordinance service for its work in extinguishing fires, the amount to be fixed for each fire by the king. This was the first appearance of the plan, so widely prevalent in after years, of imposing on insurance companies the support of fire departments; that is, of taxing the prudent who insure to protect the reckless who do not.

After 1688 the atmosphere of England was freer, and underwriting was soon practised without special license. In 1704 the societies began to insure household goods and stocks in trade, and the insurance of personal property rapidly became as important as that of buildings. In 1706 the Sun Fire Office was founded, and began to issue policies on both real and personal property in all parts of England. Other associations arose in quick succession, of which the Union Fire Office, dating from 1714, and the Westminster from 1717, still survive. Before 1720 both fire and marine insurance had become general in all great centres of trade. But life insurance was as yet hardly conceived. Sporadic evidences that it was needed, and that men were feeling after it, occur in very early records. It was a mediæval custom to advance to a mariner goods or money, to be restored with large additions, but only in case of safe return; or to contract, for a sum in hand, to ransom him if captured by pirates, or to pay a fixed amount to his family if he were lost. To evade the usury laws life annuities were often sold at a low rate, redeemable for a stipulated sum. Life estates were sold upon some guess at their probable duration; and leases, especially of Church lands, were made for one, two, or three lives on rude and conventional estimates of the time they would run. Thus there was a commercial and social pressure for some intelligent method of valuing life contingencies. But the direct insurance of life, as a means of reducing the element of chance in human affairs, was hardly thought of. Indeed, such contracts were commonly regarded as mere forms of gambling, and were prohibited in France as against good morals.

The earliest known policy of life insurance was made in the Royal Exchange, London, 18th June 1583, for £383, 6s. 8d. for twelve months, on the life of William Gibbons. Sixteen underwriters signed it, each severally for his own share, and the premium was 8 per cent. The age of the insured is not referred to, nor was it then considered, except when far advanced, in fixing the premium. Gibbons died 29th May 1584. The underwriters refused to pay, alleging that twelve months, in law, are twelve times twenty-eight days, and that Gibbons had survived the term. The court, of course, enforced payment. A few instances of similar contracts are found, mostly in judicial records, during the 17th century; but every such transaction was justly regarded as a mere wager, at least on the part of the insurer. It could not be otherwise until the principles of probability and the uniformity of large averages were understood and trusted; that is, until a new science should be created, and its authority established in the business community. A few great thinkers were pondering the subject, groping for principles which were profoundly to modify the practical reasoning of after-generations. But their work first obtained wide recognition upon the publication of the *Ars Conjectandi*, the posthumous treatise of James Bernouilli, in 1713. Meanwhile the social need for insurance continued to express itself in empirical efforts, which at least helped to make clearer the problems to be solved. Thus in 1699 "The Society of Assurance for Widows and Orphans" was

founded in London, a crude form of what is now called an assessment company. Each of 2000 healthy men under fifty-five years of age was to pay 5s. as entrance fee, 1s. quarterly for expenses, and 5s. at the death of another member; and at his own death his estate should receive £500, less 3 per cent. On default in any payment his interest was forfeited. The society lasted about eleven years, and the accounts of its eighth year are preserved, showing the payment of £5200 upon twenty-four claims. The economic significance of this society lies in its distinct recognition of the principle of association for the distribution of losses. Together with the Friendly Society, it shows that this principle had now been so widely grasped by business men that, when embodied in a practical venture, it found substantial support.

The conception of a corporation as an artificial person to hold property and support obligations uninterrupted by the death of individuals, was found in Roman law and custom. Its first use in modern business enterprise was perhaps the Bank of St George in Genoa, about A.D. 1200, a joint-stock company with transferable shares, whose owners were liable only to the amount of their shares. In England the Crown, itself the chief and type of corporations sole, was the source of chartered rights, and from about 1600 the principle steadily gained recognition, the advantages of incorporation being attested by the successes of the great trading companies. Experience showed that the corporate form was the obvious remedy for the chief difficulties in the practice of insurance. Single risks were but speculative wagers; a great number must be taken together to obtain a trustworthy average. A larger capital than an average private fortune was demanded as a guaranty, and this capital must not be exposed to the dangers of trade, but set aside for the special purpose. Individual underwriters may die or fail; only a permanent institution can be trusted in long contracts. Several projects were devised on this basis. Early in the 18th century, indeed, the English Government refused a charter for marine insurance, declaring that corporate insurance was an untried and needless experiment, while private underwriting was satisfactory and sufficient. But in 1720, when two sets of promoters offered £300,000 each for a charter, exclusive of other associations, though not of individuals, to insure marine risks, Parliament chartered the Royal Exchange and the London Assurance Company with a monopoly to this extent. The business disappointed its projectors at first, and the Government accepted half the price rather than revoke the grant. In 1721 the companies extended their operations to fire insurance throughout England.

Thus the principle of insurance had now become a distinct part of the common stock of thought in enlightened nations, and gradually, by association with successive new ideas, plans, and methods, was developed into a business or trade, which before the middle of the 18th century already formed an essential element of the social scheme. Most of the modern forms of insurance against the elements were known, and at least crudely practised. Risks were defined, appraised, and roughly classified; premiums were determined with some regard to experience, and attempts were made to collect, classify, and study the facts. Corporate and private enterprise competed for patronage, mutual and proprietary methods were discussed and tried; disputed contracts were interpreted and enforced by the courts, laying the foundations of insurance law. But there was no scientific basis for the business. Premiums were fixed, not by computation from known facts or reasonable assumptions, but by guess and the higgling of the market. Only the competition of capital checked the extortionate demands of underwriters. The first important steps towards a scientific valuation of hazards were taken in dealing with the class of risks hitherto so much neglected, those which depend upon human mortality. Marine and fire insurance had their origin in the pressure of need. The practice began before a theory existed. Men who must have protection were ready to pay so largely for it that capital was tempted to feel its way by the roughest estimates. But life insurance had its origin in the scientific study of the facts of human mortality, which suggested the possibility of provision against premature death. Both marine and fire insurance became general before there was any intelligent study of the risks by statistical or mathematical methods, nor can it be said that much progress has since been made towards establishing a scientific basis for the valuation of risks in these classes. But life insurance may be said to have been impossible until the theory of probabilities had become a recognized part of the common stock of ideas.

The value of insurance as an institution cannot be measured by figures. No direct balance-sheet of profit and loss can exhibit its utility. The insurance contract produces no wealth. It represents only expenditure. If a thousand men insure themselves against any contingency, then, whether or not the dreaded event occurs to any, they will in the aggregate be poorer, as the direct result, by the exact cost of the machinery for effecting it. The distribution of property is changed, its sum is not increased. But the results in the social economy, the substitution of reasonable foresight and confidence for apprehension and the sense of hazard, the large elimination of chance from business and conduct, have a supreme value. The direct contribution of insurance to civilization is made, not in visible wealth, but in the intangible and immeasurable forces of character on which civilization itself is founded. It is pre-eminently a modern institution. Two centuries ago it had begun to influence centres of trade, but the mass of civilized men had no conception of its meaning. Its general application and popular acceptance began within the last three generations, and its commercial and social importance have multiplied a hundredfold within living memory. Its development measures and promotes the growth of the spirit of community. It has done more than all gifts of impulsive charity to foster a sense of human brotherhood and of common interests. It has done more than all repressive legislation to destroy the gambling spirit. It is impossible to conceive of our civilization in its full vigour and progressive power without this principle which, in all its varied applications together, unites the fundamental law of practical economy, that he best serves humanity who best serves himself, with the golden rule of religion, "Bear ye one another's burdens."

II. Casualty and Miscellaneous Insurance.

Before proceeding with an account of the standard institutions of fire and life insurance, it is proper to glance at the recent vast extension of casualty insurance, which has assumed new and varied forms, and to notice certain novel applications of the insurance principle to other special classes of events. The novelty of these enterprises, however, is not in the general idea underlying each of them. In almost every instance in which insurance has been extended, so as successfully to cover new kinds of risks, it will be found that the suggestion is nearly as old as the practice of life insurance. Many more kinds of insurance than are even now found useful were attempted more than a century ago. But no statistical basis then existed for determining the probability of loss from various casualties, nor had modern methods of canvassing, accounting,

proving and checking losses, reached the perfection now recognized as necessary for efficiency and safety. The various branches of business which, in distinction from the great standard institutions of life, fire, and marine insurance, are commonly treated in the mass as miscellaneous insurance, differ widely in their subjects and methods. The most general of them, and that most widely known, is insurance against personal injury by accidents of every kind. Much has already been done by the companies in collecting and analysing facts, especially from their own experience, so as to determine the average risk of injury and disablement among different classes of men; and thus progress is steadily made towards a trustworthy basis of rates. But there is as yet no such union of effort among them to combine their resources for such purposes as among the life companies, nor does the subject admit of treatment so exact as that of human mortality. Hence it is impossible to speak of a theory of accident insurance in a scientific sense; and in its practice premiums and necessary reserves are determined by the trained business judgment of individual managers, guided by successive experiments, rather than by the calculations of actuaries from statistical collections of facts.

The insurance of railway travellers against injury upon trains was the first form of accident insurance which proved widely acceptable. This is still practised as a special business by several companies, tickets, entitling the purchaser or his family to a fixed compensation in case of his injury or death, being offered for sale with the railway tickets. Another special form of insurance is that against injury while riding a bicycle, often including also the rider's risk of liability for injuring any other person. But the development of insurance against personal injuries, which is most characteristic of the times, is the wholesale insurance of the employer against liability to the employed for accidental injuries sustained in his service. This was first undertaken on a large scale by the "Employers' Liability Assurance Corporation of London," founded for the purpose in 1880, immediately after the passage of the Employers' Liability Act by Parliament, which made employers of labour liable for injuries sustained in their service to an extent unknown to the common law. This company has gradually adapted its methods to the needs of its clients, and in 1886 extended its agencies beyond the United Kingdom, especially in America. The business has been vigorously prosecuted, and is now carried on by at least ten companies in Great Britain and seven in the United States, while nine new associations were registered in England for this special purpose in 1899. The policies are issued to the owners or operators of mills, mines, factories, railroads, and vessels, to builders and contractors, or other large employers of labour, agreeing to indemnify them for any loss to which they may be subjected, at common law or by statute, in consequence of bodily injuries suffered by any employee while engaged in their service. The insurance company undertakes the investigation and settlement of each claim within the limits prescribed by the policy, and conducts any litigation which may result. The adjustment of damages is made with more economy and skill by the companies than is usually possible for the employer, and the danger of fraudulent claims is largely reduced by methods experience has taught them. The price charged for such insurance is commonly a small percentage of the aggregate wages paid during the term, fixed in view of the peculiar hazards of the employment. But special forms of collective insurance of a similar kind are issued to cover liability for injuries suffered by casual visitors in theatres, in passenger elevators, or in the neighbourhood of factories or the works of contractors, often for fixed premiums.

The most common form of accident insurance, however, is still represented by the policy which promises the assured a fixed sum in case of death by accident, and a weekly compensation during disability from such a cause. Many policies also specify a sum to be paid for the loss or permanent damage of a member, as an eye, a hand, or foot. A recent extension of the personal accident policy is the addition of some form of health insurance, especially the grant of a weekly sum to the insured during incapacity for work caused by certain named diseases. Fourteen companies practising accident insurance against personal injuries in the United States reported for 1899 upon this class of policies aggregate premium receipts of $5,237,363, and losses paid $2,325,399. Besides the business of these stock companies, with fixed premiums, there are more than sixty associations in the United States organized for insurance against personal injury by accident, and relying upon the assessment of members to pay claims as they mature. Most of these are local and ephemeral; but a number of them, formed by men engaged in common pursuits, for mutual protection, have attained importance. Such are especially some of the commercial travellers' and the railway employees' accident associations, and a few connected with the Masonic or similar beneficiary orders. Eighteen of these societies reported the payment to members in 1899 of $874,084 in claims.

Another large class of casualty insurances applies to various forms of damage to property. The branch which seems most to have attracted promoters is the insurance of plate glass against fracture, which is carried on by at least twenty-two companies in Great Britain, and is the only business of many of them. Although twelve of these companies collected in 1898 less than £200 each in premiums, yet six new associations for this exclusive purpose were registered in England in 1899. In the United States there are five corporations which insure plate glass alone, with an aggregate capital of $650,000, annual premium receipts (1899) of $978,129, and risks in force of about $46,000,000. Seven other casualty companies issue also policies on glass to the amount of $18,000,000, for premiums of nearly $400,000. This business is not conducted in any other country upon so large a scale, but is attracting more attention than heretofore in Europe, and especially in Great Britain.

There are at least four companies in the United Kingdom and five in America which make the insurance against damage by the explosion of steam boilers a special feature of their work, but by far the greater part of the business is transacted by one company in each country. The service rendered is one of special skill and vigilance, extending far beyond the contract for indemnity. The company, in fact, employs inspectors of the highest scientific qualifications, who assume constant supervision of the machinery, and require its structure and conduct to be freed from elements of danger. It is prevention rather than compensation that is sought, and the outlay made by the companies is mainly for inspection and control, not for losses. It is usual to promise in a policy upon a steam boiler some compensation also for any personal injury which may result from an explosion.

Two small companies in England have insurance against burglary for their principal purpose, while at least six of the British accident companies and three in America issue policies of this kind, but most of the business is in the hands of one company. It is an experiment of the last few years, and the risks taken are for moderate sums, $50,000 as a maximum, at premiums determined in each case by an estimate of the danger founded on a study of all the circumstances. There is no information published concerning this branch of insurance in other countries, but the aggregate premiums paid in the United States in 1899 upon $40,000,000 of property were almost exactly $800,000, and the losses were $100,000. It is believed by many that there is an important future for burglary insurance, in connexion with improved methods of protection, by safes, automatic alarms, and constant inspec-

tion, for dwelling-houses, shops, and offices, which are often unoccupied.

Insurance against damage to growing crops by hail is practised in several parts of Europe and America, commonly by small local associations on the mutual plan, or as an incident to the business of fire insurance. No statistics can be obtained ot these operations. The same is true of the insurance against the ravages of tornadoes, and against sickness and accident in domestic animals.

A wholly distinct business, commonly classed as a branch of insurance, has recently grown to great importance, that of guaranteeing the fulfilment of contracts and of indemnifying employers against defalcations in their service. The bond of a corporation of large capital is widely taking the place which personal surety has filled in connexion with undertakings on contract, and with offices and occupations of trust, both in public and in private life. Fidelity insurance is carried on by a few of the general casualty companies, but as the practice of it extends it becomes more and more the work of special institutions organized for this purpose alone. About fifteen of these in the United States are corporations of excellent standing, with aggregate paid-up capital of more than $15,000,000 and surplus funds of nearly $10,000,000 more, and collecting in premiums about $4,000,000 annually upon bonds and guaranties amounting to more than $1,250,000,000. The business has been almost wholly created within the last fifteen years. It has had similar if not equal development in Great Britain and in several other countries, but it is only in the United States that the statistics of it are officially collected.

The insurance of titles to real property has also become widely extended within a few years, and is conducted in the United States almost wholly by fourteen corporations, with an aggregate capital of about $5,300,000. Their business, however, has indemnity for losses as but an incidental purpose. The principal aim is to furnish a final and responsible assurance that the title is flawless. Several of these companies possess elaborate and expensive collections of records, covering the sources of title for cities or large districts; all of them employ expert ability of a high order; and when they approve a title as perfect, the purchaser or lender of money may receive, with the approval, a guaranty against loss in accepting it, which private examiners or counsel cannot give. Titles are insured also in other countries, but the business has nowhere else attained such importance, nor do the institutions transacting it make full and separate statements of its accounts.

Some conception of the volume of business now transacted in the several branches of casualty insurance may be obtained from the following summary of the latest published returns in the principal countries. It must, however, be observed that the aggregates given are those of the most recent reports of established corporations, and are not of the same date, those in the United States covering the business of 1899, while those in other countries are nearly all of 1898; nor are they complete, since many companies have published no statements, while the business of local mutual and assessment associations is not included. Further, no account is made of the premiums and losses of title insurance and mortgage guarantee companies. The summary is in every case reduced to pounds sterling:—

Premiums received and Losses paid Annually by Casualty and Fidelity Companies.

	No. of Cos.	Premium Receipts.	Losses Paid.
United States and Canada .	49	£4,476,096	£1,791,913
Great Britain	89	3,129,006	1,736,070
Germany	36	1,811,929	926,195
France	12	1,158,027	688,611
Switzerland	5	1,059,110	596,716
Austria	16	557,481	573,142
Russia	7	206,941	131,340
Belgium and Holland . .	8	187,526	75,831
Denmark, Sweden, & Norway	7	106,214	71,134
Italy	2	56,640	35,994

III. Fire Insurance.

The growth of the business of fire insurance since 1880 or thereabouts has been commensurate with the increase of wealth and of commercial activity in the foremost nations, while the practice of it has also become general in countries in which it was till of late little known. The statistics of the subject have in recent years become far more full and more accessible than formerly; partly because many Governments require detailed reports of resources, receipts, and expenditures from all companies permitted to establish agencies within their jurisdiction, and periodically publish summaries of the returns; but also largely because the companies seek the widest publicity as their best means of advertising. It is to be regretted, however, that there is as yet no uniformity of method in these returns, such as would make it possible to combine or to compare the results with entire confidence; while some of the most important elements of the subject are not sufficiently illustrated for the student in the published statistics. Those of the companies of Europe, including Great Britain, are defective in that they commonly give only aggregates of each branch of receipts, expenditures, and funds, without distinguishing the business done in different countries. Many companies of the United Kingdom transact business throughout a great part of the world, and there is no means of determining how much of their receipts or their losses must be referred to Great Britain. Further, they fail to give classified amounts at risk, so that it is impossible to estimate with any confidence the total sum for which any kind of property, such as dwellings, factories, household goods, stocks of merchandise, or wares in transit, is insured. The returns of the London Fire Brigade, however, which is in part maintained by regular contributions from the fire underwriters at the rate of £35 for each £1,000,000 of risks assumed by them within the metropolitan district, continue to exhibit a regular growth. The aggregate amount insured in the metropolis was reported as follows:—

In 1882	£696,715,141
1886	741,109,316
1890	806,131,885
1894	845,998,895
1898	909,962,574

It appears probable that the rate of increase here shown is not greater than the actual growth of insurable property during the same period, so that it may be reasonably supposed that the custom of protecting all exposed property by insurance was already general in London many years ago. But the transactions of the British fire offices have grown much more rapidly, and indicate that, outside of the metropolitan district, the practice of insurance has extended greatly. Thus for 1898 the net premium receipts of fifty-eight such companies were reported as £19,346,666, and the losses paid by them in the year as £11,546,080. The tendency to concentrate the business in the control of large capital and experience is shown by the fact that more than £18,500,000 of the premiums were received, and more than £11,000,000 of the losses were paid, by thirty-one companies. There were at the same time thirty-eight corporations of foreign countries with agencies for fire insurance in the United Kingdom, but many of these do but a nominal amount of business, and twenty-three of them are exclusively or chiefly engaged in re-insurance. This tendency has been a marked feature in the recent history of fire insurance everywhere. The companies which are now in the field are the survivors of tenfold as many projected enterprises which have failed. The records of about two thousand organizations for the purpose, in America alone, which have undertaken the work and disappeared within fifty years, show the dangers to which inadequate skill and capital are exposed. But a small proportion of these failures were the direct result of sweeping disasters, though about seventy of them followed the memorable fires in Chicago and Boston in 1871 and 1872. Many more, nearly one-half of the whole, have followed a short career, in which the helplessness of inexperience to compete with long training and complete organization was demonstrated. Many hundreds of these projects were mere speculations or even frauds from the beginning; and the better education of the community at large in the principles and methods of

insurance has been the chief agent in checking such enterprises, aided by the stringent legislation of several countries and of the states in America, and by the criticism of the press.

The difficulty of establishing a new joint-stock fire insurance company is far greater in the present highly perfected state of the business than formerly, and constantly increases. The reports of the insurance departments in the United States show that less than one-eighth of the premiums are now collected by companies founded since 1880; and, except in districts remote from the principal financial centres, or mutual associations for special classes of hazards, new ones are not often formed. In Great Britain a considerable number of new corporations are registered every year, with fire insurance among their professed objects (at least twelve in 1899), but almost always in connexion with some forms of casualty insurance, which appear to be practically the purpose in view. The reports of the fire business in the United Kingdom for recent years, as collected in *Bourne's Manual*, show that less than one-fourteenth of it is done by companies organized since 1870. Though new companies have been registered, usually several every year, the number actually transacting successful business has not increased since 1880. Of the sixty British companies now recognized, the twelve smallest together collect but 1 per cent. of the premiums received by one of the largest, and the tendency to concentrate the business seems progressive. These facts are explained by the necessity of a vast basis of average and of a large capital for security, and still more by the increasing demand for a thoroughly trained and organized body of agents, able to protect their companies from fraud and imposition, and at the same time to compete for public patronage. The competition among the companies is extremely sharp, and tends to break down such of their number as are deficient in any of these qualifications.

Mutual system.

The *Mutual* principle has a strong attraction for many insurers and projectors. The conditions under which it can succeed, in the practical conduct of the business, have been put to severe tests in recent years. When a large number of pieces of property, so distributed that a single fire cannot destroy a considerable proportion of the whole, are yet owned and controlled by persons who can fully trust one another, both for financial responsibility and for good faith, there may be no need of a large capital in hand, nor of much of the costly machinery required for general competition. A contract for the assessment on all the property of losses as they occur, at rates fixed by the estimated exposure, may form a safe basis for an association. The fixed payments may be limited to necessary expenses, with a moderate reserve for emergencies, all excess of collections to be returned to the insured. This simple conception of an insurance association, with such modifications as experience indicates, has been accepted for a time as ideal in almost every civilized community, and attempts are continually made to realize it, but in the vast majority of instances with complete failure as the result. Like every other product of human skill, insurance is, for the most part, best supplied to the market by those who make it their calling to produce it for gain. But while the mutual plan has proved poorly adapted to the general service of the commercial world, so that scores of companies founded upon it disappear every year, and the number of such companies is far less than it was many years ago, yet in some communities, and especially among the owners of certain classes of property, it has achieved great and apparently permanent success. This is particularly true of manufacturing districts, in which numbers of mills and factories are exposed to peculiar danger of fire by the nature of their own operations. The best safeguard they can have is by employing great skill in the construction, arrangement, and conduct of their works, placing them for this purpose under expert supervision, trained and organized to apply every device for the diminution of the risk. A group of such properties, associated for the prevention of loss, is naturally stimulated to highest efficiency when the whole group undertakes to bear all losses which are not prevented, and thus every member has a strong interest in making the protection complete. It is in associations of this character that the mutual plan of fire insurance has rendered its greatest services, and regulations for construction and management devised by such companies have in several instances become recognized standards for the classification and valuation of similar risks everywhere. The mutual plan has been widely adopted also in local associations for the insurance of dwellings and farm improvements, where the individual risks are small, and where technical classification and special safeguards against fraud are not considered necessary, often with the result of affording satisfactory protection at low rates. But the ratio of this part of the business to that conducted by joint-stock companies diminishes from year to year, even in the agricultural and rural districts of the United States. According to the reports of the insurance departments of the States, as summarized in the Spectator Company's Year-Book, more than half of the cash premiums of mutual insurance companies are collected in the two manufacturing states of Massachusetts and Rhode Island.

The criticism of the mutual plan in the article on Fire Insurance by Mr M'Candlish in *Ency. Brit.*, vol. xiii. p. 163, has been continuously justified by experience in Great Britain, where this system has failed to win a high degree of public confidence. It is also confirmed by the almost exclusive employment of the joint-stock plan in France, Belgium, Holland, Russia, and Norway down to the present time. But it must be qualified by observing that, under the fostering influence of the national and municipal governments, the mutual plan has reached an important development in the Austrian Empire, Germany, Switzerland, and Sweden. In all these countries, indeed, corporate enterprise on a large scale, in every branch of business, is of comparatively recent growth, and mutual fire insurance was a familiar practice long before joint-stock companies entered upon this field of activity. The tendency in the large cities and commercial centres is to throw new insurances into the business corporations, while yet the time-honoured mutual associations retain their standard character and customary clientage. But in these countries the mutual plan has an established place in the confidence of the rural population, who are generally strongly prejudiced against moneyed corporations. This is especially true of the cantons in Switzerland and certain districts in the Austrian Empire, where fire insurance is administered by the local governments in connexion with a minute police supervision of the construction of buildings and of other conditions affecting the risk. From the published returns of the companies and the authorities, as collected for the *Post Magazine Almanack* (1900), it would appear that of all the fire insurance premiums paid in Switzerland, nearly 54 per cent. is collected by the mutual associations and the cantonal authorities; while in Italy 37 per cent., in Germany 27 per cent., in Sweden 27 per cent., and in the Austro-Hungarian Empire 20 per cent. go to mutual companies.

Lloyds.

The earliest plan of insurance which was successful as a business was that practised at Lloyd's Coffee-house in London (fully described in *Ency. Brit.*, vol. xiv. p. 741), and there applied almost exclusively to marine risks. Although the association known as Lloyds has been for generations a strong financial institution, with every modern safeguard, and since 1871 has been a chartered corporation with large funds, yet its name has become accepted as the symbol of the primitive practice of combined underwriting by individuals, each upon his own credit, for a share of the risk, and without common liability. A few associations on this general principle were known to exist in America, and to issue fire policies on a small scale, before 1892, but chiefly for mutual insurance. In that year, in a general revision of the insurance laws of New York, such associations already in existence were expressly exempted from all its provisions. Speculators at once discerned an opportunity. If a company by omitting to take corporate form could carry on the business free from all restrictions and burden of state supervision, it would compete at great

advantage with the insurance corporations. While the new law was in prospect there was time to take action; and upon its passage there suddenly appeared a multitude of "organizations" claiming the exemption as Lloyds, or associations of individual underwriters, and offering fire policies at rates materially lower than those of the joint-stock companies. Each of these was represented and managed by an attorney for the subscribers, supposed to have power to bind them severally to the amount of their subscriptions. The standard policy prescribed by law in New York was issued, with a clause making the liability several only, and fixing the amount. The Lloyds entered the market with the zeal and prestige of a new idea and a great name, and they grew rapidly in number and in business, but made no reports. Extending their agencies into other states, they occasioned much litigation concerning their legal existence and rights, and some rash and inharmonious legislation. But several attempts to establish similar Lloyds in other places failed. Experience soon showed that it was impossible to enforce claims in the courts, when the liability was distributed among many, without excessive expense and delay, even when all the subscribers were solvent, while a few good names, however useful in canvassing, were no guarantee of the responsibility of unknown associates. In 1896 the executive and legal authorities of New York assumed a hostile attitude towards speculative schemes of this class, and indictments were found against a number of promoters for falsely antedating constituent agreements. The bubble burst suddenly, and within three years more than one hundred of the Lloyds disappeared. A few reinsured their risks or were merged in permanent companies, but the mass of them proved to have no substance. Four or five only of the best continue to issue fire policies within a narrow and special circle, but as a group they no longer compete for general business.

The *Tariff* system, described in the earlier volumes of the *Encyclopædia Britannica* (9th ed.), has steadily developed in minuteness of classification and in adaptation to wider experience, as well as to the changes in the character of many classes of risks by improvements in building and by the introduction of new kinds of goods and machinery. But the principles there explained are still recognized. The estimates of risk and the determination of premiums are largely governed by individual opinion and by competition, no amount of experience furnishing a statistical basis on which trustworthy predictions of average loss can be made. The irregularities and fluctuations in the extent of destruction by fire in different districts and periods of time continue to be great and incalculable, and risks can only be valued, within limits which render the business safe, by making use of the largest available basis of average drawn from the experience of many companies and many communities. Hence it is only by constant co-operation among insuring institutions in the exchange and combination of their observations that justice can be done to them and to the public. The proper extent of this co-operation is easily attained where the business is free from all restrictions except those of the common law, as in Great Britain, and the competition of capital for profits is keen enough to keep the rates within reasonable limits. But in countries in which the Government regulates the business in a more paternal spirit, and meddles with all its details for the avowed purpose of securing the safest and best public service, many difficulties arise. This is increasingly the case in several of the nations of Europe, notably in Austria, Switzerland, and Germany. But it is in the several states of the United States that the Government supervision of insurance has most interfered with and modified the natural development of the business. In recent years, beginning with 1885, sixteen of these states have enacted legislation, dictated by the growing jealousy of corporate powers and privileges, forbidding fire insurance companies or their agents to combine in any form for the determination of rates. Companies have often been indicted, fined, and deprived of authority to issue policies because of membership in associations for the purely scientific purpose of ascertaining their average experience. The courts have frequently narrowed in their interpretations the sweeping intent of such laws, but have generally sustained them as within the power of the legislature, and at the present time there is an overwhelming public sentiment in large sections of the country arrayed against every semblance of union or consultation among the companies upon the basis of their business. In several instances all the important insurance companies have withdrawn their agencies at once from particular states, and the business community has been sorely distressed for want of their protection. But the popular prejudice has not yielded to its demand, and the companies have never been able to maintain their own position with unanimity, the temptation to secure a vast business upon any terms being always too strong for some of them to resist. This form of legislation has beyond dispute increased the cost of insurance to the people, while it has embarrassed and disturbed the regular work of the companies. But it is a favourite subject among politicians of appeal to popular prejudice, and is likely to continue so until its uselessness and injurious effects become understood by the mass of insurers.

Tariff difficulties.

Another pernicious tendency of popular legislation is found in the *Valued Policy laws*, the first of which was adopted by Wisconsin in 1874, providing that when any insured building is wholly destroyed by fire the amount of the policy shall be conclusively taken as the amount of the loss. This principle, with various modifications and extensions, has now become law in twenty states of the Union, though in many of them its enactment has been vigorously resisted by the executive Government; several governors have vetoed such Bills, while most of the supervising officers have had the intelligence to disapprove them. The provision is regarded by all insurance authorities as highly dangerous, inviting over-insurance and incendiarism; and there is no doubt that it has this tendency in many instances. But the statistics available, while showing that in general the rate of loss has increased where such laws are in force, do not demonstrate any such wide and ruinous stimulation of fraudulent practices as has been apprehended by thoughtful critics. The actual result is commonly to throw upon the insurer the responsibility for providing in advance against over-insurance by minute surveys and, in special cases, for continual watchfulness against depreciation. Like all other interference of Government with private contract, however, it has a marked effect in increasing the difficulty and expense of business transactions.

Need of co-insurance.

The direction in which fire insurance as a social institution calls most pressingly for improvement is the extension of the principle of co-insurance. The importance of this can only be understood by remembering that the aggregate losses of the community by fire are chiefly made up of innumerable small fires, which destroy but a portion of the particular risk exposed, and not of sweeping conflagrations. Thus the fire patrol of New York, which surveys with extreme care every loss incurred in that city, reports the following summary of all losses during 1895–99, with the amount of insurance in force upon

the buildings in which the fires occurred and upon their contents:—

Buildings.

Year.	Insurance.	Loss.	Ratio Loss to Insurance.
1895	$19,954,269	$1,063,328	·0533
1896	24,753,499	1,015,187	·0410
1897	25,598,474	801,694	·0315
1898	39,326,676	1,382,553	·0351
1899	43,021,638	2,282,538	·0530

Contents.

Year.	Insurance.	Loss.	Ratio Loss to Insurance.
1895	$10,782,646	$2,371,570	·2199
1896	14,864,703	2,736,358	·1840
1897	12,133,154	2,208,997	·1820
1898	13,724,161	2,765,087	·2014
1899	32,013,617	4,899,229	·1530

The report for 1899 covers 6449 fires, of which twenty-two resulted each in a loss to the insurers of $50,000 or more, the average being $180,000; while for the remaining 6427 fires the companies paid an average loss of $495. There are few districts in which records so complete are kept, but the experience of every company confirms the general truth, that the number of fires in which a building is totally destroyed, or in which the loss amounts to the greater part of the property exposed under the same risk, is comparatively very small. It may be asserted with confidence that, in the grand aggregate of the business, much more than three-fourths of the loss occurs in fires in which less than one-tenth of the insurable value at risk is destroyed. The practical result is obvious. If fires destroy a million of dollars' worth in property insured for its full value, and a million's worth more in property insured for one-tenth of its value, the insurers will pay $1,000,000 upon the first group and more than $750,000 upon the second. But if all the insurance is taken at the same rate the insurers will have received premiums ten times as great on the former group as upon the latter. This rough illustration, which might be indefinitely extended, shows that in an equitable adjustment of rates the amount insured as compared with the value exposed is a prime element, and that premiums might justly form a scale, highest on the smallest fractions of value, and diminishing rapidly as the percentage of insurance increases. Such a scale is, however, impracticable for many reasons, apart from the endless complications which, even if it could be constructed, it would introduce into the classification of risks. Any scientific plan of insurance, therefore, must provide another method for maintaining the proportion between amounts of premiums paid and the share in its benefits obtained for them. This is the purpose of what are generally called *average* or *co-insurance clauses*. The principle is, that when a proper rate for a class of risks is found, then the insured may protect at that rate any percentage of such a risk, and in case of fire shall be indemnified for the same percentage of his loss. When once clearly grasped, this principle largely simplifies and rectifies the business. It is in universal use in marine insurance under the name of "average," and is there recognized as indispensable. It is embodied in all fire policies in France, Germany, and several other countries of Europe, and in 1826 was made compulsory in Great Britain by law in all "floating policies," those, that is, which cover stocks of goods distributed in several places and in fluctuating amounts. But it has not yet become general in Great Britain or America, although every writer of authority on the subject, and every practical underwriter of large experience, approves it. Systematic attempts have been made since about 1892 to extend its application in the United States with much success, but they have been met by strong opposition, which shows a widespread misunderstanding of its true bearing.

The co-insurance clause, indeed, which has been generally approved by the American associations of underwriters, and applied in the great commercial cities, is less sweeping than the parallel agreements used in France and Germany. The latter regard the insured owner as self-insurer for the entire value at risk not covered by the policy, and grant indemnity only for that fraction of the loss which the amount insured bears to the whole amount exposed. The American clause is less logical, commonly providing that: "If at the time of fire the whole amount of insurance on the property covered by this policy shall be less than 80 per cent. of the actual cash value thereof, this company shall . . . be liable only for such portion of such loss or damage as the amount insured by this policy shall bear to the said 80 per cent. of the actual cash value of such property." But this limitation of the basis of co-insurance average to 80 per cent. of the total value is in perfect harmony with the conservative policy which seeks in all cases to prevent over-insurance. The most serious danger to which the entire system is open is that a fire may promise profit to the insured. To avoid this, it is a small enough margin to exclude from protection by the policy one-fifth of the estimated value, and to require the owner to assume that proportion of the risk. It is therefore reasonable not to require in any case a larger share than four-fifths to be covered, and not to press the co-insurance principle so far as to offer a differential advantage to those who insure above this limit. Thus, for practical purposes, and in the general mass of business, the 80 per cent. clause may be accepted as approximately the best application of the principle. It makes possible substantial equity in distributing the cost, while it does not interfere with proper safeguards against over-insurance. The cordial support of the mercantile community in the great cities, and of the most intelligent state officers, has been given to it.

A popular outcry has, however, arisen against all forms of co-insurance, on the superficial and mistaken assumption that in every case the principal sum named in the policy measures the insurance paid for by the premium; and that any limitation upon it must be a wrong to the insured, for the emolument of the insurance corporation. No less than ten states have passed laws prohibiting the clause within their jurisdiction, though Maine in 1895, after a trial of two years, repealed the prohibition. The law of Tennessee, a typical form, is as follows: "Insurance companies shall pay their policy-holders the full amount of loss sustained upon property insured by them, provided said amount of loss does not exceed the amount of insurance expressed in the policy, and all stipulations in such policies to the contrary are and shall be null and void" (except in case of insurance upon cotton in bales). In several states the use of the co-insurance clause is made a penal offence. It is an interesting fact, however, that while this principle, whenever it has been generally applied, has led not only to a fairer equalization of premium rates, but, on the whole, to a marked reduction of them, the laws in question have deprived the people adopting them of the resulting benefit. In the year 1899 the average premium rate upon all fire risks written in the states in which co-insurance was wholly or partly prohibited was something more than $1·20 per $1000, while in the rest of the country, where the clause was permitted and to a large extent used, the rate was but 96 cents per $1000. The marked difference, which tends to increase, is a perpetual object-lesson which must in the end appeal strongly to the popular intelligence.

The varying attitude of several civilized Governments towards the institution of insurance has found significant

expression in their tax laws. In Great Britain a stamp duty of 6d. was imposed in 1694 upon "every piece of vellum or parchment or sheet of paper upon which any policy of insurance should be engrossed or written," and was doubled in 1698. It was further increased (reaching 3s. 10d. per policy in 1713) and varied by many subsequent Acts, under some of which the percentage duty on fire insurance was also made payable by stamps upon policies. But in 1865 the stamp tax was finally reduced to the nominal sum of 1d. upon each policy. A far heavier burden, however, was imposed upon insurers by the measure of Lord North in 1782, charging all fire insurances in force with an annual duty of 1s. 6d. for every £100 insured. In 1815 the general rate was made 3s. per £100, but was collected once for all upon the policy when issued; and it so remained until reductions began in 1864. The duty was wholly abolished in 1869. The revenue from this source reached its highest point in 1863, when it was £1,714,622, presumably representing insurances effected in that year to the amount of £1,143,081,333. There are no data for determining the amount of premium receipts or of losses realized on the same volume of insurance; but the tax was recognized by economists as well as by all parties to the policy contracts as an excessive burden. In many instances it more than doubled the cost of insurance. Its effect in discouraging the prudent custom of insuring against fire was very serious, and after its abolition this custom extended so rapidly that it soon became, and continues, practically universal in Great Britain. Upon the continent of Europe fire insurance is generally taxed quite heavily; most so in France, where the direct duties on the premiums, together with the registry and stamp taxes paid by the companies, have been estimated to add one-fourth, or perhaps one-third, to the cost of insurance. In the United States the companies are taxed, each by the state in which it is domiciled, upon their real estate, and often upon their capital, surplus, or profits, and are required in other states to pay fees to the insurance departments, and commonly an excise of from one to two and a half per cent. of their premiums. An elaborate table is prepared each year by a committee of the National Board of Fire Underwriters, showing the aggregate amount of taxes paid by the companies operating in New York in comparison with their receipts and profits. The statement received and published by the Board in 1900 contained the following:—

Taxation of insurance.

	For the Year 1899.	For Twelve Years 1888–99.
Premiums (fire and marine)	$134,450,639	$1,425,929,631
Losses paid (fire and marine)	91,031,677	856,978,494
Expenses	52,849,129	517,667,238
Increase of liability (unearned premiums, &c.)	8,998,526	59,104,388
Net loss in the last year	18,428,693	...
Net profit in twelve years	...	7,820,489
Amount of taxes paid	4,495,332	35,984,081
Taxes were of premiums	3·34 %	2·52 %
Taxes were of premiums, less losses	10·35 %	6·32 %

In qualification of this statement, it may be said that the reported expenses appear to include taxes, and that the additions charged to liability are to some extent theoretical and flexible. It also appears from the state reports that upon the entire capital and net surplus of $191,000,000 employed in the business in the United States by 316 joint-stock companies, dividends to the amount of $8,000,000, or 4·2 per cent., were paid in 1899 to shareholders. Nevertheless it is true that competition among the companies, together with unfriendly legislation, has reduced the profit upon their aggregate capital near the vanishing point, and that the taxes, the average rate of which increased 50 per cent. within the period 1891–99, are heavier in many states than can be justified by public policy or by the analogy of other corporate interests. The true principle, doubtless, is that while the capital employed in insurance for gain ought to contribute to the state the same share of its profits as other capital, yet the premiums, agencies, policies, and entire machinery representing only losses and providing for their distribution, should be exempted, as far as the necessities of the public treasury permit.

One aspect of the taxation of fire insurance is of especial interest, namely, the very general disposition of legislatures and municipal authorities to impose upon the underwriters the cost of fire departments. The systematic prevention and extinguishment of fires are everywhere assumed to be proper work for the community at large, and are commonly assigned to a special branch of the local government. But the first license granted by the Crown to issue insurance policies in London in 1687 was conditioned upon regular contributions by the authorities to support the king's gunners as a fire brigade, and in the public mind the privilege of insuring the prudent has ever since been vaguely associated with the duty of guarding the property of the whole community. The voluntary support of fire patrols by the companies in London, New York, and other cities has done much to promote this view; and a substantial part of the taxes paid upon fire policies in the United States is levied for the support of fire departments, the pay and pensions of firemen, and similar purposes. The tendency to increase such taxes, under the pretext that the protection afforded is for the special benefit of the companies, is strong in some of the states; though it would be equally rational to compel life insurance companies to maintain general hospitals for the sick.

The most complete statistics of the fire insurance business collected in any country are those presented in the *United States* to the National Board of Fire Underwriters at each annual meeting. The following table is a summary of part of the information submitted by the committee on statistics, 10th May 1900, giving the amount of fire risks insured in the United States, premiums received for them, and losses paid upon them, by all joint-stock fire insurance companies for the years 1897, 1898, and 1899:—

Statistics.

Fire Insurance in the United States. Joint-Stock Companies.

			Fire Risks Assumed.	Fire Premiums Received.	Fire Losses Paid.	Premiums per $100 of Risk.	Loss per $100 of Risk.	Loss per $100 of Premiums.
			$	$	$	$	$	$
1897	American Cos.	233	10,829,475,352	91,527,779	44,210,383	·8452	·4082	·4830
	Foreign Cos.	29	5,463,433,991	41,072,624	20,592,681	·7518	·3769	·5014
	All Cos. .	262	16,292,909,343	132,600,403	64,803,064	·8139	·3977	·4887
1898	American Cos.	226	11,397,206,093	90,071,290	50,655,461	·7903	·4445	·5624
	Foreign Cos.	32	5,924,875,178	40,338,900	24,025,856	·6808	·4055	·5956
	All Cos. .	258	17,322,081,271	130,410,190	74,681,317	·7528	·4311	·5726
1899	American Cos.	218	12,251,299,499	93,577,169	59,119,018	·7638	·4826	·6318
	Foreign Cos.	35	6,087,570,275	42,958,472	29,865,014	·7057	·4906	·6975
	All Cos. .	253	18,338,869,774	136,535,641	88,984,032	·7445	·4852	6517

These returns do not include mutual companies. The compilers of the *Insurance Year-Book*, however, have obtained from the several state departments of insurance the reports of all companies made to them of the business done within each state; and from these it appears that in 1899, 160 mutual companies assumed fire risks to the amount of $1,119,772,848. Many small local associations have made no returns, but their operations are too limited materially to affect the aggregate. It is noteworthy that while mutual companies transact less than 6 per cent. of the business of the whole country, yet in the state of Rhode Island, a densely peopled manufacturing community, they have more than 78 per cent., and in Massachusetts nearly 24 per cent.; and that, while less than one-ninth of the insured property of the United States is situated in these two states, they contain nearly two-thirds of that which is insured by mutual associations.

The fire insurance business of foreign companies in the United States was comparatively small until 1870. Four strong British

corporations were then in the field, and their transactions amounted to less than 9 per cent. of the entire joint-stock business. But their success attracted others in rapid succession, especially from Great Britain and from Germany, and in 1880, 19 foreign companies assumed 23·7 per cent. of all the risks reported to the National Board; in 1889, 23 such companies took 30·3 per cent.; and in 1899, 35 such companies took 33·2 per cent. The distribution of the business among them is not given by the Board tables, but can be gathered from the reports of the American branches to the insurance departments of the states, which are summarized in the Spectator Company's Year-Books. It appears from these that of 39 branches of foreign companies in the United States in 1899—

	Collected in Premiums.		Collected in Premiums.
24 British .	$35,266,610	1 Swiss .	$786,158
10 German .	5,540,504	1 Swedish .	435,125
2 Canadian .	2,754,292	1 Dutch .	406,098

In the *United Kingdom* the statistics of fire insurance are less accessible and less complete, no official returns or records being made of the local distribution of the property insured, while the published accounts of the companies are not sufficiently uniform and detailed to make a trustworthy summary of the entire business possible. Much of it is done by foreign companies, of whose British business we have no separate statement. The following statement of the revenue accounts of 58 British companies insuring against fire shows the aggregate premium receipts and payments for losses during 1898; and of 17 of them, which receive 70 per cent. of the premiums and pay about 70 per cent. of the losses, the total amount of insurance written in 1899 and of risks in force at the end of that year. Assuming that the remaining companies have a similar average rate of premium and of loss, the aggregate of the business of the British companies will be as found in this table:—

Fire Insurance in the United Kingdom. British Companies.

	Premiums received last Fiscal Year.	Losses paid last Fiscal Year.	Percentage Loss to Premium.	Estimated Risks written in 1899.	Estimated Risks in Force Dec. 31, 1899.
58 Companies.	£19,552,065	£11,971,868	61·23	£6,060,000,000	£7,100,000,000

These sums include business done by many of the companies in all parts of the world, and while they serve to indicate the volume of their transactions, they are no index to the value of property insured in Great Britain.

In the *Dominion of Canada* the insurance companies make detailed reports to the Government Bureau, and the statistics of the business are full and accurate. There were in 1900 seven Canadian companies, twenty-one British, and nine from the United States, taking fire risks in Canada; and the comparative share of each class, and its recent growth, are shown by the following statement of capital employed, and of risks assumed and in force, for the calendar years 1895 and 1899. The aggregates may be accepted as fairly representing the entire business in the Dominion:—

Fire Insurance Business in Canada.

	No. of Cos.	Year ending 31st December 1895.		
		Funds.	Risks written.	Risks in Force.
Canadian Cos.	5	$4,587,065[1]	$127,869,652	$143,522,252
British ,,	20	11,784,712[2]	445,816,220	565,683,862
U.S. ,,	7	1,212,822[3]	98,936,452	117,978,254
Total . .	32	$17,584,599	$672,622,324	$827,184,368

	No. of Cos.	Year ending 31st December 1899.		
		Funds.	Risks written.	Risks in Force.
Canadian Cos.	7	$5,003,818	$130,509,195	$169,792,859
British ,,	21	15,747,565[2]	524,980,342	654,890,000
U.S. ,,	8	1,449,555[3]	100,767,561	112,186,809
Total . .	36	$22,200,938	$756,257,098	$936,869,668

[1] Including $1,889,920 capital paid in.
[2] Including $2,105,105 capital paid in.
[3] Funds in Canada only.

Upon the *continent of Europe* the fire insurance business is conducted, partly by local companies in each country, and partly by the great international offices of Great Britain and Germany. The local associations in Austria, Germany, and Switzerland are of three classes—public assurance organizations connected with local governments, private mutual companies, and joint-stock companies. It is impossible to obtain balance-sheets of all, nor is any information available concerning the local distribution of the risks, or the whole amount of property insured. The following table, exhibiting the capital employed by stock corporations in this business in each country, and the aggregate premium receipts and payments for losses in the last year of which a report is available, has been compiled almost wholly from the statements collected by the *Post Magazine Almanack* for 1900. In most cases the figures given are for the operations of 1898, but the fiscal years are not the same for all. The capital in each case is that actually paid in; the subscribed capital is usually much larger. The amounts are reduced to pounds sterling:—

Fire Insurance in Continental Europe.
Business of 1898.

	Number of Companies.	Paid-up Capital.	Premiums received.	Losses paid.
Germany—				
Stock . .	57	£2,305,373	£7,399,762	£4,799,200
Mutual . .	49[4]	...	2,623,462	1,627,805
Total .	106[5]	£2,305,373	£10,023,224	£6,427,005
France . . (1 Mutual)	24[6]	£2,722,303	£4,454,875	£2,409,584
Russia . . . (1 Mutual)	19	£2,771,667	£3,054,897	£2,542,115
Austria—				
Stock . .	18	£1,602,083	£2,530,000	£1,807,000
Mutual . .	20[4]	110,692	737,000	418,000
Total .	38	£1,712,775	£3,267,000	£2,225,000
Belgium . .	16[7]	£499,803	£1,066,967	£638,766
Sweden—				
Stock . .	9	£653,846	£469,733	£278,204
Mutual . .	11	...	128,525	37,240
Total .	20	£653,846	£598,258	£315,444
Switzerland—				
Stock . .	4			
Mutual and Cantonal	21	£252,227	£821,834	£515,130
Total .	25			
Italy—				
Stock . .	4			
Mutual . .	11	£432,219	£412,606	£245,405
Total .	15			
Denmark—				
Stock . .	4			
Mutual . .	4	£276,923	£319,388	£253,040
Total .	8			
Norway . .	8	£273,112	£60,068	£26,075
Holland . .	10[8]	£115,667	£258,056	£147,242
Balkan Peninsula . .	5	£241,980	£204,292	£108,619

While most of the fire insurance business in the *Australian colonies* is in the hands of British companies,

[4] Many of the mutual companies in Germany and Austria are divided into distinct departments, one for houses and one for personal property, with separate accounts, but being under the same management, the two are here regarded as one company.
[5] Seven companies not reported.
[6] Two companies not reported.
[7] Four important companies not reported.
[8] Statements incomplete.

local institutions for the purpose have had a considerable development on the same general lines as in Great Britain and with similar freedom from interference by the governments. But no accounts of the receipts and losses are available, most of the companies conducting a marine or life insurance business, or both, under the same general management. There are at least five flourishing companies in Melbourne, with paid-up capital of £272,500; five in Sydney, with paid-up capital of £190,000; five in New Zealand, with paid-up capital of £484,000; and two in Tasmania, with paid-up capital of £87,500.

Beyond the limits of the great commercial nations, no satisfactory information is accessible concerning the practice of fire insurance. Even in Spain and Portugal there is far less intelligent interest in the subject than in neighbouring countries, and the agencies of foreign companies transact much of the business in the large towns. Six Portuguese companies have maintained themselves for many years, a few of them for nearly a century, and have established agencies in the Spanish islands and in Madeira. For other nations than those represented in the table above, the only systematic effort to collect the facts is made by the compilers of the *Year-Book*, and the results are extremely meagre. The great British and German corporations are zealous in extending their transactions to the commercial ports everywhere, and local companies are often formed in the colonies. It is only in Australia and in Cape Colony that these have become financially important, though small native companies have been successful in establishing their credit in Japan, Brazil, the Argentine Republic, Chile, and Peru. A considerable business is done in insuring the property of foreign residents in the Levant, on the coasts of Asia, in South Africa, and the Pacific Islands, but mostly by European companies, and as an incident to the more general practice of marine insurance. There are several successful fire companies among the Dutch in Java, and, under British management, two at Georgetown in British Guiana, and one in the Transvaal. The small business in Mexico appears to be wholly in the hands of foreign companies.

IV. Life Insurance.

Before the middle of the 17th century no marked improvement had been made in the method of collecting and classifying social facts since Herodotus and Pausanias. General descriptions, mostly from personal observation, extended by hearsay, with vague inferences, were the sum of available information on the volume and movement of population, industry, and wealth. A few German and Italian writers had attempted large collections of comparative data in this field, but without trustworthy sources or useful method, so that their labours served only to indicate a want, not to supply it. In 1609, indeed, Sully, the great minister of Henry of Navarre, ordained a permanent national bureau to inquire into the economical and social conditions of the kingdom, but this magnificent scheme, in advance of his age, fell with the tragic death of his master. The fruitful use of statistics was impossible until the principles of the science of probabilities were grasped; and as these gradually became part of the common stock of ideas among advanced minds, statistical method was developed. The famous correspondence between Pascal and Fermat in 1654 shows two of the greatest minds of the age engaged in groping painfully after solutions of problems which are now considered elementary, the thought that probabilities can be definitely appraised and compared being grasped as a fresh discovery. Step by step a new science was created, that of the laws governing events whose causes cannot be traced. The leading conceptions of this science were firmly implanted first in the minds of a few mathematicians, were then applied to the study of social facts, especially those of human mortality, and in succeeding generations have become familiar to all educated men. The world has slowly but thoroughly learned that events which individually are impossible of prediction, whose determining forces defy analysis, and which to us are therefore casual, tend to occur with greater and greater uniformity the larger the number of instances collected; that averages are the clues to general truths, and that deviations from average diminish as instances multiply, while any persistent failure of such deviations to diminish is the clear indication that some disturbing force is exerting a uniform influence which requires investigation. Until these principles were clearly understood life insurance was impossible. They first began to find acceptance with the foremost thinkers of Europe during the second half of the 17th century. If their gradual development could be traced for the last three hundred years, from the first hints of mathematicians, philosophers, and statesmen, to their general recognition in modern research, it would form one of the most important chapters in the history of thought.

We can refer only to the outline of their progressive application to the facts of human mortality. Guesses at the probable length of life for the purpose of valuing or commuting life-estates, leases, or annuities were indeed made even by the ancients, and crude estimates of the number of years' purchase such interests are worth occur in Roman law and in many mediæval writings. In 1540 Parliament enacted that an estate for a single life should be valued as a lease of seven years, one for two lives as a lease of fourteen years, and for three lives as a lease of twenty-one years. More than a century later *The Cambridge Tables for renewing of Leases and purchasing Liens*, a standard work in England, with the certificate of Sir Isaac Newton to its accuracy, proposed, as a remedy for the inequity of this fanciful rule, to make the increase for each additional life less by one year, so that, valuing a single life at ten years, two lives shall be reckoned as nineteen years and three lives as twenty-seven years. No distinction of ages was recognized, and the results, tabulated to decimal parts of months, are of course worthless. Thus the foremost minds of the world had as yet no apprehension of a true method of reasoning on the subject. The first clear insight into the character of the problem appears in *Natural and Political Observations on the Bills of Mortality*, published in 1661 under the name of John Graunt, a haberdasher and train-band captain of London. Graunt recognized the principle of uniformity in large groups of vital and social facts, and actually prepared, from the mortality registers of London, what he calls a "Table showing of one hundred quick conceptions, how many die within six years, how many the next decade, and so for every decade till 76." This was the earliest crude suggestion of a table of mortality, and Graunt's interest in the inquiry was scientific, without definite practical purpose. But a little later the sale of annuities was pressed upon Governments as a method of discounting future revenues. In 1671 John De Witt, Grand Pensionary of Holland, reported to the States General a plan for such sales upon a scientific method, the insight and skill of which, had he possessed proper statistical data, would have anticipated results only reached by later generations. The report, however, was buried in the Dutch archives and forgotten for nearly two centuries. It was unknown in England when, in 1692, the Government undertook the sale of annuities. A loan of £1,000,000 was offered, each £100 paid in to purchase a life annuity of £14, without distinction of age. A table accompanied the offer, purporting to show how many of 10,000 persons now living, old and young taken together at random, are likely to die in each year from one to ninety-nine. Of course the purchasers, though without clear understanding of the principle, were instinctively shrewd enough to select healthy young lives for annuitants, and the nation paid enormously for the error. This speculation of the public treasury led the eminent mathematician and astronomer Dr Edmund Halley to

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examine the subject. In 1693 he presented to the Royal Society a study of "The degrees of mortality of mankind." The parish registers of England took no note of age at death, and Halley, perceiving that the average duration of life in large groups of persons can only be determined when ages at death are known, sought in vain a statistical basis for such an inquiry in his own country and in many others. But it happened that the city of Breslau in Silesia had kept such records, and he succeeded in obtaining the registers for five years, 1687–91, including 6193 births and 5869 deaths. No census of the city having been taken, he made the best estimate he could of the population, and computed how many of a thousand children taken at the age of one year will die in each succeeding year. Arranging the results in three parallel columns, showing in successive lines the age, the number living at that age, and the number of deaths during the year, he formed the first mortality table. The arrangement was itself a discovery, exhibiting at a glance the essential data for valuing life-risks, and suggesting solutions for problems which had puzzled the ablest students. This general form of the mortality table remains in use as the natural and best for such collections of facts. The method of using such a table in calculating the values of life contingencies was also discovered by Dr Halley. He showed that where a payment is to be made at a future date, if a named person be then alive, its present value is the sum which compounded at interest during the interval will amount to that payment multiplied by the fraction representing the probability that the person will survive. These two elements, compound interest and the probability of life or death, are the foundations of the theory of life contingencies.

Halley's Table.

From Halley's time the progress of the theory has been in three directions: first, in accumulating facts from which averages are deduced, and analysing the data so as to eliminate disturbing influences, that is, in constructing trustworthy tables of mortality; secondly, in extending the inferences from such tables, and multiplying their applications to needs of practical life; and thirdly, in facilitating the calculations which these applications require, the enormous labour of them being beyond human capacity until the highest mathematical skill has devised means of shortening them. But while Dr Halley thus firmly and lastingly drew, in outline, the theory of life contingencies, the numerical results attained by him were grossly imperfect. Forced by the lack of data to assume that the population was stationary, and to rely on a rude estimate of its numbers, he well knew that his conclusions were but provisional. Yet they were far in advance of the general mind of his time. As late as 1694, and even in 1703, Parliament substantially re-enacted the old law for valuing leases at seven years for each life. The meagre Breslau Table long remained the only serious attempt to utilize actual observations of mortality for scientific purposes. In 1746 de Parcieux, a mathematician of Paris, published an *Essai sur les Probabilités de la Durée de la Vie Humaine*, in which he presented mortality tables formed by himself, one from the records of certain Tontine associations, and five others from those of several religious orders in Paris. The Tontine experience table was a much closer approximation to the true course of mortality, as shown by later investigations, than any of its predecessors, and indeed now appears, despite the crude manner in which the materials were treated, to have been more accurate and more trustworthy than the Northampton or even the Carlisle Table of much later date. The essay of de Parcieux was an important source of information to advanced students in France and Germany, but attracted no general or popular interest, nor was it followed up by progressive researches of the same character in continental Europe, while it remained almost unnoticed in England.

Throughout the 18th century the customary treatment of life annuities was as chaotic and fanciful as before, though some writers of eminence, most notably Dr Thomas Simpson of London (1752), treated the theory of the subject with great intelligence, and in 1753 Dodson of London (great-grandfather of Dr A. de Morgan) projected a life insurance company in which the premiums should be accommodated justly to the ages of the insured. But life insurance as a business really began with the Equitable Society of London, founded in 1762. The associates petitioned for a charter, but the law officers of the Crown refused it, saying that the scheme depended for success on the truth of certain tables of life and death, "Whereby the Chance of Mortality is attempted to be reduced to a certain standard. This is a mere speculation, never tried in practice." The society was organized as a voluntary association, and began business in 1765. Its premiums were computed from the Breslau Table, with some corrections from the London Bills of Mortality, and were far higher than any now in use. But the managers, in face of actual business, needed more light. Dr Price, a student of the new science of life contingencies, was consulted, and soon devised tests of the society's experience and measures of the financial results, which are in principle those still practised. He also aspired to construct a more accurate table of mortality, and discovered data in certain parish registers of Northampton which promised to represent the average of life in England. From these he formed in 1780 the Northampton Table of Mortality, and computed a new and largely reduced scale of premiums for the society. The historical importance of the Northampton Table lies in the profound impression it made on the general mass of intelligent mind, spreading widely the new conception of a regular death-rate of population, to be determined only by observations classified according to age. The crude state of previous knowledge on such subjects is hard to realize. Although mortality had long been recognized by special inquirers as a promising theme for statistical inquiry, its actual treatment, except in the narrow school founded by Süssmilch in Germany (1746), and in the isolated and almost prophetic work of de Parcieux in France, had been speculative and vague. De Moivre handled it with mathematical acuteness, but framed his scale of mortality (about 1750) on a hypothesis of his own, not on known facts. Out of each group of eighty-six deaths, according to this scale, one dies on the average each year till all are gone; so that x being the present age, the probability of death within a year is always $\frac{1}{86-x}$. This conjecture, which, during middle life, served as a rough approximation to the truth, almost as well as some of the early tables of repute, long found remarkable acceptance among men of science as a discovery. Dr Price's researches first brought to general apprehension the conviction that a large basis of observed facts is the only source of real knowledge. The Government of the day felt the influence of the movement. In 1786 Mr Pitt, then Chancellor of the Exchequer, consulted Dr Price on plans for the conversion of debt, and in 1789 the Government first showed knowledge that in granting annuities ages must be distinguished, and that the prospective life at ninety and that at twenty-five are not to be estimated as equal. About 1808 a conversion of 3 per cents. into annuities was planned. The Northampton Table was adopted, and Mr Morgan computed rates from it which were used for twenty years. It proved to represent a mortality far in excess of the average, and in

Northampton Table.

1821 Mr John Finlaison, being made Actuary to the Debt Commissioners, protested against the rates in use. But the Government was slow of conviction, and not until 1828, when the Treasury had lost two millions of pounds by selling annuities too cheap, was the law repealed. Mr Finlaison then constructed a new and less wasteful scale of conversions, but singular results followed. At the age of ninety, for instance, £100 would purchase an annuity of £62. Combinations were formed to purchase annuities on the lives of old people selected for their vigour; 675 of these were taken, with a further loss of at least a million to the Treasury. The Northampton Table, in fact, like the earlier Breslau Table, was formed without a census, and upon the false assumption that the population was stationary. Dr Price's estimate, founded on the recorded baptisms, was much too low, many of the people being of a sect which rejected infant baptism. His table represents an average life of twenty-four years, whilst subsequent inquiries indicate a true average of about thirty years at that time in the same parishes. The actual mortality in the Equitable Society proved to be less by one-third than that anticipated by the table. The error had consequences of vast moment. The immediate and dazzling prosperity of the societies founding rates on this supposed scientific basis excited the public imagination, stimulated the business exceedingly, and led to many extravagant projects, followed by fluctuations and failures which impaired its healthy growth and usefulness.

In spite of gross defects, the Northampton Table remained for a century by far the most important table of mortality, employed as the basis of calculation by leading companies in Great Britain, and adopted by the courts as practically a part of the common law. Parliament, followed by some state legislatures and many courts in America, even made it the authorized standard for valuing annuity charges and reversionary interests. But in life insurance practice it is now wholly antiquated, though its service in first introducing the common mind to the elements of the subject gives it great historical interest. Like its most famous successor, the Carlisle Table of Mr Milne, it rested upon observations of the population of a town. How far this limited and peculiar group represented the nation was still doubtful; no less so how far the rate of mortality among applicants for insurance, accepted by the offices, would correspond with that of the urban citizens or of the whole body.

Recent actuarial progress.

As soon as the companies had sufficient records of their own experience the work began of striving to construct, for business use, tables which should truly express it. This branch of research has ever since been prosecuted with all the resources they could command of industry, practical judgment, and mathematical skill; and the successive achievements in it may be accepted as in general the sum and measure of the progress of actuarial science. Thus during the last three generations the recognition of an ascertainable uniformity in human mortality has become part of the general stock of thought, and the accurate determination of the normal rate for all ages has been an accepted branch of scientific inquiry. The great mental and social changes in civilized men, which are implied in the general adoption of the practice of insurance, the growth of associated forethought and the decline of the gambling spirit, have no doubt made gradual and continuous progress in all the enlightened nations. But actuarial science, which originated in Great Britain, was long the peculiar and almost exclusive possession of British students, and even till now has been practised most fruitfully in its first home, mainly by the actuaries of life insurance institutions, but with important contributions from other inquirers, especially those in the service of the Registrar-General. The most complete storehouse of technical and practical learning on the general theory and on all its applications to life insurance practice is found in the successive volumes of the *Journal of the Institute of Actuaries.* The tables published by the Institute in 1872, founded on the experience to 1863 of twenty companies, and sufficiently described in *Ency. Brit.*, vol. xiii. p. 170, still remain the most authoritative expression of the mortality of insured lives, and have largely replaced all earlier standards in the valuations of the British companies, more than three-fourths of which, in their latest returns to the Board of Trade, compute their reinsurance reserves by the $H^{m.}$ and $H^{m.5}$ tables. But for several years a committee of the Institute and of the Scottish Faculty of Actuaries has been engaged in collecting and arranging for investigation the far vaster experience which has now accumulated in the hands of sixty companies, including the records of more than a million policies. The large basis of facts thus obtained will be treated with special reference to different classes of risks, and will throw much light on difficult questions of selection, which have hitherto been treated speculatively, or at least without the conclusive evidence of large averages, and are still more or less in controversy. Some of these will require more detailed notice hereafter.

It is only since the middle of the 19th century that actuarial science has rapidly advanced in other countries, chiefly under the stimulus of the extending practice of life insurance. Both in America and upon the continent of Europe the small business transacted by the pioneer companies was largely conducted on empirical and conjectural methods from year to year, English custom being consulted as a guide in fixing premiums. The Gotha Bank, the first institution to insure lives upon business principles in Germany, adopted at its foundation in 1827 a mortality table formed by Mr Babbage upon the basis of the Northampton Table, corrected from cursory notes upon the early experience of the Equitable Society, which had been given by its actuary to a general meeting of its members in 1800. The French companies, and several in Germany of later origin than the Gotha, took as their standard the so-called Table of de Parcieux, previously described; and this table, with modifications dictated by experience, was continued until very recently in general use in France. The Seventeen Companies' Table of 1843 was adopted by the Insurance Commissioners of Massachusetts, who in 1859 introduced the methods of state supervision of insurance now generally practised in the United States. This table, though long superseded in the esteem of actuaries in their ordinary work, is still the standard for official valuations in most states of the Union, a fact which has given it undue prominence. The so-called American Table, derived in 1868 from the limited experience of the largest American company during its earliest years, was the first important work of the kind done in America. In view of its narrow basis of facts, it has stood the test of time singularly well, and it is now in wider use than any other for computing the premiums of American companies. Its most marked difference from the standard British tables for insured lives is that it indicates a decidedly lower rate of mortality throughout the period of mature manhood, between the ages of thirty-five and seventy-five, though with a higher rate at the extremes of life; and this peculiarity is also found in American tables deduced from more recent and far larger experience.

Actuarial science has been widely cultivated in the *United States* of late years, the numbers and zeal of its professional students having kept pace with the extraordinary growth of life insurance. The aggressive activity of the companies through their agents and solicitors has brought the principles of the business home to the popular mind as in no other country, and a large number of periodicals are published devoted entirely to the subject of insurance, and striving constantly to make it intelligible and interesting to the general reader. These tendencies have been strengthened by the system of supervision practised by the states, which has also greatly influenced public opinion, directing attention in an extraordinary degree to certain special and technical features, to the neglect of more comprehensive and more useful criticism. In the official work of the state departments the actuary's province appears substantially to begin and end with the valuation of liabilities upon the net premium basis, which is applied with increasing strictness as the sole and final standard of solvency, and the determination by it of the "legal surplus" of each company. But a considerable number of professional actuaries have prosecuted their studies in a scientific spirit, and most of these since 1889 have been associated in the Actuarial Society of

America, which has established a high standard of professional competence in its examinations and transactions. The question how far the rate of mortality among insured lives in America is fairly represented by tables drawn from British experience has of course attracted much inquiry; and many companies have made important contributions to it from their own records, in several instances in the finished form of carefully graduated tables, each with an individual character, but all with some features which distinguish them as a group. By far the most comprehensive effort to establish a standard table for America is that of a committee of actuaries, for which, in 1881, L. W. Meech published the classified experience of thirty offices to the end of 1874, including most of the large companies in the United States, and embracing more than a million policies. The observations collected in this work have furnished materials for many important investigations, but the finished tables have rarely been applied in practice, being drawn from an aggregation of largely incongruous experiences, the influence of each of which upon the general average is indeterminate.

The business of life insurance upon the *continent of Europe* has extended rapidly since 1880, and has given an extraordinary stimulus to actuarial studies. Before 1883 the German companies computed their premiums and reserves by antiquated life tables, partly borrowed from early British usage and partly constructed by rough methods upon meagre observations. The most approved of these, as illustrating the duration of German life, was that prepared by Brune of Berlin in 1837 from the records for seventy years of an annuity society for widows, which practised careful medical selection of the husbands and kept exact mortality registers. In 1883 was published an admirable table founded on the combined experience of twenty-three German companies, which has superseded all other standards for ordinary valuations within the German Empire. The French companies generally continued to rely on the tables of de Parcieux, with modifications of their most glaring defects, until a still later date. In 1898 a committee of French actuaries published a new set of tables drawn from the experience of four of the principal offices in France, and these are now accepted as the best basis for life insurance practice by similar companies there. Schools of actuarial science have been opened in both Germany and France, and the professional actuaries of these countries, and of Austria and Belgium, have formed associations for the promotion of their pursuits. In 1895 delegates from the several institutes and societies of actuaries throughout the world met in general congress at Brussels, and again in 1898 in London, and in 1901 in Paris. Such sessions, which are held triennially, do much to broaden and harmonize the scope and aims of the profession.

Elaborate efforts have been made by several enlightened governments to employ the vast machinery of census bureaus for determining the general rate of mortality, and it has been the worthy ambition of able actuaries to devise trustworthy methods of utilizing the census returns for this purpose. The British Statistical Office, under Dr William Farr and his successors, and more recently the Swiss Federal Bureau of Statistics, have accomplished the best work in this direction, and the series of "English Life Tables," founded on successive decennial censuses, interpreted by the registered deaths during the intervals, are the most useful data now available for the average value of civilized life. But all such general tables are as yet but tentative and provisional. The imperfections of mortuary registries and of census returns are great, and result from a variety of causes, and corrections are largely conjectural. Until new and completer methods of collecting the facts are practised, the experience of life insurance companies promises to furnish the only mortality tables having claim to authority. Such a table, in the most trustworthy form now attained for it in each of the enlightened nations, is the result of immense intellectual labour for generations. A brief sketch of its evolution cannot suggest the amount of patient observation, of profound reflection, of ingenious mathematical research, which has gone to its production. As it approaches accuracy it becomes an epitome of human destiny, an essential element in momentous problems, historical and social. The work of correcting and improving it will go on with increasing zeal and insight. But the inquiry thus made does not aim, as some have imagined, at the formulation of a final law of mortality. The highest perfection attainable is but the expression of a temporary phase of human progress. It is already becoming evident that the general rate of mortality, and in particular the rate at each age of life, not only differs widely in different communities, but undergoes important changes in successive generations. A multitude of forces are at work in civilized society which must influence the average duration of life, such as the extension and concentration of many industries, the vast growth of cities, the progress of medical and hygienic science, the increase of wealth, comfort, and luxury, the changes in the frequency and destructiveness of war. It is plausibly maintained, on the one hand, that these and other causes have already added some years to the average lifetime of civilized man; and again, on the contrary, that their combined effect has been to lessen the sharpness of the struggle for existence, to rescue the weaklings from destruction and enable them to multiply, and so to weaken society at large. The final decision of the question will be found in the gradual modifications of the true table of mortality through successive epochs.

Rates of mortality.

For the purposes of life insurance the future of mortality tables looks to less ambitious problems. The business calls for exact equity in determining the value of all life contingencies, and therefore for the most precise forecast attainable of the dates at which the amounts assured must be paid. Some idea of the historical progress of this inquiry may be gathered from the accompanying table, which epitomizes the general characteristics of a number of typical tables of mortality, showing at ages which are multiples of five years the annual death-rate indicated by each of them. The comparison will be found interesting in many ways, most strikingly, perhaps, as suggesting what is confirmed by a detailed examination of the facts, that insured life on the average in Great Britain is decidedly inferior to that in the United States, but superior to that upon the continent of Europe, and especially in Germany. From a careful investigation of the published experience, Dr McClintock concludes: "It is an ascertained fact that after the first five years of insurance the probability of death," in Great Britain, "is fully one-fifth greater at any given age than the corresponding probability shown by American experience"; while "the average value of assured life in Germany is as much inferior to that shown in the H$^{m.}$ experience as that in America has been found to be superior."[1]

Table showing the number of persons who will die in a year out of 100,000 who have attained the given age, according to several tables of mortality :—

Age.	Northampton.	Carlisle.	Seventeen Offices.	Institute of Actuaries.	Institute of Actuaries.	American Experience.	Thirty American Offices.	Twenty-three German Offices.	Four French Offices.
	1780.	1815.	1843.	H$^{m.}$ 1869.	H$^{m.5}$ 1869.	1868.	1881.	1883.	1895.
10	916	449	676	490	400	749	648	...	364
15	922	619	694	287	325	763	659	...	515
20	1,403	706	729	633	833	780	676	919	690
25	1,575	731	777	663	1,050	806	703	854	628
30	1,710	1,010	842	772	920	843	748	882	698
35	1,870	1,026	929	877	1,000	895	821	999	807
40	2,090	1,300	1,036	1,031	1,132	979	936	1,176	975
45	2,401	1,481	1,221	1,219	1,294	1,116	1,120	1,437	1,236
50	2,835	1,342	1,594	1,595	1,712	1,278	1,417	1,814	1,638
55	3,350	1,792	2,166	2,103	2,219	1,857	1,893	2,506	2,258
60	4,023	3,349	3,034	2,968	3,064	2,669	2,653	3,535	3,213
65	4,902	4,109	4,408	4,343	4,461	4,013	3,864	4,943	4,675
70	6,493	5,164	6,493	6,219	6,284	6,199	5,778	7,276	6,897
75	9,615	9,552	9,556	9,816	9,949	9,437	8,779	10,647	10,241
80	13,433	12,172	14,040	14,465	14,577	14,447	13,407	15,516	15,119
85	22,043	17,528	20,509	20,988	21,010	33,555	20,363	22,211	22,332
90	26,087	26,056	32,373	27,945	28,244	45,455	32,815	32,356	32,225

No final explanation has been given, and there is no proof that the average life in America is longer than in England or Germany. But Dr McClintock inclines to

[1] *On the Effects of Selection*, by Emory McClintock (New York, 1892), p. 94.

believe that one potent cause of the great difference in the insured experience is that, while European offices have generally awaited applications, which are commonly prompted by some sense of need for insurance, the custom of American companies is actively to solicit business through agents. On the average, lives which are only induced by persuasion to insure are better than those which voluntarily apply. That this suggestion points out a real and perhaps an important differentiating influence upon groups of risks is not doubted, but the measure of its effects has not yet been determined. The question is one of many which yearly assume more prominence, and which, as a class, are conventionally termed problems of selection. Assuming that the general rate of mortality is precisely known, any deviation from it occurring in a special group of insured lives, as the result of some influence peculiar to that group, is called the effect of selection. If insurance were offered on equal terms to all, the feeble and dying would apply in disproportionate numbers, and the mortality would be excessive. To avoid this danger careful medical examinations are required, excluding risks which appear to be impaired; and this selection by the insurer uniformly reduces the mortality below the general average during the earliest years of insurance. During these years large numbers of the insured withdraw, either from inability or from indisposition to pay their premiums, but the motive to do so is weakest with lives which have become impaired. The average vitality is lowered by the loss on the whole of a superior class, and the average mortality of those who persist rises. The extent of this influence varies widely with the proportionate number of lapses and the motives which induce them, increasing in a startling degree when lapses multiply in a discredited company, and remaining small, or even at times doubtful, under very favourable conditions; so that the ascertainment of its amount in different circumstances, and for different groups of the insured, is a problem of extreme complication. Its importance is increased by two tendencies which have grown stronger in the practice of recent years: first, to permit at all times the withdrawal by any policy-holder of a substantial part of the technical or average reserve upon his assurance, a privilege which legislation and public opinion in the United States have extorted from the companies; and, secondly, the extensive introduction, under competition for public favour, of forms of policies which grant the option, at fixed dates in the future, between withdrawing the entire "accumulations," or technical reserve and surplus, and continuing the insurance. It is well known that at the maturity of these options the motive is strong for impaired lives to remain insured, and that the cash withdrawals are so largely of superior lives that the subsequent rate of mortality is much increased. Other problems in selection arise from varieties in the forms of policies. It is commonly recognized that there are general and marked differences between the mortality experienced upon assurances issued at low and those at high premium rates. Policies for short terms, on which the computed net rates are the lowest, have been found so unprofitable to the insurers that they are rarely granted, and only with a very heavy loading of the tabular value. Upon those insured for life, with annual premiums, there is a large and constant excess of death losses above the endowment assurances, while groups of policies with tontine or cumulative features or reserved bonuses, available only after surviving a term of years, uniformly experience a low mortality.

Problems of selection.

It is also to be remarked that, as the result of several investigations, it is found in general that the average amount of policies matured by death is higher than the average of all policies in force; and some actuaries incline to believe that tables of pecuniary loss might, for practical use, take the place of tables of mortality, since the actual claims are in units of money, not of lives. The vast field of inquiry opened to actuaries by these and many more special questions of selection promises to engross more and more of their attention and labour. The technical methods of reducing and treating the data of mortality have been brought to a high degree of perfection, but the necessity for a better classification of the data themselves, with reference to special groups of lives or policies, differentiated by social or local circumstances, by business methods, by forms of contract, by race or personal characteristics, must assume ever greater prominence. It is conceivable that, at some period hereafter, the practical reliance of the offices will be more upon tables to be computed for such special groups, from select experience, than upon those drawn from vast aggregates without discriminating among their somewhat incongruous divisions.

The mortality tables in common use, however, have been proved by a vast experience to furnish a safe and fairly equitable basis for the business of assuring lives. Assuming that the table shows how many of a large group now assured may be expected to end in each succeeding year, the present value of the claims upon them depends exclusively upon the rate of interest at which funds will accumulate. Exact foresight of this rate being impossible, the insurer must assume a rate which can with certainty be realized. The difficult problem of determining the limits of safety in this assumption attracts the more attention now, because of the recent persistent decline in the average productiveness of invested capital. The actuary is forced to observe that the interest factor in his calculations is much less definitely fixed by known facts than the mortality factor. The longer a contract has to run, the greater the effect of the difference in rate. The value of a payment to be made in thirty years is greater by above one-half with interest taken at 3 per cent. than at $4\frac{1}{2}$ per cent., and one to be made in thirty-six years is more than twice as great. Hence the most careful study of the forces determining for long periods the average rate of interest is fundamental in life insurance. But while the general theory of interest has been treated with masterly skill by some economists, it is but within a few years that the special problem of ascertaining what maximum rate can with entire safety be assumed, as obtainable for one or more generations hereafter, has excited wide discussion, and it has elicited singular diversity of judgment. The tendency of opinion is to hold that a progressive lowering of interest rates must result from the accumulation of wealth. In support of this belief it is pointed out that from 1872 nearly to the present time there has been a general and somewhat uniform decline in the yield of invested capital, as represented by government stocks, mortgage loans, savings bank deposits, and discounts in all commercial nations. The movement has been disguised by wide fluctuations, temporary or local, but has been on the whole world-wide and continuous, when great masses of capital, such as the investments of life companies, are kept in view. The fall has been greatest, too, in countries where rates were formerly highest, suggesting that as the great financial markets of the world become more intimately connected the normal rate of interest assumes a more cosmopolitan character, with an increasing tendency to equality among them. These considerations have had an important influence upon the computations of life insurance companies. In Great Britain, and commonly in continental Europe, the leading offices from the first assumed lower rates of interest than those in America, usually $3\frac{1}{2}$ or 3 per cent.; and the reductions in their

The interest factor.

estimates have as yet been moderate, only thirty-one out of seventy-four British offices having lowered the interest basis in their valuations reported to the Board of Trade. These returns show that of these companies only twenty-three now compute reserves upon a rate as high as $3\frac{1}{2}$ per cent., while forty-four assume 3 per cent., and seven a still lower rate. But in America, when the business first became important, 6 per cent. was a more frequent rate of investment than 5 per cent., and the laws of New York and of many other states countenanced the confident expectation of a permanent yield of at least $4\frac{1}{2}$ per cent. The rate of 4 per cent. adopted by the principal companies, and by the law of Massachusetts from 1861, was regarded as highly conservative. But as early as 1882 one important company began to reserve upon new business at 3 per cent., and since 1895 there has been a gradual change by the leading offices to $3\frac{1}{2}$ per cent., and in a few instances to 3 per cent., as the basis of premiums and of reserves upon new policies. Serious efforts have been made to induce legislation which will gradually establish one of these rates as a test of technical solvency.

There are not wanting, however, indications that the protracted decline in rates of interest in the world's markets may have been checked, and even that a reverse movement has begun. Rates of discount everywhere, interest on government loans except in America, and on mortgage loans in Europe, on the whole advanced during 1897–1900, the minimum average rates having been reached, after twenty-five years of gradual reduction, in 1897. These facts are entirely consistent with the conclusions suggested by the history of the subject. No uniform or secular tendency to reduction in the average rate of interest, which is the index of the average productiveness of capital, not of its amount, can be found to have prevailed. Fluctuations in the average rate are found, quite independent of the local and temporary fluctuations, which are often extreme; and these long tidal waves of change have at times, for generations together, risen and fallen with some approach to periodicity. The prevailing rate has been a little lower on the average in the 19th century than in the 18th, but was lower through the middle decades of the 18th century than through those of the 19th. On the whole, it seems clear that the accumulation of wealth in itself has no necessary tendency to diminish the productiveness of capital; that this productiveness, on the general average, has not materially varied in many generations; but that the promise and expectation of productiveness which prompt the demand for its use depend upon the activity of enterprise, growing out of the prevailing spirit of hope; upon the rapidity with which new inventions are made, industries extended, and floating or loanable capital expended in permanent works. These conditions are subject to fluctuations extending through considerable periods, so that for a number of years the rate may be higher, and then for a similar series of years lower than the normal rate, determined by average productiveness, but always tending to return to this normal rate, as the tide-swept surface of the ocean to its normal level. With this principle in view, it may be affirmed that, since the years 1895–99 were, on the whole, the period in which the average rates of interest were the lowest ever known throughout the commercial world, and since there were already unmistakable indications of an incipient advance, any rate the assumption of which for life assurance investments proved safe through these years may with much confidence be assumed for an indefinite future. Neither economic science nor history gives support to the belief, so often expressed, that a progressive decline in interest is the necessary result of increasing wealth, and must be accepted as a law of our industrial civilization. And while the excess of the average yield of capital in America, above that of the older nations, is diminished as the facilities of transfer and exchange increase, there is no reason to conclude that it will disappear for generations to come. It seems, therefore, that the general assumption of 3 per cent. for the valuation of British offices, and that of $3\frac{1}{2}$ per cent. which is becoming the accepted standard for the companies of the United States, should command unquestioned confidence.

Assets and reserve.

The present value of all the sums the future payment of which is promised by its policies, makes up the amount which the company must in some form possess, and must accumulate at interest, to meet these payments. If all insurance were purchased for cash (single-payment policies) this amount would be its necessary reserve. But the system of annual premiums, adopted for the convenience of the insured, is so nearly universal, that it has controlled the form in which the subject is conceived by actuaries as well as by the public. Let a mutual company be asked to insure one thousand healthy men, each aged thirty, for life for \$1000 each. It assumes that their lives will end substantially in accordance with an approved table of mortality, and that the price it receives for its contracts can be improved at compound interest until they mature. Making these assumptions conservative, it may perhaps value at this time the entire million of dollars to be paid in the future at \$331,407. But as a provision for the expense of management, and as a margin to protect it against all contingencies, such as excessive mortality or losses upon investments, it may add a charge of 30 per cent., with the understanding that whatever proves from time to time to be excessive in the price shall be equitably returned to the insured. Each policy then is sold for \$430·83. The insurance becomes the property of the insured, the price of it belongs to the company. But the actual transaction, under the customary system, is this: The insured, instead of paying the price in cash, grants the company an annuity due upon his life, making one payment for the first year. These annuities, if valued by the same assumptions of mortality and interest as the insurance, may be for \$21·76 each, the average present value of them being the price of the policy, or \$430·83. It is evident that while the company has sold its contracts for full value, it has invested 95 per cent. of the proceeds in the annuities, and has but 5 per cent. in hand for other purposes, less than one-fourth of the amount it has prudently assigned for expenses and as a margin upon its own assumptions. Each of the insured takes his policy subject to a lien or mortgage to secure an annuity worth 95 per cent. of its price; and of each annual payment subsequently made, the excess above his share of the expenses of the year, including losses by death, is applied to reduce this lien. In fact, if there were no expense and no deaths, it would still require fifteen annual payments by each of them, and compound interest for fifteen years upon these payments, to extinguish the debt. After thirty years, if we suppose all the contracts to have been kept, there may be 681 survivors of the 1000 insured; and their policies, upon the original assumptions, are now worth \$421,471·58, the amount which, with its interest, will pay them at maturity. The company must have this sum secured, together with a proper addition for expenses and a margin for safety. The annuities of \$21·76 upon each survivor are now together worth \$152,180·69. If this sum be still held to include a margin of 30 per cent. for all possible needs apart from expected death claims, the company must hold in other good investments than its future annual premiums at least \$304,409·52 as a guaranty for these contracts. Thus it is evident that the true assets of an active company must always consist in

large proportion of the future premiums secured to it by a lien upon its policies. But, in common language, its assets are understood to include only the funds held or invested by it in other forms; and its reserve is defined as that sum which, together with the appraised value of its future premiums, will suffice to pay its policies. This conception of the reserve would be strictly logical if the valuation of the premiums were exact. But no general method for this valuation has any claim to scientific precision. The net premium method generally adopted, and made obligatory by the laws of many of the United States,[1] has its important uses, as an aid to the management of the company, both in determining its condition and the tendencies of its progress towards strength or weakness, and in ascertaining the amount which can with entire safety be treated as surplus. The reserve thus computed is properly kept in view by actuaries, and its integrity is jealously guarded by all companies in good standing. When, however, a net valuation of liabilities by one fixed standard is imposed upon all companies by law, and the continuous possession of the technical reserve is made the condition of solvency, much injury is done in several ways. This reserve, being definite and easily calculable, has obtained undue prominence in the public mind and in legislation, as the one infallible test of a company's trustworthiness, to the exclusion of others, at least equally important, which are mainly matters of practical judgment. As a merely numerical test it is widely unequal in its application to companies with different scales of office premiums. In some instances, too, companies have been pronounced insolvent, and forced into costly and wasteful liquidation in the courts, to the irretrievable loss of their members, because of a technical deficiency of reserve, which would without doubt have been speedily recovered if they had been continued under wise management. The assumptions on which the net reserve is computed are all taken with wide margins upon the side of safety. It is assumed that future interest will be lower than the average now obtained; that the mortality will be that indicated by a table, which represents a probable maximum; and that the entire margin for all purposes provided in the loading on future premiums will be absorbed in expenses alone. These possible sources of surplus, taken together, give an immense recuperative power to the administration of a well-established company, and a rule which excludes them from consideration is not justified by business principles.

A prevailing fallacy in the popular mind, which has grown out of the practice of net valuations, is the inference that the average technical reserve represents the value of the individual policy. Each risk is properly assumed at its probable or average value at the time. But from that moment its circumstances are constantly changing in directions then unforeseen, and the expectation that such changes will occur is the motive for insuring. To treat them singly as unchanged in value at any later time is as illogical as it would be after some have matured. The actual value of any one risk borne by a company is indeterminate. It may become a claim to-morrow, or not for a generation to come. In the former case the company must now hold funds to pay in full; in the latter, the future premiums will perhaps more than suffice, so that no present reserve is needed. An entire reserve for the whole body of risks is essential, and its amount is definite, upon the reasonable assumption that the general average remains undisturbed by individual changes. A distinct reserve for a single policy is inconceivable. To recognize it is to deny the first principle of insurance. The average amount by which the reserve of a company must be increased, because of the existence of policies of a given class, is to the actuary an important fact, and is commonly accepted as his best guide in the distribution of surplus. But a popular theory has seized upon the assignment of this average sum to each policy, in the technical shorthand of the actuary, and holds that it is in each case the special property of the owner of that policy. The practical consequences are serious when, as often, many of the insured cease to pay premiums, and each demands the amount of the supposed individual reserve. His right to claim it is countenanced by a widespread public opinion, which has inspired statutes in Massachusetts and some other states, requiring companies to redeem all policies lapsing after the first two or three years of insurance at a price founded on the technical reserve. Yet, in by far the majority of instances, the lapse of policies is of itself a loss to the company. It is deprived of business secured at much expense before it has derived any of the advantage expected from the accession. It is compelled to pay numbers of its profitable contributors for ceasing to contribute. The burden falls in a mutual company upon the insured who fulfil their contracts. Such laws favour those who withdraw after few payments at the cost of those who maintain their insurance to the end, or for many years. But the American companies have largely yielded to the pressure of a mistaken public sentiment, and compete for favour by promising excessive values in case of surrender. Similar conditions exist in Switzerland, Austria, and other countries in which the business is minutely regulated by Government bureaus. But in Great Britain the companies are largely free from such influences, while an open market exists for policies which have a commercial value, with results on the whole more satisfactory to all parties interested than any rule of compulsory purchase which could be enforced on the companies.

Industrial insurance.

A special form of life insurance, which has had a wonderful development of late years, is the family insurance of the labouring people by the so-called industrial companies. Until recently this class of people had no satisfactory share in the benefits of insurance, although the friendly societies in Great Britain, and many forms of beneficial associations in the United States, were attempts, often in part successful, to provide for special wants, mainly for maintenance of the sick and for the costs of burial. Most of them, however, lacked a scientific basis and an efficient and permanent organization, while thousands of them were grossly mismanaged, and proved expensive burdens to their members. In Germany an elaborate scheme of compulsory insurance for labourers was established by a law of the empire in 1883, and extended in subsequent years; and similar legislation has been enacted in several other countries, most thoroughly in Switzerland and Austria. The ultimate value of this great social experiment cannot yet be determined. That it relieves much want and does a great service in preventing pauperism is not disputed; but that it also undermines the independent spirit of the people, and that it imposes a burden upon the national industry, which not only hampers it in the world's competition, but reacts with special injury upon the class it aims to benefit, are criticisms not satisfactorily answered. No scheme of Government insurance, certainly, is adapted to a people impatient of paternalism in its rulers and thoroughly habituated to voluntary association for all common interests. The solution of the great problem, how to apply the insurance principle to the most pressing needs for protection of the class supported by the wages of labour, is now sought in Great Britain and America mainly in the universal offer to them of industrial insurance. The Prudential Assurance Company of London was the pioneer in this work, beginning it experimentally in 1848, but

[1] It is fully explained in the earlier article in *Ency. Brit.* (9th ed.), vol. xiii. pp. 176, 177.

gradually adapting its methods to the new field, until a generation later they showed themselves so efficient that an extraordinary growth resulted, and has continued without interruption. This company and others upon a similar plan assure whole households together for burial expenses in case of death, and a small provision for dependents or for old age, charging as premiums small fractions of a day's wages, which must be collected weekly. The great difficulties encountered were the cost of small and frequent collections, and the high rate of mortality, which is from 40 to 90 per cent. more than that in the experience of the older companies. This high death-rate is due not so much to the fact that life is shorter in the labouring class, as to the lack of efficient medical selection, which would be too costly. The premiums, at best, must be made higher than in offices insuring for annual payments, but the demand for insurance extended as rapidly as the system could be explained, and the Prudential is said to have now in force 12,000,000 policies, with an average premium of twopence a week, secured by an accumulated insurance fund of £17,000,000. It has superseded a host of petty assessment societies of various classes without scientific basis or business responsibility, which deluded and disappointed the poor. The British Government in 1864 undertook to administer a plan for the insurance of working men, but in thirty years accomplished less than the work of one private company in a year. Eleven joint-stock companies and two mutual companies transact industrial business in the United Kingdom, besides a large number of friendly societies which have adopted similar plans. No complete statistics of their operations are available, but the claims paid by them in 1898 amounted to more than £3,900,000.

The system of industrial insurance was introduced into the United States in 1876. Its growth, though much more rapid than in Great Britain, was at first slow compared with that of recent years. The following table, condensed from the *Insurance Year-Book* for 1900, is an interesting exhibit of the character as well as of the extent of this form of insurance among working men :—

Industrial Insurance in the United States.

Year.	No. of Cos.	Insurance written.	Policies in force 31st December	Insurance in force 31st December.	Premiums received.	Losses paid.
1876	1	$400,000	2,500	$248,342	$14,495	$1,958
1880	3	34,212,131	228,357	19,590,780	1,155,360	430,631
1884	3	89,150,302	1,076,422	108,451,099	4,486,612	1,499,432
1888	7	161,260,335	2,788,000	302,033,066	11,939,540	4,162,745
1892	11	276,893,923	5,118,897	582,710,309	24,352,900	8,847,322
1896	11	360,852,458	7,375,688	886,484,869	40,058,701	13,420,336
1899	16	519,789,085	10,048,625	1,292,805,402	56,159,889	17,023,485

It is remarkable that the average weekly premium in the United States appears to be about 10 cents, or two and a half times as high as in Great Britain. The average policy is also proportionally larger, and the progressive increase in its amount deserves notice. At the rate at which the practice of insurance is now extending among working men, it would require but few years for it to become as universal in these countries as any paternal government has aimed to make it by compulsion.

Surplus distribution.

On the subject of surplus and its distribution little need be added. The very large sums officially reported as surplus by many American companies, and computed by net valuations of their contracts, are to be used with extreme caution as a means of comparing their merits. The character of their risks and their investments, the actual premiums and other terms of their contracts, are at least equally important elements of the question. But when these are satisfactory, and no reason appears for holding a large margin beyond the computed reserve, it is safe to treat the technical surplus as real, and in mutual companies to distribute it in some form among the insured. Besides the several bonus systems mentioned in *Ency. Brit.*, vol. xiii. p. 178, the so-called "contribution plan" deserves notice, since its theory is generally accepted by the American companies, though carried out with many variations in detail by different actuaries. The principle is, that since each of the insured is charged in his premium a safe margin above all probable outlays, when the necessary amount under each head becomes determinate the several excesses should be returned to him. It is therefore sought to calculate what each member would have been charged for net premium and loading had the mortality, rate of interest, and expenses been precisely known beforehand, and to credit him with the balance of his payments. As a corollary of the theory of net valuations, which regards every life insured as an average life until its end, and assumes the rigid accuracy and equity of all the formulas employed to represent business facts, it is consistent and complete. But many minds find it more curious than practical, and prefer to seek equity in faithfulness to contract rights rather than in adjustments which they deem too refined, if not fanciful. The plan has met with little favour in England, where surplus is more commonly distributed on general business principles. Enormous bonuses were saved by the British offices out of the excessive premiums at first collected, and by the American companies during the epoch of high interest rates. But the use of more accurate tables, the decline in interest, and the increased expenses of later years, have vastly reduced the apparent profits. Former methods of distributing surplus, when ascertained, have largely given way in America to novel and more complex plans. The Tontine idea, historically familiar, was for many years imitated by some offices in their assurance contracts. All premiums above outlay, in a company or a class of policies, were accumulated, only stipulated amounts being paid on death claims meanwhile maturing, with no compensation to its members withdrawing, until the end of a fixed term, when the whole fund was apportioned to the survivors. Large returns were sometimes made, but many who could not maintain their policies were dissatisfied. "Semi-tontines" followed, partly meeting the difficulty by pooling only the surplus, and allowing some return in case of withdrawal. But these cruder forms of contract are now largely superseded by various "reserve-dividend," "accumulation," "bond," and "investment" policies, with options at stated periods between cash withdrawals and continued assurance, the simple inducement to provide against death being more or less merged in that of making a profitable investment of capital. New and ingenious forms of contract are devised to meet the needs and fancies of all classes. This tendency is promoted by the growing wealth of the community, and is fostered by the companies, because small and frequent returns are far less impressive and less useful than the large accumulations of long periods. With the general increase of wealth and intelligence life assurance and investment become ever more closely associated.

A remarkable difference in the development of life insurance between Great Britain and the United States is, that among the British companies only one-third of the assurances in force is in purely mutual institutions, while in America the proportion exceeds four-fifths. In both countries there are also "mixed" companies, in which policy-holders receive a fixed percentage of the realized surplus, often from three-fourths to nine-tenths of the whole, but the control and management are in the hands of shareholders. These form the great majority of the proprietary offices in the United Kingdom, and the profits of the business have been large. The amount of capital paid in by shareholders of forty-one joint-stock companies was £5,931,000, but the capital authorized and subscribed was much more, and the subscriptions have often been paid, wholly or in part, by credits from surplus. The shares of these companies, at market prices, represent a value of at least £50,000,000, but the dividends upon these shares are drawn largely from other business, many of the largest and most

prosperous corporations conducting also fire insurance, and some of them marine or casualty insurance.

No branch of social statistics has been more diligently studied than this, and several governments publish classified accounts of corporations insuring lives within their jurisdiction. But the reports are not uniform in method and in periods covered, and aggregates derived from them must be used with reserve. A few tabular summaries of the general condition and growth of the business in the principal nations will illustrate the importance which the institution has attained, and its present tendencies and rate of development. By the Life Assurance Companies Act, 1870, and amendments made in later years, each company issuing policies in the United Kingdom must deposit with the Board of Trade every year its revenue account and balance-sheet for the preceding year, and must at fixed intervals cause an investigation of its financial condition to be made by an actuary, and furnish the public through the Board of Trade with the detailed results, in forms prescribed by the Act. Thus these returns are the highest authority for the conditions and operations of the offices, which often supplement or anticipate them by voluntary publications. In the United States the laws exact still more minute and much prompter reports to the insurance departments of the states; and every annual statement is required to show the results of an actuarial investigation, so that the fullest information concerning the business in any year and the condition of each of the companies is made public early in the following year. All these facts are diligently collected, classified, and compared by statisticians for several standard annuals in both countries, especially the *Post Magazine Almanack* and *Bourne's Directory* and *Manual* in London, and *The Insurance Year-Book* of the Spectator Company in New York. The first table contains a condensed summary of the accounts of the British companies for 1895–99, so arranged as to show in general the volume of the business, its rate of growth, and its financial results. The aggregates, however, are not precise for any date, since for some of the companies the fiscal year and the calendar year do not coincide.

Aggregate Revenue and Assurance Accounts of British Companies.

Rendered in . .	1895.	1896.	1897.	1898.	1899
No. of Cos. reporting . . .	88	85	87	85	85
	£	£	£	£	£
Total Funds . .	188,372,536	196,010,383	204,379,825	214,137,829	224,372,455
Receipts—					
Premiums . .	16,862,514	17,637,683	18,657,348	19,604,748	20,199,386
For Annuities .	1,415,769	1,742,387	2,365,466	2,330,381	1,985,892
Interest and Dividends . . .	7,252,747	7,393,739	7,576,282	7,964,761	8,198,530
Appreciation of Investments .	189,614	198,286	401,206	196,515	282,031
Miscellaneous .	90,155	43,896	87,551	867,067	79,266
Total . . .	25,810,799	27,015,991	29,087,853	30,963,472	30,745,105
Disbursements—					
Death Claims and Endowments .	12,774,929	12,792,252	13,614,138	13,191,929	13,176,900
Bonuses and Reductions of Premiums . . .	1,085,490	1,054,089	1,008,220	1,201,353	1,028,396
Surrenders . .	1,006,851	981,465	973,737	993,397	930,339
Annuities . . .	1,054,276	1,135,282	1,230,700	1,377,819	1,504,225
Commissions and other Expenses	2,504,429	2,584,635	2,714,975	2,840,424	2,899,497
Losses and Depreciations . .	39,288	148,835	245,336	61,586	112,591
Dividends to Shareholders .	531,004	616,690	573,562	458,961	361,919
Miscellaneous .	134,903	64,890	471,455	949,648	483,051
Balance, Increase of Funds . . .	6,679,629	7,637,847	8,255,730	9,888,355	10,248,187
Total . . .	25,810,799	27,015,991	29,087,853	30,963,472	30,745,105
Assurances in force . . .	500,006,066	529,184,344	551,645.412	562,344,968	587,907,816
No. of Policies in force . . .	1,291,148	1,428,137	1,494,000	1,543,026	1,698,043

Industrial Companies (Joint-Stock).

Rendered in . .	1895.	1896.	1897.	1898.	1899.
No. of Cos. reporting . . .	11	11	11	11	11
	£	£	£	£	£
Total Funds . .	11,875,423	12,290,052	14,329,635	15,437,518	16,969,333
Receipts—					
Premiums .	5,927,835	6,382,927	6,616,613	7,151,109	7,570,150
For Annuities .	791	10,550	6,114	5,734	1,635
Interest and Dividends . . .	368,639	396,850	436,303	480,264	523,361
Appreciation of Investments .	3,739	953	53	1,363	1,788
Capital paid in .	101,406	104,488	111,064	116,353	104,433
Miscellaneous .	32,051	42,586	39,067	43,644	49,163
Total . . .	6,434,461	6,938,354	7,209,214	7,798,467	8,250,530
Disbursements—					
Death Claims and Endowments .	2,547,832	2,418,754	2,774,101	2,751,230	2,912,046
Bonuses and Reduction of Premiums . . .	27	13	3	579	288
Surrenders . .	20,393	25,220	24,353	27,702	37,836
Annuities . . .	2,418	3,806	4,151	4,733	5,142
Commissions and other Expenses	2,572,730	2,788,915	2,919,529	3,159,906	3,272,538
Losses and Depreciations . .	364	208	92	4,269	4,041
Dividends to Shareholders .	231,256	286,119	333,644	382,831	386,771
Miscellaneous .	93	690	46	500,075	100,053
Balance, Increase in Funds . . .	1,059,348	1,414,629	1,153,295	967,142	1,531,815
Total . . .	6,434,461	6,938,354	7,209,214	7,798,467	8,250,530
Assurances in force . . .	128,064,110	144,142,569	147,187,937	152,073,819	165,988,493
No. of Policies in force . .	13,324,778	14,990,581	15,301,621	15,860, 54	17,230,712

A similar table follows, summarizing the accounts of American companies reporting to the New York Insurance Department. The income and outgo here include those of the industrial business, but the assurance account is of ordinary assurances only.

Aggregate Revenue Account of American Companies having Agencies in New York.

	1895.	1896.	1897.	1898.	1899.
No. of Cos.	35	36	35	36	37
	$	$	$	$	$
Funds . .	1,142,419,926	1,228,324,342	1,334,051,345	1,451,116,914	1,576,334,673
Receipts—					
Premiums .	211,621,718	218,675,475	233,330,276	247,689,649	276,637,528
For Annuities . . .	3,577,584	5,038,846	6,064,135	5,027,385	6,400,834
Other Income, Interest, Dividends, &c. . . .	51,697,900	55,658,786	61,873,768	68,093,594	72,907,643
Total .	266,897,202	279,373,107	301,268,179	320,810,628	355,946,005
Disbursements—					
Death Claims .	71,925,224	76,110,579	76,977,875	81,409,305	92,800,710
Endowments . .	10,471,736	12,026,328	12,725,176	13,872,118	15,323,258
Annuities .	2,394,662	2,631,399	2,985,255	3,367,804	3,664,723
Bonuses, Dividends to Policy Holders .	15,297,604	17,083,169	18,425,197	19,700,600	20,917,143
Surrenders	22,889,493	26,368,039	26,431,31[illegible]	26,437,777	23,080,965
Commissions, Taxes, and other Expenses . .	62,052,872	64,160,732	67,582,025	72,898,502	86,622,697
Dividends to Shareholders .	741,313	793,052	739,554	829,151	745,063
Total .	185,772,904	199,173,298	205,866,394	218,515,257	243,154,559

Assurance Account.

	1895.	1896.	1897.	1898.	1899.
	$	$	$	$	$
Ordinary Assurances in force .	4,818,170,945	4,967,576,418	5,255,725,545	5.630,053,311	6.265,908,078
No. of Policies in force . .	1,877,808	1,975,747	2,155,241	2,364,597	2,700,550

The reports of the insurance department of New York cover more companies than those of any other state. The institutions not included in them are about thirty-five in number, mostly small and local. In the aggregate, as appears by their statements to the authorities of the states in which they organized, they held, 31st December 1899, in accumulated funds $24,470,240; their aggregate income for the year was $9,972,260; with assurances in force at the end of the year, $231,301,327. The New York reports, therefore, may be accepted as representing 95 per cent. of the entire business of the United States. On the other hand, while the amount of life assurance done by British and other foreign offices in the United States is insignificant, fourteen companies of the United States have agencies in Canada (ten for new business), and four transact business in Europe and in other parts of the world. The foreign operations of these companies brought in 1899 premium receipts of $34,609,291, and their assurances in force upon foreign lives was $826,537,158. Thus the home business of the American companies is in the aggregate about 87½ per cent. of the whole.

There are fifteen companies engaged in industrial insurance in the United States, whose aggregate assurances in force were as follows, on 31st December of each year:—

	1895.	1896.	1897.	1898.	1899.
	$	$	$	$	$
Industrial Assurances	819,521,573	886,484,869	995,545,736	1,109,526,870	1,292,805,402
Number of Policies	6,943,769	7,375,688	8,000,636	8,794,178	10,048,625

The statistics of life assurance in the Dominion of Canada are collected and published by the insurance department with the same diligence as in New York. A summary follows of the ordinary life insurance business transacted by the Canadian companies during the years 1895 to 1899. Sixteen of these are joint-stock companies, the one mutual company holding about 9½ per cent. of the assurances in force, and issuing about 8½ per cent. of the new assurances in 1899.

Life Insurance Business of Canadian Companies.

	1895.	1896.	1897.	1898.	1899.
No. of Companies	13	13	16	16	17
No. of Policies Issued	22,131	23,827	33,840	41,686	42,054
Assurances of New Policies [1]	$32,027,664	$31,511,074	$38,576,944	$42,984,588	$48,890,881
Total Premiums received	6,259,758	6,905,674	7,469,350	8,291,226	11,334,833
Income from other Sources	1,508,611	1,576,037	1,992,250	2,074,299	2,183,242
Policy Claims paid	1,784,762	2,263,575	2,420,631	2,540,406	2,873,845
Expenses	1,729,351	1,806,656	2,138,898	2,433,487	2,616,220
Dividends on Capital	132,113	76,291	83,774	87,956	88,510
Capital Stock paid in	848,729	856,041	1,480,958	1,816,362	1,976,679
Life Assurance Funds (exclusive of Capital)	34,658,727	38,326,142	42,108,403	46,650,716	51,785,129
Assurances in force 31st December [2]	204,414,025	214,208,998	231,327,406	252,077,492	279,962,174

There are also fourteen British companies and fourteen of the United States which report Canadian business to the Government office, though five of the former and four of the latter group have ceased to issue new policies there. The financial operations and policy accounts of these companies are included in their statements to the British Board of Trade and to the New York State Department. The assurances in force upon Canadian lives in these companies were as follows:—

	Dec. 31, 1895.	Dec. 31, 1899.
14 British Companies	$34,451,168	$38,025,948
14 American ,,	93,402,067	104,460,607

None of the tables given above include the business done by assessment insurance associations, orders, and companies, most of which is of a local or ephemeral character. The volume of it in

Life Assurance Companies on the Continent of Europe.
Business of 1898.

	New Assurances.	Total Assurances.	Premiums Received.	Other Incomes.	Claims Paid.	Annuities Paid.	Funds.	Capital Paid In.
Germany—								
28 Joint-Stock Cos.	£20,670,633	£173,436,668	£8,112,066	£2,083,809	£2,503,592	£382,825	£49,960,803	£1,706,555
34 Mutual ,,	17,348,753	178,667,545	6,954,597	2,081,328	2,949,043	180,623	56,577,207	
Total	£38,019,386	£352,104,213	£15,066,663	£4,165,137	£5,452,635	£563,448	£106,538,010	...
France—								
17 Joint-Stock Cos.	£13,923,178	£142,288,325	£1,427,526 [3]	£270,694	£2,148,363	...	£80,139,881	£1,677,127
Austria—								
10 Joint-Stock Cos.	£11,120,370	£73,441,978	£2,472,091	£708,237	£1,112,070	£56,951	£18,921,284	£1,156,250
10 Mutual ,,	3,507,042	23,893,985	931,154	239,943	367,337	27,493	6,388,407	
Total	£14,627,412	£97,335,963	£3,403,245	£948,180	£1,479,407	£84,444	£25,309,691	...
Russia—								
8 Joint-Stock Cos.	£7,994,630	£45,398,731	£1,665,584	£471,861	£562,273	£47,133	£9,792,693	£1,212,800
Holland [4]—								
22 Joint-Stock Cos. 2 Mutual ,,	£3,466,040	£36,654,367	£1,376,157	£206,959	£365,617	£119,975	£6,699,513	£395,336
Sweden—								
12 Joint-Stock Cos. 3 Mutual ,,	£5,220,167	£28,457,540	£904,299	£233,373	£248,016	£39,107	£6,186,412	£622,492
Switzerland—								
5 Joint-Stock Cos. 2 Mutual ,,	£1,002,215	£19,220,874	£762,973	£202,925	£326,824	£48,821	£5,480,976	£187,663
Denmark—								
3 Joint-Stock Cos. 3 Mutual ,,	£1,458,099	£9,179,379	£438,252	£209,525	£311,064	...	£5,744,744	£49,451
Italy—								
3 Joint-Stock Cos.	£1,194,736	£8,450,982	£341,054	£119,582	£131,739	£16,954	£2,107,397	£555,380
Norway—								
4 Joint-Stock Cos. 2 Mutual ,,	£858,021	£5,254,503	£175,099	£62,823	£43,980	£18,797	£1,304,915	£118,851

[1] Including renewals, but exclusive of industrial policies.
[2] Exclusive of industrial assurances.
[3] Credit balance after payment of claims, &c.
[4] The largest company is included only in the last two columns.

the United States and Canada was very large a few years ago, but it is rapidly declining in amount and in public confidence, except where it is made an incident of membership in a benefit society. No general statistics relating to it are sufficiently comprehensive and accurate to be of value.

In the principal countries of continental Europe life assurance is offered by the chief international institutions of Great Britain and the United States, and their policies are in force probably to the aggregate amount of £140,000,000. The domestic companies have been stimulated to increased activity by the aggressive canvassing of the foreign agencies, and the business in recent years has grown rapidly, until now the total sum assured upon lives on the continent of Europe is little less than a milliard of pounds sterling. The preceding table collects in outline the accessible information concerning the life insurance companies of the countries named, as shown by their published reports at the close of 1898, all amounts being reduced to sterling money. Where the annuities paid are not specified, they are included in claims paid. The column of "Funds" gives the amount of accumulations held for life assurance in addition to the share capital, but in a few instances amounts held for other branches of business are included.

In Belgium there are four flourishing life companies, with accumulated funds of at least £1,500,000, and paying large dividends to shareholders. There are also six in the Balkan peninsula, three of them at Bucharest, most of which transact several kinds of insurance and are prosperous, though of only local importance. In Australia there are eleven domestic companies in the field, besides the Government Life Insurance Office of New Zealand. These Australasian offices together collected in 1899 premiums to the amount of £2,879,642; paid for death claims, £1,097,279; for endowments, £469,894; for annuities, £44,265; for surrenders, £517,714; and in cash bonuses, £69,458. They issued new assurances for £9,194,752, and held at the end of the year accumulated funds of £26,783,808. There are three small domestic corporations for life insurance in India, one in China, and two in Cape Colony, all conducted by Englishmen; but Brazil has five, the Argentine Republic one, Mexico two, and Japan thirty-three companies, organized and carried on by native managers. (C. T. L.)

V. Marine Insurance.

Marine insurance long antedates the kindred businesses of fire and life insurance. Villani, a 14th-century Florentine historian, speaks of marine insurance as having originated in Lombardy in 1182. This proves, at least, that in his day it was no novelty. It is mentioned in a Pisan ordinance of 1318, and in Venetian public documents of the early years of the 15th century. The earliest form of policy known is that given in the Florentine statute of 1523. It is uncertain whether insurance was introduced into England directly from Italy or by way of Flanders. The earliest policies issued in England which have yet been discovered are in Italian, but the subscriptions are in English (*Santa Maria di Venetia*, Cadiz to London, 1547, *Santa Maria de Porto Salvo*, Hampton to Messina, 1548).

History.

The earliest known policies in English are one of 1555 on the *Sancta Crux* "from any porte of the Isles of Indea of Calicut unto Lixborne," and one of 1557 on the *Ele* from Velis Maliga to Antwerp. In the *Sancta Crux* policy there is no detailed statement of perils insured against, or of risks undertaken by the underwriter; the whole obligation of the underwriter to the assured is embodied in the following words:—"We will that this assurans shall be so strong and good as the most ample writinge of assurans, which is used to be maid in the strete of London, or in the burse of Andwerp, or in any other forme that shulde have more force." This reference to Antwerp usage is 67 years before the date of Malyne's statement that all Antwerp policies contained a clause providing that they should in all things be the same as policies made in Lombard Street of London. The wording of the English policies written in Italian is very much simpler than the Florentine form of 1523, from which it almost seems that the wording used in England followed an earlier Italian form. But even the Italian policies in the two *Santa Marias* mention the uses and customs of "*questa strada Lombarda di Londra*" as the standard of the assurance they afford. The next most ancient policy we possess is dated 1613; it covers goods on the *Tiger* from London to "Zante, Petrasse, and Saphalonia." This document is much more ample than any of those already mentioned: it details the perils insured against in words closely resembling the Florentine formula of 1523, and differing only slightly from the form adopted by Lloyd's at a general meeting held in 1779, and afterwards incorporated in the Sea Insurance Stamp Act of 1795, which is the stem form of all modern British and American marine insurance policies.

While the form of the insurance policy was thus developing, there was a singular absence of legislation (and, as far as we can yet trace, of litigation) on the subject. Till 1601 differences seem to have been generally settled by arbitration. This accounts for the poverty of the British Admiralty records in matters of marine insurance. In 1601 a special tribunal was established by statute for summary trial of disputes arising on insurance policies; but, owing mainly to the opposition of the common-law judges, the new court languished, and by 1720 it had fallen into utter disuse. Park states that not more than sixty insurance cases were reported between 1603 and 1756. Consequently, when Lord Mansfield came to the Court of King's Bench in the latter year, he found a clear field. He practically created the insurance law of England. He made use of all the Continental ordinances and codes extant in his day, taking his legal principles largely from them; the customs of trade he learnt from mercantile special jurors. Subsequent legislation referred solely to the prohibiting of certain insurances (wager policies, &c.), the naming in the policy of parties interested therein, and the stamp duty levied on marine insurances. In 1894 Lord Herschell introduced his Marine Insurance Bill, which endeavoured "to reproduce as exactly as possible the existing law relating to marine insurance." This Bill has been examined and amended by various bodies of parties interested, and was referred to a committee. It was reprinted in 1899, but has not yet become law. In America a similar fate has attended the insurance code, forming part of the proposed civil code of New York, completed and published in 1865, of which a very slightly altered version was adopted in California and has been in effect there since 1st January 1873. On the Continent legislation at first took the form of local ordinances of commercial cities, such as Barcelona (1434–1484), Florence (1523), Burgos (1538), Bilbao (1560), Middelburg (1600), Rotterdam (1604–1655). In the third quarter of the 16th century Rouen produced a handy guide to marine insurance, *Le guidon de la mer*; and in 1656 Cleirac published there his *Us et coutumes de la mer*. This was followed in 1681 by the *Ordonnance de la marine*, which, through Lord Mansfield, had a great effect on English case law. In 1807 France produced the *Code de commerce*, on the model of which nearly every European nation has issued a similar code. Probably the best of these, and the most adequate as regards marine insurance, is that of the German Empire; but Hamburg and Bremen still preserve many of their local conditions by special contract in their policies. At the Buffalo conference of the International Law Society in 1899 an attempt was made to harmonize some discrepancies between the insurance contracts of different States, and the matter was referred to a committee, which reported to the conference of 1900 at Rouen, and of 1901 at Glasgow.

A contract of marine insurance is a contract of indemnity, whereby the insurer undertakes to indemnify the assured, in the manner and to the extent agreed, against marine losses, *i.e.*, the losses incident to marine adventure. There is a "maritime adventure," where any ship, goods, or other movables are exposed to maritime perils, such property being termed "insurable property"; also where the earning of any freight, hire, or other pecuniary profit or benefit, or the security for any loan or expenditure, is endangered by the exposure of insurable property to maritime perils; and where any liability to a third party may be incurred by the person interested in or responsible for insurable property by reason of its exposure to maritime perils. By "maritime perils" are meant the perils consequent on or incidental to the navigation of the sea, *i.e.*, perils of the seas, fire, war perils, pirates, rovers, thieves, captures, seizures and restraints, and detainments of princes and peoples, jettisons, barratry, and any other perils, whether of the like kind or not, which may be designated by the policy.

Definition.

The contract being one of indemnity against maritime perils, it is evident that no one can derive benefit from it who has not some

interest exposed to these perils. Hence the illegality of "wager" policies which are made "interest or no interest," or "policy proof of interest," or "without benefit of salvage," or subject to any other such term (19 Geo. II. c. 27). Wager policies are illegal only in the sense of being null and void to all intents and purposes. They cannot be sued upon, hence they are known as "honour" policies. They are of frequent use, generally for the protection of interests which, though real, are not easily defined, or are of pecuniary value hard to determine. But they are utterly ignored by the courts. The essential of insurable interest is the pecuniary advantage seen at the time of insurance as arising to the person in question from the safety or due arrival of the adventure, or the pecuniary disadvantage similarly arising from its loss or deterioration. But such interest may lapse before arrival or destruction of the venture, and with the interest lapses the right of the assured to recover from the underwriter. Should the assured simply transfer his interest to another, *e.g.*, by sale, he can assign his policy to the party who acquires his interest—unless, of course, the policy contains terms expressly prohibiting assignment. The customary form of assignment is endorsement of the policy either in blank or to a specified party. Within the limits already named, interests are insurable whether complete or partial, defeasible or contingent; similarly loans on bottomry or respondentia, advance freight not repayable in case of loss, charges of insurance, and shipmaster's, but not yet officers' or seamen's wages.

Value.

The owner of insurable property may insure its full value even though some third party have agreed or become liable to indemnify him in case of loss: a mortgagor has the same right of insuring to full value; while a mortgagee may insure only up to the sum due or to become due to him under the mortgage, unless the mortgagee is insuring for the benefit of the mortgagor as well as for himself, in which case, even though he insure in his own name only, he may insure up to the full value. A consignee may insure in his own name the total amount of his interest and that of others for whose benefit he insures. Where no special contract is made between assured and underwriter, the insurable value of certain matters of insurance is ascertained as follows. *Ship*—Her value at the commencement of the risk, including outfit, provisions, stores, advances of wages, and any other outlays needed to make the ship fit for the voyage or period of navigation covered, *plus* cost of insurance upon the whole. In the case of a steamship, the word "ship" includes machinery, boilers, coals, and engine stores. In the case of a vessel engaged in a regular trade, the word "ship" includes the permanent fittings necessary for that trade. *Freight* (whether paid in advance or not) —The gross amount of freight at the risk of the assured, *plus* cost of insurance. *Goods*—The prime cost, *plus* expenses of shipping and cost of insurance. *Other Interests*—The amount at the assured risk when the policy attaches, *plus* cost of insurance.

Policy.

A contract of marine insurance must be embodied in a document called a policy, which must specify the name of the assured (or of his agent in the effecting of the policy), the undertaking to insure, the objects insured, and the risk insured against, the voyage or time (or both) covered, the sum insured, the name of the assurers. The signature of the assurer is necessary; it is found at the end of the policy, and he is often on this account called the *underwriter*. The objects insured must be designated with reasonable certainty, regard being had to customary usage. The undertaking is usually expressed by saying that the assured or his agent "doth make assurance and cause himself to be insured." The risks are either the whole body of maritime perils detailed above, or any one or set of these, or any other named peril against which the assured desires protection. There is no restriction by law of the length of voyage that may be insured, but time policies are invalid if made for more than one year; a voyage and a period of time not exceeding a year may be covered on one policy. Policies are classed as *time* or *voyage* policies. It is not necessary to state in the policy the value of the objects insured, but generally the value is given; policies are therefore classed as *valued* or *unvalued*, the latter being often called *open* policies. The values of objects insured under open or unvalued policies are the insurable values given above. As it frequently happens that merchants desire to have all their shipments covered, by whatever vessel they may come, they require insurance in general terms; such a policy is termed a *floating* policy. It states the limits of voyage and value covered by the underwriter, and the class of ships to be employed. The particulars of each shipment are declared as the shipments occur, the declarations being usually endorsed on the policy. All shipments within the terms of the policy must be declared at their honest value, or in accordance with the special provisions of the policy, if any.

The consideration paid by the assured to the underwriter in return for the protection granted by the latter is called the *premium*. Until payment be made or tendered the policy is not ordinarily issuable, *i.e.*, unless otherwise agreed. When the assured effects insurance with an underwriter through a broker, then, unless otherwise agreed, the broker is liable for the premium to the underwriter, who is, however, directly responsible to the assured for losses or liabilities falling on the policy. But the broker has a lien on the policy for the premium and for his brokerage, and in case he has had dealings as a principal with the assured, he has a lien on the policy for any balance due to himself in insurance transactions, unless he should have known that in these transactions the assured was merely an agent. Some policy forms state definitely that the premium has been paid; when such a form is used and no fraud is proved, this receipt is binding between assured and underwriter, but not between broker and underwriter. If an insurance is effected at a premium "to be arranged," and no arrangement is made, then a reasonable premium is payable. The same holds where additional premiums have to be charged at a rate to be arranged and no arrangement is made.

It is evident that in nearly all the particulars of any adventure insured by an underwriter he is entirely dependent upon the assured for correct information. It is therefore the law that an insurance contract can be avoided and broken by either of the parties to it if the utmost good faith be not observed by the other. The obligation of perfect good faith is thus made reciprocal. Bad faith may show itself either in *concealment* or in *misrepresentation*. It is therefore made essential to the stability of any insurance contract that the assured must disclose before conclusion of the contract every material circumstance known by him, failing which the underwriter may avoid the contract. Every circumstance is deemed material which would influence the underwriter in his decision as to acceptance of the risk or the fixing of the rate of premium. Consequently the assured is not bound, unless specially asked by the underwriter, to disclose the favourable features of the risk offered, or matters known or presumably known by the underwriter (matters which are of common knowledge, and such as an underwriter ought in his usual business to be aware of), or matters respecting which the underwriter waives or declines information, or which the nature of the transaction renders superfluous. An agent effecting an insurance must, in addition, disclose everything material known to himself, or that he should know in the ordinary conduct of his business. Every representation of material fact made to an underwriter before conclusion of a contract by the assured or his agent must be true, or the underwriter may avoid the contract. Every representation is material which would influence the underwriter in his decision as to acceptance of the risk or to fixing of the rate of premium. A representation of fact is regarded as true if it be substantially correct; literal correctness is not essential. A representation of expectation or belief is true if it is made in good faith. The contract is deemed to be concluded when the underwriter accepts the risk.

Voyage insured.

It frequently happens in the course of business that before a vessel has completed the venture on which she is engaged arrangements have already been made for her future employment. Where a vessel is insured on time, this is of no moment as respects her insurance. It has likewise been decided that where any insurable object is covered by a voyage policy "from" or "at and from" a named place, the policy is not rendered invalid by her not being at that place when the insurance is concluded; but, on the other hand, there is an implied condition that she will begin the venture

within a reasonable time, and that if she fails in this the underwriter may avoid the contract. If the delay springs from circumstances known to the underwriter at the time of conclusion of the contract, or if the underwriter then acquiesces in it, the implied condition is nullified. If the assured abandons the venture insured, the contract expires; *e.g.*, if, before the risk commences, the vessel's destination is changed to one not covered by the policy. Where the policy specifies a place of departure, and the ship does not sail from that place, the risk does not attach. If, however, the vessel actually starts from her intended port of departure, and commences the venture, and thereafter it is decided to change her destination, this decision constitutes a change of voyage. In default of provision to the contrary, the underwriter may elect to avoid his assurance from the time of that decision, although the ship be still in the course she would have followed in her originally intended venture.

Should a ship depart from the proper course of the voyage she starts upon, and for which she is insured, such departure, when made without lawful excuse or justification, is termed *deviation*. From the moment it occurs, even though she subsequently return to her proper course without loss or injury, the underwriter may avoid his contract; but the intention to deviate is not effective. Deviation occurs (1) when in a policy a course is definitely specified and the vessel departs from it; (2) when, in absence of such definite specification in the policy, the vessel departs from the course usually and customarily followed in the voyage insured; (3) when, in absence both of definite specification in the policy and of customary course of navigation, the vessel, to the knowledge of the assured, departs from the course which would be followed by a prudent master acting in a seamanlike manner. If a policy provides for several named ports of discharge, the vessel may, without committing deviation, omit to proceed to one or more; but whether she goes to all or to some she must (in absence of usage or sufficient cause to the contrary) take them in the order in which they appear in the policy. If the policy provides for "ports of discharge" in a given district, then (in absence of usage or sufficient cause to the contrary) unless the vessel proceeds to them in their geographical order she makes a deviation. Similarly, in the case of a voyage policy, the want of reasonable despatch throughout, unless lawful excuse or justification exists, entitles the underwriter to avoid the contract from the time that the delay becomes unreasonable. As excuses for deviation or delay on the voyage contemplated by the policy, the following are regarded as valid: authorization by license or other provision in the policy, *force majeure*, compliance with express or implied conditions of the policy (*e.g.*, warranties, see below), reasonable steps taken for the safety of the ship or other objects insured, saving life, or helping a ship in such distress that life may be in danger. If barratry is insured against, delay arising from barratrous conduct of master or crew does not avoid the policy. A deviation ceases to be excusable unless the ship resumes her proper course and proceeds on her voyage with reasonable promptitude after the cause of the reasonable delay ceases to be effective.

Warranties.

In every contract of insurance there are certain conditions precedent to the liability of the underwriter and incumbent on the assured, which must be fully and literally complied with, whether material to the risk or not. These conditions are known in insurance as *warranties*. The name is unfortunate, as in every other branch of the law of contract it bears another meaning; still it is convenient, and its insurance signification is now firmly established. Failure on the part of the assured to fulfil a warranty *literally* entitles the underwriter to avoid his contract as from the moment of breach,[1] but it does not limit his obligation up to that moment. Breach of warranty is not nullified by subsequent remedy of the breach, consequently loss occurring after breach of warranty is not at the charge of the underwriter, even although before the loss the assured has again complied with the warranty. Breach of warranty is excused in two cases only: (*a*) when by change of circumstances the warranty ceases to be applicable to the contract, (*b*) when by subsequent legislation the warranty becomes unlawful.

Warranties are of two classes: (1) express, (2) implied. Express warranties must be written or printed on the policy, or contained in some document explicitly referred to in the policy, and so regarded as incorporated in the contract. No special form of words is essential to the validity of a warranty if the intention to warrant can be inferred. Express warranties may refer to anything which the parties to the contract choose, *e.g.*, the nationality of the vessel, her sailing on a named day, proceeding under convoy, being excluded from certain voyages or trades or the carriage of certain cargoes, being "well" or "in good safety" on a named day (in which case the warranty is fulfilled if she be safe at any time of that day). As regards *nationality*, if no express warranty be given there is no undertaking on the part of the assured that the vessel is of any particular nationality, or that she will not change it while the risk lasts. The warranty of *neutrality* in case of a ship's insurance means that at the commencement of the risk the vessel concerned is actually neutral, and that as far as the assured can control the matter she shall so continue during the whole course of the risk. It is also an implied condition of the ship being warranted neutral that to the utmost of the assured's power she must carry the papers necessary to establish her neutrality, must not falsify or suppress these papers, or use simulated papers; if this condition is broken the assurer can avoid the contract. Where goods are insured and warranted neutral, they must be owned by neutrals during the whole course of the risk, be properly documented, be shipped to a neutral destination on a neutral vessel, which must, so far as she is within the assured's control, remain neutral throughout the venture. The words of an express warranty are always to be taken in their commercial sense; within that sense they are to be strictly and literally taken.

In addition to these expressed conditions, there are also certain essential factors or conditions inherent in each and every contract of marine insurance without exception; these are *implied* warranties, which are presumed from the very fact of the making of the insurance. They are (*a*) completion of the prescribed venture without *deviation*, (*b*) *legality* of the venture (viz., that the adventure insured is a lawful one, and that, so far as the assured can control it, it shall be carried out in a lawful manner), (*c*) *seaworthiness* of the ship. In a voyage policy it is an implied warranty that at the commencement of the voyage the ship shall be seaworthy for the particular venture insured. If the risk commences when the ship is in port, then she must in addition be reasonably fit to stand the ordinary dangers of the port. If the voyage insured is one in which different degrees of peril are to be encountered, or for which the ship needs different kinds of outfit at different stages, then she must be seaworthy for each stage at its commencement, and the warranty will be fulfilled if she is at the beginning of each stage seaworthy for that stage. The warranty of seaworthiness is held to be fulfilled when the ship is reasonably fit in every respect to meet the ordinary marine dangers of the venture insured; that is to say, the mere loss of a vessel by perils of the sea is not a proof of unseaworthiness in the sense of this warranty. The only ship policies not subject to the warranty of seaworthiness are policies on time (the reason given being that there is nothing to prevent a time policy lapsing and a new one commencing when the vessel is at sea beyond her owner's control as to seaworthiness); but where the assured knowingly sends a ship to sea in an unfit state, and the loss is produced by that unseaworthiness, the underwriter is not liable for such loss. It is not implied in a policy on goods or movables that these goods, &c., are seaworthy.

Interpretation.

When the main points of the preceding particulars of the contract of insurance are summarized it may be said that the transaction is (1) a contract of indemnity reduced to written or printed words, (2) made in good faith, (3) referring to a defined proposition or amount, (4) of a genuine interest in a named object, (5) being against contingencies definitely expressed, to which that object is actually exposed, and (6) in return for a fixed and determined consideration. The presentation of the contract in words may fail to convey the complete common intention of the parties making it, and it is therefore necessary to state in what way the written document is properly to be interpreted. Duer (*M. I.* i. 158, 159) states that with the exception of con-

[1] Lord Mansfield expressed it: "The warranty in a contract of insurance is a condition or a contingency, and unless that be performed there is no contract" (*Hibbert* v. *Pigou*, *apud* Marshall, 3rd ed., p. 375).

ditions in a policy which are construed as warranties, and must be literally fulfilled,

the actual intention of the parties is the controlling principle from which all the special rules of interpretation flow, and to which they are all subsidiary and subordinate. These rules have no positive and arbitrary force.

But as the policy is a written instrument, account must be taken of its wording. The terms used in the policy

are assumed to be understood in their plain, ordinary, and popular sense, unless they have generally in respect to the subject matter, as by the known usage of trade and the like, acquired a peculiar sense distinct from the popular sense of the same words, or unless the context evidently points out that they must, in the particular instance and in order to effectuate the immediate intention of the parties, be understood in some special and peculiar sense (Ellenborough, *Robertson* v. *French*, 1803).

In briefer form, the words of the policy are to have their proper value and effect given to each of them, and to be understood in their plain sense, except in so far as they are affected by (*a*) custom or (*b*) context.

(*a*) As regards *custom*, the policy is interpreted in accordance with the usages of the particular trade in which the adventure insured is engaged or employed. In fact, a valid usage is a part of the contract.

Lord Mansfield said, "Usage is always considered in policies of insurance even when the words are plain" (*Preston* v. *Greenwood*, 1785); and Buller, J., stated that "Usage not only explains but controls the policy" (*Long* v. *Allen*, 1785). Duer (*M. I.* i. 245) develops this dictum as follows: "Where the words to be interpreted are indeterminate or ambiguous, the usage *explains* them; but when they convey a definite meaning that the court would be bound to adopt, or their construction has been settled by law, the usage *controls* them: and in these cases it does *set aside* what, judging alone from the terms of the policy or the rule of law, was the plain intention of the parties; but, in controlling, the usage does not contradict the words—it merely varies by extending or enlarging their application."

(*b*) The contract being one contract, the various parts of it are reasonably to be expected to tend to one end; therefore the document must receive the effect of its general scope and intent. Consequently, should there be two possible readings of an ambiguous clause, the one of which would add nothing to the contract as expressed elsewhere, while the other adds to the effect of it, the latter interpretation is to be adopted. It cannot have been added without the intention of extending the contract. But this principle operates within the limits prescribed by the nature of the insurance itself; so the words insuring against "all other perils, losses, and misfortunes" are restricted to apply only to occurrences of the same class (*ejusdem generis*) as those perils enumerated in the policy. Similarly, as the policy has been for the last 150 years generally a printed document, clauses specially added have attached to them more weight than the ordinary text of the policy. These may be printed clauses in the margin of the policy, or printed clauses impressed on or attached to the policy, or clauses written on the policy. At each stage we come nearer to the circumstances of the particular risk and the special contract of assured and underwriter. Duer (*M. I.* i. 166) puts it, the printed words "may not express the intentions of the parties," while the written words "certainly do": it might be safer to say "are certainly expected to do so." The policy being a contract of indemnity to the assured, its provisions in his favour are to be taken cumulatively, and not as restricting or excluding one another, the underwriter being taken to intend that he shall understand the indemnity given to be as extensive as its terms will upon any fair consideration import. Similarly, as the policy is the language of the underwriter, any ambiguity in it must be taken most strongly against him.

It has become a settled rule of marine insurance that "the underwriter is liable for no loss which is not proximately caused by the perils insured against." The decisions of the courts lead to the conclusion that what has to be done is to determine the immediate, the very last cause of the loss or damage; if this very last cause is one of the perils insured against, or is *ejusdem generis*, then the loss or damage is at the charge of the underwriter, unless there is among the more remote causes personal fault of the assured, simple tear and wear, ordinary leakage and breakage, unseaworthiness of the vessel, or the inherent nature of the article insured (*vice propre*). Where a policy insures against only certain named perils to the exclusion of others, it becomes of primary importance as regards the incidence of liability to determine whether the *causa proxima* (the immediate cause) of any particular disaster is of the perils enumerated in the policy or not. Some of the most difficult questions of marine insurance have arisen in this connexion.

Causa proxima.

The earliest English policies named neither the perils which they were meant to cover, nor the kinds of losses for which the underwriters were liable, nor the pecuniary limit to which that liability extended. Later policies designated the perils, but none of them contains full details either of the kind of losses covered by them or of the extent of the underwriter's liability. In the "sue and labour" clause (which appears to be indigenous to England, and has not yet been traced farther back than the policy of 1613 on the *Tiger*) particulars are given of the special kind of liability imposed by it on the underwriters, and the principle of *pro ratâ* liability of the several underwriters is stated. But this is only a subsidiary side-contract dealing with particular charges. The "waiver" clause, which grew out of the "sue and labour" clause mentions "abandonment" as somehow connected with the perils insured against; but this clause is not found as early as 1613. Lastly, in the *Memorandum*, which was first introduced into policies about the year 1749, there are found the words "average, unless general." It is therefore only in an indirect way that we can arrive at a knowledge of the "losses and misfortunes" that are at the charge of the underwriter. One occasion of liability must from the first have presented itself as indubitable, namely, actual total loss arising from any of the perils insured against. Very nearly allied to it is total loss by disappearance, manifested by want of news within reasonable time respecting the venture, *i.e.*, the case of a "missing ship." Next comes the case of an insured object being so damaged by perils insured against, that although not actually and absolutely lost, it is to all reasonable and commercial intents and purposes as bad as lost: this is what is known as "constructive total loss." But marine perils may produce loss not necessarily total, *i.e.*, partial loss: it may only amount to "damage," which may be either a diminution in quantity (total loss of part) or a deterioration in quality of the objects insured. The liability attaching to a marine policy for such losses less than total is termed "average." When the loss is in the end borne by the various parties to the venture, the average is called "common" or "general average"; when it is throughout entirely borne by the party interested in that object, it is known as "particular average." Again, as is explained above, there are side-agreements embodied in the same document as the ordinary insurance contract, dealing with "sue and labour" expenses or "particular charges," and (in most modern steamer and sailer policies) there is the clause in which the underwriter assumes liability for a stated proportion of the vessel's liabilities for damage done by "running down" another vessel in collision. The law on these various losses is as follows.

Effect of policy.

A total loss may be (1) actual, or (2) constructive; and

an insurance against total loss covers the assured against both, unless a different intention appears from the terms of the policy. It is an actual total loss when the object insured is completely destroyed, or is damaged beyond repair—so as to cease to be of the denomination of goods to which it belonged when insured, or so as to be incapable of reaching destination in specie—or when the assured is irretrievably deprived of the property insured. Under this may be regarded the case of a missing venture, *i.e.*, where after a reasonable lapse of time no news has been received of the ship concerned, in which case an actual total loss may be presumed. When a ship is so damaged by perils insured against that the costs of repairing the damage would exceed the value of the ship after repairs, there is a constructive total loss. Among the costs of repair are reckoned the expense of future salvage operations and future contributions to general average which the ship would have to make. (It appears to be doubtful whether the damaged value of the ship should come into calculation at all: if so, then it should be deducted from the repaired value of the ship: *v. The Gallia*, before Phillimore, J., Liverpool, 5th December 1899). If the assured is deprived of possession of his ship by an assured peril, and it is doubtful whether her recovery is possible, or can be effected at a cost less than her value when recovered, there is a case of constructive total loss of ship. In the case of all interests other than ship, where the damage or deprivation by insured perils is so severe that it is not, in view of the cost, commercially reasonable to insist on the completion of the venture, there is a constructive total loss. In determining what is commercially reasonable, regard is to be had to the course which would be adopted in the same circumstances by a prudent person uninsured.

Total loss.

When the assured has proved his loss to be constructively total, he must decide within reasonable time whether he will treat the loss as partial (and receive his indemnity as described below under partial loss), or as an actual total loss, and abandon the object insured to the underwriter. If he elects the latter he must give notice of abandonment, failing which the loss will be treated as merely partial. Notice of abandonment must clearly indicate the intention of the assured to abandon the goods without reserve or condition to the underwriter: it may be spoken or written, or partly spoken and partly written. Notice should be given as soon as the assured has such definite intelligence as will enable him to make up his mind that the venture is in effect totally lost. Once notice is given it is irrevocable unless the underwriter consents to the withdrawal. Similarly notice may be waived by the underwriter. The refusal of the underwriter to accept abandonment does not prejudice the rights of the assured. If the underwriter returns no reply to the tender of abandonment he is held to have declined acceptance. But he may accept either by express statement or by implication. Acceptance once stated or implied is irrevocable, being regarded as conclusive admission of the loss and of liability for it. Notice is unnecessary when there can be no possible benefit from it to the underwriter at the time news of the loss reaches the assured. When abandonment is declined, the validity of the abandonment is determined from the state of the case at the time of action brought. In consequence it has become not unusual for the assured to add to tenders of abandonment words in which they request, in case abandonment is declined, to be put in the same position as if writs had been issued and thus action brought. Valid abandonment effects an immediate transfer to the underwriter of all interest in what remains of the property insured, and he becomes possessed of all rights and remedies of the assured connected therewith as from the time of the casualty causing the loss. He equally stands at the risk of all reasonable acts or things done in good faith by the assured or his agents after the date of the casualty causing the loss. In the case of abandonment of a ship in course of a voyage the underwriter becomes entitled to the freight she is in the process of earning, and does earn after the casualty leading to the abandonment, but he is not entitled to the transfer of any other freight contracts. Should the vessel at time of abandonment be carrying goods belonging to her owner, the underwriter is after valid abandonment entitled to reasonable freight for any carriage of them which the ship may perform after the accident causing the abandonment. When the assured fails in an action for total loss, actual or constructive, he is not precluded from recovering a partial loss if the policy insures him against partial loss. When in consequence of the occurrence of a total loss, actual or constructive, the assured has a valid claim against his underwriter on a valued policy, the assured receives from the underwriter the amount which the latter has insured, and surrenders to him what remains of the subject matter of the insurance. If the policy be unvalued the assured cannot recover beyond the insurable value of the property insured, and each underwriter is liable for his *pro ratâ* share up to the amount of his subscription.

Losses other than total would naturally be called partial losses, but there is some variation in the use of this expression. By many it is used as designating solely diminution in quantity or deterioration in quality of objects insured, that is, as equivalent to particular average as explained above. Some would also include under it general average; others would add salvage charges, particular (or special) charges, and sue and labour expenses. General average is really an outlying branch of the law of affreightment; it is a reciprocal liability of shipowner and cargo owner to one another, and comes into insurance only in so far as the underwriter has assumed the liability of either of these parties. An act whereby any extraordinary sacrifice or expense is voluntarily and reasonably made or incurred at a moment of danger, and to preserve the whole common venture, is called a general average act; the loss directly arising from it is called a general average loss. In case of such a loss the various parties to the adventure are by the universal law maritime liable for a rateable contribution to the same, called general average contribution. The amount of contribution from the owner of any particular goods is, subject to the terms of the policy, recoverable from the underwriter to the full extent, if the amount insured on these goods equals or exceeds their contributing value, but *pro ratâ* if it is less. If the general average act is a peril insured against in the policy, as jettison usually is, then the assured can claim his whole loss by the act directly from his underwriter, who enters into his rights of recovery in general average. But the underwriter is not liable for general average loss or contribution not incurred in connexion with perils against which he insures. The costs of services in the nature of salvage rendered by the assured or his agents or employees to avert from the whole venture some peril insured against, are apportioned as general average rateably over all the interests benefited. The shipowner is bound to take the necessary steps for procuring an adjustment of any general average loss connected with his vessel and for securing its payment. Should ship, freight, and cargo all belong to one person, he may recover from the underwriters of each separate interest their share as if they had insured them for different persons. Particular average may now be defined as a loss which is not general average loss; it falls exclusively

General average.

on the owner or other person interested in the goods, and gives no claim for contribution from other persons concerned in the common marine venture. The consideration of particular average is much complicated by the fact that in modern insurance practice hardly any object is insured without some special condition in the policy, usually expressed in the form of a warranty, that the insurance is either to be free from claim for particular average altogether, or free unless the damage attain a certain percentage of the value of the object. What follows must therefore be taken subject to any such special provision expressed in the policy. When a damaged ship has been repaired the owner insured is entitled to recover the reasonable cost of these repairs, less certain customary deductions based on tradition and long-standing practice (such as the deduction of one-third from the cost of new materials used in repairs, called thirds "new for old"), but he cannot recover in respect of any one accident more than the sum insured. The same cost of repairing the whole damage similarly reduced by deductions is the limit of the underwriter's liability in case the vessel is not repaired at all, or if she is only partly repaired. If the vessel is not repaired, but sold during the course of the risk, the assured is entitled to the reasonable cost of the repairs less the proper deductions; but in this case the limit of indemnity is the actual depreciation as ascertained by the sale. In case of partial loss of freight the assured recovers such proportion of the insured value (in a valued policy) or insurable value (in an unvalued policy) that the amount of freight lost bears to the whole freight at the assured's risk. While particular average on ship is usually determined by the cost of repairs, particular average on goods is usually determined by survey and appraisement of the percentage of damage, or by sale of the goods and by comparison of the sound and the damaged arrived values. The percentage of loss is applied to the insured value if the policy be valued, and to the insurable value if unvalued, and the amount thus arrived at is the liability of the underwriter. The sound and damaged values employed are the gross sound and damaged values of the goods at the time and place of arrival when freight duty and landing charges have been paid; except in the case of certain articles subject to severe customs duties, and therefore usually sold by importers in bond (such as tobacco, tea, coffee, wines, spirits), in which case the price in bond is taken as the gross value. The expenses of sale falling on the buyers are added to the gross proceeds; and if a claim is established against the underwriter, they are recoverable from him as "extra charges." If various classes of goods are insured in a valued policy without specification of the separate items, the insured value of each class is ascertained by taking the same proportion of the policy valuation that the insurable value of each class bears to the insurable value of the whole; and the claim on the underwriter is made up as above.

Particular average.

When the policy contains such warranties respecting particular average as have been indicated above, then the loss of any separate parcel or parcels is not recoverable unless there is an agreement to that effect in the policy, or the parcels are separately valued therein, or there is a commercial custom to treat them as if separately valued. When a particular average warranty specifies a certain percentage below which no liability attaches to the underwriter, this percentage is called the franchise. As a rule, the more delicate the goods the higher the franchise. It is not permissible to add general average contribution or loss to particular average loss to make up the franchise. On voyage policies separate losses occurring on the voyage can be added to make up the percentage: on time policies the losses of each separate voyage have to be treated separately as regards franchise, and the underwriter is liable for them although the sum of them may exceed the amount insured. But if a total loss occurs to an insured object which has sustained damage for which no recovery has been made from the underwriter, then the underwriter is not liable except for the total loss. In order to prevent the failure to attain the franchise becoming onerous to the assured, and thereby as it were depriving him of the protection of insurance, the plan was adopted of breaking up a shipment into subdivisions, each of which is treated for purposes of franchise as a separate interest; these subdivisions are called series. The size of the series depends on the value of the goods; it is usually taken as about one hundred pounds' worth of the article insured, *e.g.*, 10 bales of cotton, each package of indigo, 10 chests of tea, 20 baskets of Java sugar, 50 bags of pepper. But as this arrangement was introduced for the benefit of the assured, the specification of franchise in the policy does not override his right to claim his indemnity on the whole if that is more to his advantage.

Certain charges and expenses are treated similarly to particular average: (1) Sue and labour expenses incurred solely with a view to the preservation or benefit of the particular object insured; (2) the charges recoverable by a salvor under maritime law, which may be called charges for independent or speculative salvage, to distinguish them from the salvage services of agents hired to effect a benefit to the whole venture, which are apportioned as general average; (3) particular or special charges, such as cost of reconditioning cargo at an intermediate point on the voyage, warehouse rent there, cost of reshipping, and cost of forwarding. But special charges are not particular average, so they are not excluded by a particular average warranty, and they do not need to attain any named percentage to be recoverable.

This method of determining an underwriter's liability for damage applies only to cases in which the cargo reaches its destination. When it does not arrive, but remains at an intermediate point, and either cannot be forwarded at all or cannot be forwarded except at a loss, it becomes a constructive total loss; and when the underwriter accepts abandonment or pays the loss the proceeds become his. The practice in such cases is for the captain or ship's agent at the intermediate point to sell the cargo, and forward the proceeds to the consignee through the ship's agents or owners at destination; whereupon the assured claims from the underwriter the difference between the amount insured and the proceeds realized. This form of settlement is termed a loss with salvage or a salvage loss. When an underwriter pays for a loss, total or partial, he thereupon becomes possessed of all the rights and remedies of the assured in so far as the assured has been indemnified by the payment of the loss: in case of payment for a total loss, whatever remains of the object insured becomes vested in the underwriter.

It may happen by accident or by design that an insurable object has been covered twice or more times, and that in consequence the sum of the insurance effected exceeds the value in the policy or the insurable value, if an unvalued policy has been employed. This occurrence involves a new set of relations between the assured and his various underwriters; the underwriters themselves are brought into relation to one another. As regards the assured, he may, in the absence of agreement to the contrary, claim payment from whomsoever of the underwriters he may select, but he is not entitled to receive in all more than his proper indemnity. Each underwriter is entitled to receive credit for his proper proportion of the sum received by the assured under any other policy. If the assured does obtain any sum in excess of indemnity, he is regarded as holding it in trust for his whole body of underwriters. In such case each underwriter is bound, as between himself and the other underwriters, to contribute to the loss rateably in proportion to the amount of his liability under the policy; and if any one pays more than his proper share, he is entitled to sue the rest for contribution. Should the assured get any of his premium back? It would not be equitable to enforce a return from any underwriter who has at any time stood alone so as to be liable to the full extent of his policy; but if overlapping policies were accidentally effected all at the same time, the case is rather different. This leads to the general question of return of premium. Such return may be claimed under the terms of the policy, in which case the claim for return is simply the carrying out of the agreement between the parties; it may refer to the whole or to a part of the interest insured. But there are other circumstances in which returns can legally be claimed. For instance, it may turn out that interest insured by a particular vessel and for a particular voyage is never shipped in that vessel for that

Multiple insurance.

voyage; the underwriter has in this case run no risk, and therefore the consideration for which he received the premium totally fails, and the premium is properly returnable to the intending assured, unless there has been fraud or illegality on the part of the assured. Similarly in the case of part of the interest insured on a policy, if that part is distinguishable in the policy or by custom of trade. But the interest might have made the voyage in the vessel, and the intending assured might yet remain without insurable interest. In this case, in absence of fraud or illegality, and if the policy is not merely a gaming or wagering contract, the assured is entitled to return of his premium. Similarly if the underwriter legally voids his policy from the beginning of the risk; as he runs no risk, he receives no premium. The only cases, except those of fraud and illegality, in which the underwriter can retain his premium without running risk, are those of risks underwritten *lost or not lost*, and arrived safely, in which the underwriter takes his chance as to the condition and situation of the ship when he assumes the risk. But this is practically a case of agreement that there shall be no return.

Liabilities.

Recent extensions of marine insurance in England have mostly been in the direction of giving to shipowners protection against liabilities to third parties. The first addition was the running down clause (*r.d.c.*) by which underwriters take burden of a proportion, usually three-quarters, of the damage inflicted on other vessels by collision for which the insured vessel is held to blame. The rapid increase in the use and size of steamships was accompanied by an equally rapid increase in the frequency of collisions at sea, tending to make the shipowner's liability increasingly serious, and to make the shipowner desirous of insuring himself against the balance of his collision liability, and against whatever other liabilities to third parties might be imposed upon him. There was a hesitation on the part of underwriters to meet these wants, and the result is that in Great Britain most liability insurances are effected in mutual insurance societies. The insurance of such liabilities is perhaps simpler in Great Britain than in other countries, as the amount for which a shipowner can be liable is limited by law, although, of course, none but English tribunals are bound by that law. The general rule of English law regarding the indemnity to be paid by an underwriter on liabilities is that its amount is (subject to the amount insured and the provisions of the policy) the sum payable by the assured to the injured third party. Another interesting class of insurances has received much attention, namely, those against the risks of capture, seizure, and detention by a hostile Power, generally described briefly as war risks. But the difficulties connected with such risks probably lie more in determining the legal position of the owners of the property and the obligations under which they lie, than in settling those of their underwriters. Such questions concern *blockade*, *contraband*, *domicile*, *nationality*, *neutrality*, &c.

Conflict of laws.

An attempt was made at the Buffalo conference of the International Law Association in 1899 to prepare a body of rules dealing with those parts of marine insurance on which the laws of maritime countries differ. This undertaking is of the same nature as the earlier efforts of the same association which resulted in the formulation of the York-Antwerp rules of general average. There are four important subjects on which great divergence prevails: (*a*) Constructive total loss; (*b*) Deductions from cost of repairs, new from old; (*c*) Effect of unseaworthiness and negligence; (*d*) Double insurance.

(*a*) Constructive total loss results, according to the law of France, Italy, Spain, Belgium, Holland, in case of loss or deterioration of the things insured amounting to not less than three-quarters; in German law a ship is considered to be "unworthy of repair" when the cost of the repair, without deductions new for old, would amount to over three-fourths of the ship's former value (no similar provision seems to exist in Germany for goods); in the law of America a damage over 50 per cent. of the value of the vessel when repaired is a constructive total loss of the vessel, in case of the policy containing no express provision to the contrary. None of these varying systems appears to be so equitable to all concerned as the British rule, which was for this reason suggested to the Buffalo conference for international adoption. As regards the time when the test for constructive total loss should be applied, it was suggested to reject the British rule, prescribing that it shall be the time of commencing action against underwriters, and to adopt the Continental and American rule referring to the facts as they existed at the time of abandonment. Then, as respects the effect of a valid abandonment on the rights in the property insured, the conference proposed to adopt the British and American rule of making the abandonment refer back to the time of the loss, as against the Continental system of making the transfer operative only from the date of the notice of abandonment. Finally, as to the freight of a properly-abandoned ship, it was proposed to follow for international purposes the American rule of dividing the freight of the voyage between shipowner and underwriter in the proportion of the distances run before the disaster and to be run thereafter, rejecting the British rule of complete transfer to the underwriter and the various Continental rules of proportional division between shipowner and underwriter.

(*b*) It was proposed to adopt the deductions set forth in the York-Antwerp rules as being suitable for international adoption in marine insurance contracts.

(*c*) As regards unseaworthiness and its effect on insurances on ships and goods, it was proposed in the case of ships to reduce materially the obligations of the assured as required by English and American law; to diminish the requirement from the absolute attainment of seaworthiness to the mere exercise of all reasonable care to make the vessel seaworthy. Even this attenuation did not appear sufficient, as it was proposed to degrade the performance of the already minimized warranty from being a condition of the insurance, and its non-performance from invalidating the policy. As to goods, they were proposed to be exempted from any warranty of seaworthiness of ship. Concerning negligence, it was proposed to hold the underwriter liable (subject to the new seaworthiness warranty) for any loss caused proximately by a peril insured against, although wholly or partly the result of the neglect of the assured, or his servants or agents, or by the wilful act of his servants or agents, or the inherent nature or unsoundness of the article insured.

(*d*) The conference proposed to adopt the British rule of making all the policies effectual, independently of the order in which they were effected, and of making all the underwriters entitled to contributions *inter se*. As regards the premium, it was proposed that no premium should be returnable where the risk has attached.

With the exception of those embodying the two suggestions named in par. (*a*), all the resolutions proposed were accepted by the conference. But it appears extremely unlikely that British and American underwriters will voluntarily consent to the practical annihilation of the seaworthiness warranty, and no less improbable that American and Continental assured will voluntarily accept the stricter rule of constructive total loss embodied in English law, when their national law enforces on the underwriter terms more favourable to the assured. The fewness of the international insurance markets of the world diminishes the need for uniform international regulations in this matter. The matter may be one for adjustment by variation in the rate of premium, but this is not certain.

The Glasgow conference of 1901 adopted the rules, after excepting time policies from the scope of the rule respecting seaworthiness. The rules are to be known as the Glasgow Marine Insurance Rules.

Course of business.

The usual procedure in the offer and acceptance of a risk is as follows:—The intending assured (principal or broker) offers the risk by showing to the underwriter a brief description of the venture in question, called in Great Britain a slip, in America an application. The underwriter signifies his acceptance of the whole or of a part of the value exposed to perils by signing or initialling the slip, putting down the amount for which he accepts liability. Or he may sign and issue to the assured (principal or broker) a similar document made out in his own office, called a covering note or insurance note. These documents are simply first sketches of the contract, *mémoires pour servir*, so imperfect that they can be explained only in conjunction with the contract in its completed form (the policy). In America it is not at all rare for insurances to be effected through applications alone without any policy existing. In Great Britain the existence of a policy is essential, slips and covering notes

being merely provisional agreements, binding in honour only, to issue policies on certain terms and conditions on receipt of the necessary information. One reason for insisting on a policy being issued for every risk is that a means of raising revenue by stamp taxes is thus created. In Great Britain the stamp duties under the Stamp Act, 1891, are as follows:—

Where the premium does not exceed ⅛ per cent. of the amount insured	1d.
Where the premium exceeds ⅛ per cent. of amount insured—	
(a) On any voyage, per £100 or per any fractional part of £100	3d.
(b) For any time not exceeding six months, per £100, &c., as above	3d.
(c) For any time exceeding six months, and not exceeding twelve months, per £100, &c., as above . . .	6d.

In consequence of this regulation, no time policy can be issued for a period exceeding twelve months. Policies or certificates of insurance coming from abroad are subject to the same duties, which should be paid within ten days after receipt in the United Kingdom. The shortness of the time allowed for stamping often prevents payment of the tax. These stamp regulations are very troublesome, and produce only a comparatively insignificant revenue. On small premium insurances the tax is so excessive that it drives business out of the country. A uniform tax per policy has been several times suggested, but these proposals have not yet been accepted by the Treasury.

The documents required to establish a claim for total loss are:—(1) Protest of master. (2) Set of bills of lading (endorsed if necessary, so as to be available to the underwriter). (3) Policy or certificate of insurance (endorsed if necessary). (4) In the United States: Statement of loss in detail. In the United States certified copies of Nos. (1), (2), and (3) are taken; but as none of these copy-documents can transfer possession to the underwriter, there is necessary for that purpose another document, viz., (5) Bill of sale and abandonment with subrogation to underwriter—that is, an assignment of all interest to the underwriter. In the absence of the *full* set of bills of lading, a similar document should be taken in Great Britain, especially in all cases in which salvage operations are likely to be undertaken. Such a document handed to a salvage association or a manager of salvage (whether acting for shipowner or for underwriter) settles the ownership of salved goods, and ensures that any claim for salvage expenses will be sent directly to the underwriter. This is from the assured's point of view desirable, and it greatly simplifies the management of salvage cases. As a claim for total loss cannot extend beyond the full amount insured in the policy, it follows that the documents required to substantiate such a claim must be supplied to the underwriter free of charge.

For the substantiation of a claim for particular average the following documents are required:—(1) Protest of master or log-book. (2) Set of bills of lading (cargo claims). (3) Policy or certificate of insurance (endorsed if necessary). (4) Certified statements in detail of actual cash value at destination of goods in *damaged* state, all charges paid. Certified statements in detail of sound value at destination of goods on same day, all charges paid. Or original vouchers of costs of repair of ship, all discounts, rebates, allowances, and returns deducted. (5) In the United States, subrogation to underwriters of damaged goods.

AUTHORITIES.—ALLEN, E. K. *Stamp Duties on Sea Insurances.* London, 1890.—ANDRESEN, TH. *Seeversicherung.* Hamburg, 1888. —ARNOULD, JOSEPH. *Treatise on the Law of Marine Insurance and Average*, 2 vols., 2nd edition. London, 1857. Seventh edition by DE HART and SIMEY. London, 1901.—BAILY, LAURENCE R. *Perils of the Seas.* London, 1860.—BARBER, WILLIAM. *Principles of the Law of Insurance.* San Francisco, 1887.—BLACK, W. G. *Digest of Decisions in Scottish Shipping Cases, 1865–90.* Edinburgh, 1891.—DE COURCY, ALFRED. *Commentaire des polices françaises d'assurances maritimes*, 2nd edition. Paris, 1888.—DOUGLAS, R. R. *Index to Maritime Law Decisions.* London, 1888.—DUER, JOHN. *Law and Practice of Marine Insurance*, 2 vols. New York, 1845, 1846. —GOW, WILLIAM. *Marine Insurance, a Handbook*, 2nd edition. London, 1900.—JACOBS, VICTOR. *Étude sur les assurances maritimes et les avaries.* Brussels, 1885.—LOWNDES, RICHARD. *Practical Treatise on the Law of Marine Insurance*, 2nd edition. London, 1885.—*Law of General Average, English and Foreign*, 4th edition. London, 1888.—M'ARTHUR, CHARLES. *Contract of Marine Insurance*, 2nd edition. London, 1890.—MACLACHLAN, D. *Arnould on the Law of Marine Insurance*, 2 vols., 6th edition. London, 1887.—MARSDEN, REGINALD G. *Admiralty Cases, 1648 to 1860.* London, 1885.—*Law of Collisions at Sea*, 3rd edition. London, 1891.—OWEN, DOUGLAS. *Marine Insurance Notes and Clauses*, 3rd edition, 1890.—PARSONS, THEOPHILUS. *Law of Marine Insurance and General Average*, 2 vols. Boston, 1868.—PHILLIMORE, G. G. "Marine Insurance" in *Encyclopædia of the Laws of England*, vol. viii. London, 1898.—PHILLIPS, WILLARD. *Treatise on the Law of Insurance*, 2 vols., 5th edition. New York, 1867. TYSER, C. R. *Law relating to Losses under a Policy of Marine Insurance.* London, 1894.—ULRICH, RUDOLPH. *Grosse Haverei.* Berlin, 1884.—WEIL, G. DENIS. *Des assurances maritimes et des avaries.* Paris, 1879. (W. GO.)

VI. BRITISH POST OFFICE INSURANCE.

In 1864 Mr Gladstone, then Chancellor of the Exchequer, advocated the extension of life insurance amongst persons of small means, and, encouraged by the remarkable success of the Post Office Savings Bank, then recently established, proposed that the services of the Postmaster-General should be enlisted in the promotion of insurance. The result was the passing of the Government Annuities Act, 1864. This Act authorized the Commissioners for the Reduction of the National Debt, for the first time, to insure a life without granting an annuity upon it, and enabled the Postmaster-General to act as the agent of the Commissioners in the issue of life policies and the grant of annuities. The limits of insurance were fixed at £20 and £100, and of annuities at £4 and £50; and the purchase of deferred annuities or old-age pay, by monthly, or even more frequent instalments, was sanctioned. The work was eagerly accepted by Lord Stanley of Alderley, the Postmaster-General of the day, and the machinery for putting the Act in action was elaborated by Mr Scudamore of the Post Office and Sir Alexander Spearman of the National Debt office. The business was commenced on the 17th of April 1865. By the end of the year 560 policies of insurance had been issued, and 94 immediate and 54 deferred annuities granted. In the first twelve months these figures had increased to 809 policies and 230 annuities.

Mr Fawcett's reforms.

The opportunity thus given of insuring through the Post Office with Government security was not, however, embraced with the warmth which had been anticipated. In 1882, when Mr Fawcett, then in office, examined the subject, he found that the average number of policies of insurance granted annually during the seventeen years which had elapsed was under 400—less, in fact, than during the first twelve months of the system. The purchase of annuities had increased slightly, but the business was transacted chiefly in immediate annuities, and hardly, therefore, indicated any progress in provision for old age by means of early savings. Mr Fawcett procured a Select Committee of the House of Commons on the subject. Before this Committee Mr Cardin, then Assistant Receiver and Accountant-General of the Post Office, propounded a scheme for combining the annuity and insurance business of the Post Office with that of the savings bank. The Committee recommended the adoption of this scheme, together with some enlargement

of range and some relaxation of conditions. The recommendations of the Committee were embodied in the Government Annuities Act, 1882, which came into operation on the 3rd June 1884, and which forms the basis of the present system.

Any person between 14 and 65 can now insure through the medium of the Post Office Savings Bank for any amount from £5 to £100; and the life of a young person between 8 and 14 can be insured for £5. Through the same channel can be purchased annuities, immediate or deferred, from £1 to £100, on the life of any person from 5 years old upwards. Old-age policies, that is, policies securing payment of a specific sum either at the expiration of a fixed period (varying from 10 to 40 years), or upon the attainment of a certain age, or sooner in case of death, can also be obtained. Policies for a fixed period can only be purchased by a single payment, but in all other cases the purchase can be effected by payment either of a lump sum or of annual instalments. Further, all purchases are effected through the Post Office Savings Bank. As soon as a contract is completed, the purchaser is required to pay the first instalment to his account in the bank, or, if he has no account already, to open an account for the purpose. This and all further instalments are then transferred by the Postmaster-General, as they become due, to the credit of the National Debt Commissioners; all the purchaser has to do is to keep his banking account in funds; he can pay his savings into the bank when and as he pleases. So, also, when old-age pay, secured either by a deferred annuity or an endowment policy, becomes due, it is paid to the account of the purchaser; and, if it does not cause the sum standing to his credit to exceed the statutory limits, it can remain there earning interest, and be drawn out in such amounts as may be convenient from time to time. The purchaser has also the advantage of the ubiquity of the Post Office Savings Bank. He can make his deposits, and can draw out his old-age pay when it becomes due, at any one of the 12,900 post offices where savings bank business is transacted. He can even, if his savings are made from day to day, use the penny stamp slips introduced by Mr Fawcett, affixing a stamp whenever he has a penny to spare, and paying in the slip when it is worth a shilling. In short, every advantage open to the ordinary depositor in the Savings Bank is placed at the service of the working man or woman who wishes to secure old-age pay, or to have a small sum to aid those who may suffer pecuniarily from his or her death. Even the reluctance of many persons to submit themselves to medical examination is tenderly regarded. A policy for any sum up to £25 may, if the information afforded is satisfactory, be obtained without a doctor's certificate, on condition that, if death happens during the first year, only the premium paid is returned, and if during the second year, only half the sum insured is paid. As regards old-age pay, a purchaser can, by adopting a slightly higher scale of payment, secure the return of his purchase money if at any time before the annuity falls in he repents of his bargain. Further, employers of labour and friendly societies can, on behalf of their workmen or members, make all the payments necessary to buy an insurance or annuity, and recoup themselves out of wages or members' contributions.

The Act of 1882 directed that the tables upon which annuities and policies of insurance are granted should be revised from time to time; and in February 1896 new tables reducing the rates of annual premiums, and giving greater facilities for old-age insurance, were issued. The rates are now but very slightly (less than 3 per cent.) higher than the average rates of the larger insurance offices. But the expense of small insurance business must necessarily be above the average, and it is fairer to compare the Post Office rates with those of the office which stands pre-eminent in the insurance of the working classes. Such a comparison shows that up to the age of 40 a life insurance can be effected with the Post Office at a cheaper rate than with the Prudential Insurance Company; between 40 and 60 the advantage is slightly on the side of the company.

Nevertheless, the endeavour to popularize the provision for old age and death through the machinery of the Post Office must be pronounced a failure. In 1885, the first complete year after Mr Fawcett's improvement took effect, 103 deferred annuities and 457 insurance policies were granted; in 1898, 164 deferred annuities and 731 policies. The increase of business, measured in percentages, is no doubt appreciable, but the figures themselves are so small as to make such a comparison trivial. If we compare the two periods, before and after Mr Fawcett's reforms, we find that between 17th April 1865 and 2nd June 1884 (about 19 years) 7064 policies of insurance, amounting to £557,625, were issued, and between the latter date and the end of 1898 (about 14 years) 11,581 policies, amounting to £620,266. For the whole period the figures are 18,645 policies for £1,177,891. During the same time 3144 contracts for old-age pay, amounting in all to £64,378, were made. When we contrast with this sum total the fact that in 1898 alone 1,333,395 new accounts were opened in the Post Office Savings Bank, and more than £37,000,000 deposited in the bank in the course of the year, it becomes apparent that, while the Savings Bank has reached the mass of the population, insurance against old age and death through the Post Office has not.

In 1894 Mr Lang, the Controller of the Post Office Savings Bank, and Mr Cardin, giving evidence before the Commission on Old-Age Pensions, ascribed the small insurance and annuity business of the Post Office to the want of a personal canvass. They pointed out that there had been some temporary increase in insurance through an appeal to the Post Office employés themselves, and they suggested that something might be done if the masters of the elementary schools could be induced to interest themselves in recommending to their scholars and the parents of their scholars the advantages offered by the Post Office. It was also pointed out that the friendly societies might, if they were so disposed, act as intermediaries between their members and the Post Office, and thereby, as it were, reinsure their risks with the Government; but it was added that all overtures of this nature to the societies had failed, apparently from the fear—quite groundless—of introducing Government control of the societies' affairs. There may, indeed, be another reason for the failure of the deferred annuity system. The insurance of old-age pay is not at present popular even amongst the members of friendly societies, or even in Germany, where it has been given to the workmen largely at the expense of other people. Insurance against death, sickness, and accidents appeals to the young working man; but old age is too far off to be an object of solicitude, or to warrant the foregoing of the many pleasant things that money can give. However, if at any time opinion changes, the Post Office stands ready to make foresight or philanthropy easy. Though no great results have been achieved, a machinery has been established which works with perfect smoothness, and which may some day be of service to the nation.

AUTHORITIES.—*Annual Report of the Postmaster-General, presented to Parliament by Command.*—*Report of Royal Commission on the Aged Poor*, vol. iii., Evidence, pp. 744–755.

(R. H*.)

Interlaken, a Swiss village, 1864 feet above the sea, in the canton of Bern, between the lakes of Thun and Brienz. It is 17½ miles from Thun by rail (itself 19¼ miles from Bern), while from Interlaken cog-wheel lines run to Lauterbrunnen (8 miles), up to the Schynige Platte (4½ miles) and to Grindelwald (12½ miles). In different parts of the church of the old Monastery various denominations now have places of worship. The population of Interlaken proper (*i.e.*, all on the left bank of the Aar) was 2958 in 1900. The town of Unterseen (2612 inhabitants in 1900) was built on the right bank of the Aar in 1280 by Berchtold von Eschenbach.

International Arbitration. See ARBITRATION, INTERNATIONAL.

International Law (Private).—There is in every territory the law of the land, or territorial law, by which the courts decide all cases that include no circumstances connected with any foreign territory. Often, however, such a circumstance suggests the question whether justice does not require that the law of some other territory shall be applied. Thus the Gretna Green marriages, by which English unions escaped the necessity of banns or the consent of parents or guardians, suggested the question, which was answered in the affirmative, whether even in England their validity ought not to be tried by the law of Scotland, where they were celebrated. Often, again, the question is suggested whether justice does not require that the courts of law should allow some effect to foreign legal proceedings, such as a judgment obtained or litigation pending abroad. Such questions as these are answered by private international law, which, since both laws and legal proceedings are emanations of public authority, may be defined as the department of legal science which is concerned with the effect to be given in the courts of law of any territory to the public authority of another territory. The extradition of criminals is also an effect given to foreign public authority, but rather by the Government which surrenders the criminal (see EXTRADITION) than by the courts of law, whose only function is to check the surrender so far as the domestic legislation allows them to do so. If private international law were defined as the effect to be given by any mode in one territory to the public authority of another, extradition would be included in it, as is often done; but since the principles governing extradition have little to do with those applicable to the other cases, it seems best to treat it as a separate department of law, as is generally done in England.

Comity of Nations.—In the 17th century the Dutch jurists Paul and John Voet and Huber brought forward a view which has since been largely adopted in England and the United States, namely, that the effect given by courts of law to foreign public authority is only due to the comity of nations, but for which every possible question before them would have to be decided by the law of the land. Comity, in that phrase, may only be intended to express the truth that foreign public authority has no inherent effect, without denying that the effect which domestic public authority allows to it is dictated by justice. But the limitations implied in the popular meaning of comity have sometimes been made the ground for deciding questions of private international law in the manner supposed to be most for the interest of litigants belonging to the territory; the phrase is consequently reprobated by most Continental writers, and had better be dropped. The justice on which private international law is founded acknowledges no interest but the general one of intercourse between persons sharing a common civilization in different countries. This interest, as manifesting itself in the domain of law, it seeks to satisfy, and it is therefore a true legal justice, rightly classed under *law*, *droit*, *recht*, *diritto*, *derecho*, and other corresponding terms.

Of the two words which, together with *law*, make up the title of our subject, *private* is justified by the fact that its application is between litigants in courts of law, and not between Governments except so far as they may be such litigants. *International* (although *interterritorial* would be better) is justified by the facts that public authority, which may be internationally foreign, has to be considered, and that Governments display a great interest in the question by concluding treaties about it, and occasionally even by suspending diplomatic relations when a court of one country has applied to the subjects of another a rule which the Government of the latter deems unjust. But those who think that the primary division of law should be into public and private, and not into international (or interterritorial) and territorial, object to the order in which the three words of the name are usually placed, and call the subject "international private law."

Conflict of Laws.—This is another name for our subject, and indeed an older one than "private international law," besides being still much used. But although laws may differ, they cannot properly be said to conflict, unless each can lay a just claim to application in the same circumstances. Now this does not happen. The justice which points out that in certain cases effect ought to be given in one territory to the laws or legal proceedings of another, really traces the limits of laws and legal proceedings in space; and the tracing of limits is rather the prevention of conflict than its solution. Savigny has well pointed out that our subject is analogous to the determination of the limits of laws in time, which has to be made when the just application of a new enactment is to be distinguished from the *ex post facto* application which cannot justly be allowed it. The truth which is aimed at in the phrase "conflict of laws" is that the main problem of our subject is the selection of a law for each given case; but different laws are candidates for selection, not from anything in them as laws, but from differing opinions about the justice of the case. From this selection, again, will be seen the contrast between private international law and attempts at the assimilation of the laws of different countries. To a great extent such assimilation is desirable, especially in mercantile law, but it must always be limited by different views of social order and differences in national habits of thought and action. So far as it is realized, private international law comes to an end with the occasion for selection.

Territory.—This word, as entering into the definition of private international law, does not imply a separate state, whether sovereign or semi-sovereign; it includes every geographical area having a separate legal system, England and Scotland, as well as France or Germany. The case of the Gretna Green marriages above referred to illustrates the necessity of rules of private international law between all such, as well as between areas internationally foreign to one another; and indeed the rules are so applied, and in the language of our subject, the area of every separate legal system is foreign to every other such area. Only where a rule contemplates a person as attached more or less permanently to a particular territory, the tie which so attaches him to it may be either nationality or domicile if the territory is a separate state, as France; but it can only be domicile if the territory is combined with others in one state. Nothing but domicile can distinguish British subjects as belonging to England, Scotland, or Jamaica, or citizens of the United States as belonging to New York or Pennsylvania.

Legal rules must have relation to the physical and mental characters, and the consequent habits of action, of

the populations for which they are intended; they would not satisfy legal justice if they endangered social order as understood and desired by those populations, or if they failed to give due effect to the expectations of parties. This must be true for the rules of private international law as well as for those of any territorial law, and it leads us to ask whether the differences which preclude the universal identity of the latter must not also preclude the existence of the former. The answer is: (1) That where circumstances connected with different territories are concerned, wise rules for the selection of a law will generally give better effect to the expectations of the parties than an exclusive adherence to the territorial law of the court; (2) That the circumstances in which a foreign law is held to apply are exceptional as compared with those in which the domestic law applies, and naturally occur oftenest among the persons and in the affairs having most of a cosmopolitan character, so that the moral shock of applying to them a law founded in a foreign social order is greatly attenuated; (3) That throughout Christendom (to which Japan has been added for legal purposes) there does exist, though not an identity, yet a considerable similarity in views of social order and prevalent habits of thought and action. Within the same geographical limits there also exists another requisite for the working of a system of private international law, namely, a mutual confidence between countries in the enlightenment and purity of their respective judicatures, to whose proceedings the respect enjoined by the rules of our subject is to be mutually given.

Even within the geographical limits just mentioned there are certain differences on points of social order, especially on marriage or divorce, which have hitherto prevented a complete agreement being attained in the rules of private international law. But no attempt has ever been made to establish any system of the kind as between Christian communities and Mahommedan or other polygamous ones, or between countries enjoying a Christian standard of civilization and those, of which China may be taken as an example, which, whether polygamous or not, do not inspire the necessary confidence in their judicatures. In Turkey and other Eastern countries (in which designation Japan is no longer included for purposes of law) Christians are placed by treaty under the jurisdiction in civil matters of their respective consuls. When in the courts of Christian countries Eastern persons or circumstances connected with Eastern laws have to be dealt with, the peculiar institutions of those countries are not enforced; and while in other respects the judges may be assisted by some of the rules of private international law, especially such as have for their object to carry into effect the reasonable intentions of parties, yet those rules are not applied as parts of an authoritative system.

Rules for the selection of the territorial law to be applied in the different classes of cases, or for the recognition of foreign legal proceedings, have sometimes been made the subject of international treaties, and have often been enacted by territorial legislatures. England possesses a few such enactments, as in the Bills of Exchange Act, 1882, and many other countries possess them to a much larger extent in their codes. Where such enactments exist, or where treaty stipulations have been made and the territorial law makes such stipulations binding on the judges, the courts of law must obey and apply them as they must obey and apply any other part of the law of the land. If, as in England, judicial precedents are held to be binding, so that the law of the land consists in part of judge-made law, a similar result is produced; an English court must follow English precedents on the application of foreign law or the refusal to apply it, to the same extent to which it would be bound to follow them on any other point. So far as our matter remains open for a judge, he has, to assist him towards a just decision, the treaties, written laws, and judicial precedents of other countries as examples, and a vast literature which has grown up in all Christian countries. That this apparatus does not always furnish concordant results is due, not only to the divergences on points of social order above referred to, but also to the different bases of the legal systems with which the respective Governments and writers have been familiar. The legal systems of different countries have been founded on Roman law, feudal law, English common law, and still other bases. The arguments of lawyers are affected by the prepossessions thence arising, and they have consequently failed to arrive at so much agreement on the rules of private international law as would have been compatible with the conditions and modes of life and action surrounding them. It is possible that lawyers, whose tendencies are usually conservative, have been left a little behind on the roads by which the modern world seems to be travelling towards uniformity. But the general acceptance of a complete body of rules on private international law is a goal well within sight, and it is probable that for its attainment we must look to international treaties concluded under the joint direction of professional and non-professional minds.

The most remarkable steps that have been taken in or towards the conclusion of such treaties as have been mentioned were those initiated, to its high credit, by the Government of the Netherlands. That Government first moved in the matter in 1874, but it was not till 1893 that it succeeded in assembling at The Hague the official representatives of Germany, Austria, Hungary (separately represented, because having different laws from Austria), Belgium, Denmark, Spain, France, Italy, Luxemburg, the Netherlands, Portugal, Rumania, Russia, and Switzerland. A second conference was held at the same place in 1894, at which the same Powers were represented, with the addition of Sweden and Norway, also separately represented, as differing in their laws; and the result was a considerable, though far from complete, body of rules of private international law, which the delegates of all the sixteen countries agreed in submitting to the appreciation of their respective Governments, subject to the reservations expressed in the minutes of the sittings. These rules related to the conditions for the validity of marriage, the effects of marriage on the status of the wife and children, divorce and judicial separation, guardianship, bankruptcy, wills and succession to property on death, and several points of judicial procedure. On 14th November 1896 a treaty embodying seventeen out of the twenty articles on judicial procedure (to be found at length in the *Revue de droit international et de législation comparée*, tome xxviii. pp. 574–579) was signed at The Hague by eight of the Powers above mentioned, and all the others have since acceded to it. A third conference met at The Hague in 1900, and prepared draft treaties completing the subjects of marriage, divorce, and succession on death, and adding that of the guardianship of minors. These drafts, as well as the remainder of the work of the preceding conferences, await adoption by the Powers represented. Next in importance among combined official efforts should be mentioned the congress of seven South American States at Montevideo in 1888–89, which on many branches of private international law drew up rules intended for adoption by treaty on that continent. And though the Institute of International Law, founded in 1873, is not an official body, a high place in this subject must be given to its discussions and votes, in which eminent lawyers of almost every country have participated.

In considering the particular rules of private international law which are most consonant with justice, perhaps *Nationality; domicile.* the most obvious cases which present themselves for admitting foreign circumstances to influence the decision of a judge are those in which rights are so connected with the person of an individual that the justice of deciding on them by a law having relation to his person speaks almost for itself. Hence arises the notion of a personal law, which must be that either of the person's political nationality or of his domicile, these being the only circumstances that for the time being are fixed for the individual irrespectively of the spot where he may happen to be, and of the transaction in which he may happen to engage. Political nationality, or the membership of a separate international state, with the circumstances of parentage or place of birth on which it depends, and its change by naturalization or otherwise, belongs to public international law, though it may produce its effects in private law. Domicile, though it occasionally produces effects in public law, belongs originally to private law. It is residence considered technically, residence viewed in the light of technical rules intended to secure that each person shall have but one domicile at a time, as is necessary if it is to be the criterion of personal law. For that purpose it is distinguished into domicile of origin and acquired domicile. The former is that which is attributed to every one at his birth, in general the domicile of the father at the date of the birth; the latter is that which a person *sui juris* acquires by changing either his domicile of origin or any other domicile he may have previously acquired, which change must be made *animo et facto*, by intentionally taking up a new principal and permanent residence. Of the subsidiary rules the chief are that the domicile of a person under age follows that of his father, and that of a wife follows the domicile of her husband, through all their changes respectively. In and long after the Middle Ages domicile was the unquestioned criterion of the personal law, so far as such a law was allowed to be applied in preference to the territorial law of the court. Political nationality had not then been defined with the clearness which now marks it, and the variety of laws which existed within most of the larger states, together with the narrow geographical range within which intercourse was usually restricted, caused questions about the conflict of laws to arise with much the greatest frequency between subjects of the same state, who could for the present purpose be distinguished only by the provinces in which they were domiciled. Now, all these conditions being changed, there has been on the continent of Europe a wide movement towards adopting nationality as the criterion of personal law. Certainly it has the advantage of being seldom doubtful, while the determination of domicile gives rise to many of the most difficult and most expensive lawsuits, depending as it often does on evidence about the acts and intentions of a person in changing his residence or as between two residences, sometimes even about such acts and intentions on the part of a person long dead, from whom it may be alleged that a domicile of origin was derived. The British dominions, however, include, besides England and Scotland with their different laws, other legal provinces governed by what in the main is English law, though more or less varied by local legislation (Ireland, Australia, West Indies, &c.), Roman-Dutch law (Ceylon, Cape, Natal, Guiana), the French codes (Mauritius), and a code largely based on older French law (Quebec), not to mention India, with its copious and independent legislation, tempered by the large application, still necessarily made there, of Mahommedan and Hindoo laws. Domicile, and not political nationality, therefore, continues to be the only possible criterion of personal law in a very large part of the cases which come before the English courts of justice—a circumstance which no doubt has contributed to the preference of it as a criterion even in other cases which those courts still display.

Formerly, and as late as Lord Eldon's time, or even later, the English courts, peculiar in this respect, held that the competency of a person to contract depended on the law of the place where the contract was made. This doctrine, carried to America with the rest of *Capacity; status.* English jurisprudence, still maintains in the courts of the United States a struggle with the doctrine of personal law as governing capacity and status, which now prevails in England, as in most other countries —such personal law being in England based on domicile. Thus the capacity of a party to enter into a contract, whether it be disputed on the ground of his age, or, in the case of the contract of marriage, on the ground of his consanguinity or affinity with the other party, will be decided in England by the law of his domicile. Guardians, curators, and committees of foreign minors or lunatics, deriving their authority from the law or jurisdiction of the latter's domicile or nationality, can sue and give receipts in England for their personal property. The English court will not decree the divorce of persons not domiciled within its jurisdiction, and it will recognize foreign divorces if and only if they have been decreed by a jurisdiction to which the parties were subject by domicile or nationality. The legitimation of a child by the subsequent marriage of its parents will be held in England to depend on the law of its father's domicile or nationality. In France the Code Napoleon, Art. 3, says that "the laws concerning the status and capacity of persons govern Frenchmen even though residing in foreign countries"; and the French courts, by analogy, determine the status and capacity of foreigners by the law of their nationality. The Italian code, preliminary Art. 6, says that "the status and capacity of persons, and their family relations, are governed by the law of the nation to which they belong." The German statutory provisions belonging to private international law are contained in the statute enacting the code, of which Art. 7 says that "the capacity of a person shall be determined according to the law of the state to which he belongs," but adds, "If a foreigner enters in Germany into a transaction for which he is incapable or has only a restricted capacity, he is to be treated for that transaction as being so far capable as he would be by the German legislation. This, however, does not apply to transactions with regard to rights of family or of succession, or to those disposing of foreign immovable property." It may be added that Art. 13 makes it clear that marriage stands on the same footing as contracts relating to the family, capacity for it by his or her national law being required from each party. In a spirit similar to that which dictated the German enactment, the French courts have not generally allowed a Frenchman to suffer from the incapacity, by his personal law, of a foreigner who contracts in France, when the foreigner would have been capable by French law, and the Frenchman was in good faith and without great imprudence ignorant of his incapacity. Lately a disposition has been shown to limit this protection of nationals to the case in which the foreigner has been guilty of fraud. English courts usually hold themselves to be more stringently bound by rules, whether those enacted by Parliament or those which they have adopted for themselves; and if they should continue to profess the doctrine that capacity depends on the law of the domicile, it is not probable that they will deem themselves entitled to make exceptions for the protection of persons contracting in England with foreigners not enjoying such capacity. The point furnishes an illustration of

the fact that to deal satisfactorily with so complex a subject as private international law requires the assistance of the legislature, which again cannot be given with full utility unless uniform provisions, to be enacted in different countries, are settled by international convention.

Another ground for the application of a personal law is furnished by the cases in which masses of property and rights have to be dealt with collectively, by reason of their being grouped around persons. The principal instances of that kind are when it is necessary to determine the validity and operation of a marriage settlement or contract, or the effect of marriage on the property of the husband and wife in the absence of any express settlement or contract, and when property passes on death, either by a will or by intestate succession. These matters, at least when the property concerned is movable, are generally referred to the personal law of the husband at the time of the marriage, or to that of the deceased respectively; but about them, besides the question between domicile and nationality, there arises the question whether immovable property is to be included in the mass governed by the personal law, or is to follow the territorial law of its own situation (*lex situs*). Here we touch the distinction between *real* and *personal* statutes which arose in the Middle Ages, when the local legislation of the free cities was contrasted, under the name of statutes, with the general Roman law. That distinction did not bear the same character at all times, but in the 16th century, under d'Argentré, it acquired its most developed form, absorbing all laws into one or other of the two classes, and giving a vast extension to the real class, for which was claimed exclusive application to immovables situate in the territory of the law. In accordance with this system, the highly feudal character of which was very sympathetic to English jurisprudence, English practice has refused to include English immovables in the mass to be dealt with as a unit on marriage or death. But it refers the validity and operation of a marriage settlement, at least as to movables, and the effect of marriage, in the absence of express contract, on the movable property of the husband and wife, to the law of the husband's domicile at the time of the marriage, called the matrimonial domicile. And with regard to the succession to movables on death, it adopts the principle of massing them irrespectively of their situation, so far as is permitted by the peculiar system under which the property in movables situate in England does not pass directly to the legatees or next of kin, but to the executors or administrators, who are charged with the duty of paying the debts of the deceased and distributing the beneficial surplus. The validity of a will of movables, otherwise than in respect of form (about which more hereafter), and the rights, whether under a will or under an intestacy, in the beneficial surplus arising from them, are determined in England by the law of the testator's last domicile. On the points here glanced at, the decisions in the United States generally agree with those in England, only allowing the pecuniary relations of a married couple, in the absence of express contract, to be varied by a change of domicile, notwithstanding that such change is in the husband's exclusive power, instead of maintaining them as fixed by the matrimonial domicile. On the continent of Europe partisans of a variation after the marriage are scarcely to be found; but as between the nationality and the domicile of the husband or of the deceased, and on the question whether the mass to be governed either by nationality or domicile, on marriage or on death, includes immovables situate under a different law, the division of opinion, legislation, and practice is considerable and intricate.

Lex situs, lex loci actus, lex loci contractus, lex fori.—The law of the territory in which they are situate (*lex situs*) is generally applied to the property in particular things, whether movable or immovable, so far as they are not included in any mass grouped round a person; in England, therefore, always to immovables. In drawing up documents and conducting ceremonies public functionaries must necessarily follow the law from which they derive their authority, wherefore the law of the place where any public document is entered into, or any public ceremony performed (*lex loci actus*), is the only one that can be followed in its external form. This maxim applies to the forms of notarial acts, and to that of marriage celebrated with the official concurrence of clergymen, registrars, and so forth. And since documents and ceremonies entered into without official concurrence are rarer on the continent of Europe than in England, the inevitableness of the form of the *lex actus*, when such concurrence is had, has generally led to the form being also held sufficient whenever the affair comes to be inquired into later. Nor in England has the sufficiency of the form of the *lex loci actus* for the celebration of marriage ever been doubted, but a will made by a notarial act in accordance with that law was not admitted. Disregarding the distinction between external form and internal validity and operation, a will of English land could not take effect unless made in English form (that is, since the Wills Act of 1837, with two witnesses), and a will of personal estate could not be admitted in England to probate unless made in the form of the law of the testator's last domicile. But now, by Lord Kingsdown's Act, passed in 1861, there are given for wills of personal estate made by British subjects, besides the form of their last domicile, three alternative forms, namely, the form of the place of making the will, that of the testator's domicile at the time when it was made, and that of the part of the British dominions where he had his domicile of origin—only the first of the three, however, being offered when the will is made in the United Kingdom; and no will is to be revoked or invalidated by a change of the testator's domicile after making it. The law of the place of contract, *lex loci contractus*, is distinguished into that of the place where the contract is entered into, *lex loci contractus celebrati*, and that of the place where it is to be performed, which, from the particular case in which the performance consists only in a payment, is called *lex loci solutionis*. To the first of these is generally referred the formal validity of a contract, so far as entered into without the intervention of a functionary, and therefore not covered by the principle of the *lex loci actus*, and so far also as the performance is not tied to any particular place. For example, the form for contracting marriage, whether with official intervention as in England, or by private and even oral contract as in Scotland, depends, both as to necessity and as to sufficiency, on the law of the place of contracting it. But as to the internal validity, interpretation, and operation of a contract, there has been and still remains much difference of opinion between the laws of the place of contracting and of that of stipulated performance; the former being supported, among other grounds, on some texts of Roman law which Savigny has shown to have been misunderstood, while the latter agrees much oftener with the intention of the parties. The English decisions do not adhere closely to either of those laws, but while repeating much of the traditional language about the *lex loci contractus*, they aim at doing substantial justice by referring a contract to that place with which its matter has the closest connexion, or which the intention of the parties points out. In matters of legal procedure every court follows its own practice exclusively (*lex fori*), as, for instance, whether the remedy on a contract shall be damages or specific performance, and whether a judg-

ment may be executed against the person or only against the property of a party. A point much disputed under this head is whether the time of limitation of actions shall, as held in the United Kingdom, be decided by the *lex fori*, as an incident to the procedure, or by the *lex loci contractus* in one of its varieties, as an essential modality of the obligation.

It must not be supposed that the law of the land, the proper territorial law of the court which has to deal with a case in which foreign circumstances arise, always gives way to the law pointed out by the general maxims which even that particular court accepts with regard to the law of the domicile or state, or that of the situation of property or the place of contract. All rules for the application of foreign laws are subject to an exception commonly called that of *public order*, *i.e.*, where such application would interfere with essential principles of morality or policy received in the territory. This reservation is usually made in general terms where legislation on private international law is attempted, as in Article 6 of the Code Napoleon, and preliminary Article 12 of the Italian code; but the courts have to administer it, as they have also in England and other countries where it rests only on judicial practice, and the greater or less extent given to it is one of the causes of the uncertainty and want of uniformity in our subject. One example often quoted is the refusal of the courts in all Christian countries to give effect to polygamous marriage, but this case goes deeper still, for none of the countries in which polygamous marriage exists is allowed to enter at all into the communion of private international law. All, so far as Great Britain has settled legal relations with them, are among those in which British subjects live under consular protection and jurisdiction, or (in Egypt) under that of the Mixed Courts. A better instance is afforded by the refusal of courts, normally within the pale of European legal communion, to recognize divorce as dissolving a marriage, notwithstanding that it has been decreed under the personal law. As another instance, there can be little doubt that an incapacity to marry imposed by the personal law in virtue of religious vows or orders would be disregarded by the English courts in the case of a person marrying in England. Again, it is established in England that damages cannot be recovered for a *tort* unless the act complained of was a wrong both by the law of the country where it was done and by the law of England; and Article 12 of the statute enacting the German code is in accordance with that doctrine. Now the law of the country where the act is done would naturally give the standard for measuring its legal consequences, and it seems to be due to the connexion which laws qualifying acts as wrongs have with public order that respect for that law is tempered by respect for the law of the countries in which it is invoked; but Article 8 of the Belgian code refers the liability for torts to the former law without any restriction.

In the rules which have passed before us in the foregoing general review it is easy to perceive a leading motive—that of securing, so far as public order allows, the certainty and stability both of personal and of business relations in the international or interterritorial intercourse which has always accompanied civilization, but is now especially frequent and extensive. It has been attempted to erect this motive into a guiding principle of law, laying down that rights once accrued in any territory, or sometimes, it is said, by virtue of any territorial law, are to be recognized and enforced, subject to the requirements of public order, in any other territory in which they may be invoked before a court of justice. From this, which may be called the principle of the acceptance of foreign rights, it is claimed that the rules of private international law are to be deduced, and that by their consonance with it any such rules are to be tested when proposed. The difficulties of the subject, however, do not admit of being unlocked by so simple a key. They meet us again when we inquire in what territory, or by virtue of what territorial law, a particular alleged right has accrued. Persons belonging by domicile or nationality to A enter in B into a contract to be performed in C; where and by virtue of what law does either acquire a right against the other? Is it to be in or by the law of their homes, where they are normally, though not always necessarily, to be sued? Or of the country where they contract, which for various purposes, as those of police, but not for all purposes, has the control of them when they contract? Or of the country where their contract is to be performed, under a similar control by which, perhaps extending to the very acts of performance, they or their agents may be brought by the operation of their contract? Evidently we cannot apply the principle to guide us in our choice of a law till the very problem which that choice presents has first been solved. There is, however, one case in which the principle of the acceptance of foreign rights leads to a conclusion, namely, where the right has been declared by the judgment of a competent court, which may have been given in an ordinary case, presenting no question of private international law, but in which, if such a question arose, it has been solved by choosing the law and basing the judgment on it. The rule in England and in many other countries as to foreign judgments is that the judgments of competent courts in other territories (foreign in the sense of civil law, whether politically foreign or not) are to be enforced without reopening the merits of the questions disposed of by them. In some countries, however, a foreign judgment is examinable on its merits before being enforced. This was formerly the unquestioned rule in France, though the practice there seems to be now turning the other way. In the system adopted in England everything turns on the competence. For judgments *in rem*, declaring or disposing of the property in a thing, the test of competence is that the thing, whether movable or immovable, was within the territory of the court. Judgments which declare the status of a person, as with regard to marriage or majority, are competent if the person was subject to the jurisdiction by nationality or domicile. The property or the status is treated as being what has been so declared or decreed. For judgments *in personam*, decreeing the payment of a certain sum, the test of competence for the present purpose is again that the person against whom it was pronounced was subject to the jurisdiction by nationality or domicile; the judgment may then be sued on as giving of itself a good title to the sum decreed by it to be paid. For domestic purposes the competence may exist on quite other grounds. By its own territorial law a court may be authorized to entertain a suit *in personam* because the plaintiff possesses its nationality, as by Article 14 of the Code Napoleon, or because the contract sued on was made or was to be performed in the territory, and so forth. But judgments based on these grounds will not be enforceable outside the territory. Here we touch the root principles of our subject. The distinction between domestic and international grounds of competence can only be explained by the history of law, and we come in sight of the fact that the rules of private international law rest finally on conventions which could not have existed if the civilization of different countries had not so much that was common in its origin and in the course which it has followed, but which suit the life of those countries just because that life is itself another outcome of those common antecedents.

Foreign judgments.

The best authority on the history of private international law to the end of the 18th century is LAINÉ, *Introduction au droit international privé*, 2 vols., Paris, 1888. For modern progress the most copious materials are to be found in the *Revue de droit international et de législation comparée*, Brussels, from 1869; the *Journal du droit international privé et de la jurisprudence comparée*, Paris, from 1874; and the *Annuaire de l'institut de droit international*, Paris, from 1877. The most comprehensive general treatise is that of von Bar, of which the 2nd edition appeared at Gottingen in 1889, and has been translated: *The Theory and Practice of Private International Law*, by L. v. BAR, 2nd edition, translated by Gillespie, Edinburgh, 1892. Other works, many of great merit, are numerous in all languages; but in this, as in every department of law, the first place for England and the United States must be given to the different Law Reports, since in those countries it is not in the study but on the bench that the highest legal intellect is usually displayed, and the judgments delivered are often essays on the points involved. The following works, however, among others, treat the subject from the English or United States point of view:—STORY. *Commentaries on the Conflict of Laws, Foreign and Domestic*, 8th edition, by Bigelow. Boston, 1883.—WHARTON. *A Treatise on the Conflict of Laws or Private International Law*, 2nd edition. Philadelphia, 1881.—WESTLAKE. *A Treatise on Private International Law, with Principal Reference to its Practice in England*, 3rd edition. London, 1890.—FOOTE. *A Concise Treatise on Private International Jurisprudence, based on the Decisions in the English Courts*, 2nd edition. London, 1890.—DICEY. *A Digest of the Law of England with Reference to the Conflict of Laws, with Notes of American Cases* by J. B. MOORE. London, 1896. (JNO W.)

Interpolation.—If u denote any function (known or unknown) of a variable quantity x, and if the values of u for a series of values of x be given, it is the business of *Interpolation* to deduce from these data the values of u for intermediate values of x. We shall deal first with the case in which the given values of u correspond to equidifferent values of x. Explanation will be facilitated by an example:—

SPECIMEN TABLE.

$u=1000\times 10^x$. $\qquad x=\log\frac{u}{1000}$.

x	u	First Differences.	Second Differences.	Third Differences.	Fourth Differences.	Fifth Differences.
·0	1000					
		259				
·1	1259		67			
		326		17		
·2	1585		84		6	
		410		23		−3
·3	1995		107		3	
		517		26		+7
·4	2512		133		10	
		650		36		−3
·5	3162		169		7	
		819		43		+5
·6	3981		212		12	
		1031		55		+1
·7	5012		267		13	
		1298		68		+8
·8	6310		335		21	
		1633		89		
·9	7943		424			
		2057				
1·0	10,000					

In the above table the first column contains a series of values of x proceeding by increments of ·1. The second column contains the corresponding values of u. By subtracting each of these from the next we obtain the First Differences, or Differences of the First Order, which form the third column. Each of them is written opposite the space between the two values of u whose difference it is. In the same way the Second, Third, Fourth, and Fifth Orders of Differences, which form the remaining four columns, are obtained, each from the column which precedes it. In general the successive orders of differences diminish rapidly, and the process is to be continued till they either vanish or become small and irregular.

Notation.—Any one of the given values of u being denoted by u_m, the preceding and following values will be denoted by u_{m-1} and u_{m+1}. Thus any five consecutive values may be called u_{-2}, u_{-1}, u_0, u_1, u_2. Δu_m denotes $u_{m+1}-u_m$; $\Delta^2 u_m$ denotes $\Delta u_{m+1}-\Delta u_m$; $\Delta^3 u_m$ is $\Delta^2 u_{m+1}-\Delta^2 u_m$; and so on.

Putting $f(x)$ for u, and taking h to denote the constant increment of x, we have by definition $\Delta fx=f(x+h)-f(x)$. We may accordingly write

$$(1+\Delta)f(x)=f(x)+\Delta f(x)=f(x+h),$$

and, by repeating this operation n times,

$$(1+\Delta)^n f(x)=f(x+nh). \quad . \quad . \quad . \quad . \quad . \quad (1)$$

We shall now extend the definition of Δ by removing the implied restriction that n is an integer; and shall adopt equation (1) with n unrestricted as our working definition of Δ. It is easy to show that Δ conforms to the ordinary laws of combination of algebraic symbols. Hence, by the binomial theorem, we have from (1)

$$f(x+nh)=\{1+n\Delta+\frac{n(n-1)}{2}\Delta^2+\frac{n(n-1)(n-2)}{2\,.\,3}\Delta^3+\&c.\}f(x) \quad (2)$$

which, when n is fractional, is a formula for interpolation, and is the best known of all the formulæ for this purpose. It may be written

$$u_n=u_0+n\Delta u_0+\frac{n(n-1)}{2}\Delta^2 u_0+\frac{n(n-1)(n-2)}{2\,.\,3}\Delta^3 u_0+\&c. \quad . \quad (A)$$

If we employ another symbol δ, defined by

$$\delta f(x)=f(x)-f(x-h),$$

or more generally by

$$(1-\delta)^n f(x)=f(x-nh), \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

we obtain for $f(x-nh)$ or u_{-n} the expression

$$u_{-n}=u_0-n\delta u_0+\frac{n(n-1)}{2}\delta^2 u_0-\frac{n(n-1)(n-2)}{2\,.\,3}\delta^3 u_0+\&c. \quad . \quad (B)$$

In our specimen table, if we take the value 2512 as u_0, then the numbers 650, 169, 43, 12, which slope down from it, will be Δu_0, $\Delta_2 u_0$, $\Delta^3 u_0$, $\Delta^4 u_0$; and the numbers 517, 107, 23, 6, which slope up from it, will be δu_0, $\delta^2 u_0$, $\delta^3 u_0$, $\delta^4 u_0$.

The value assigned to n in (A) and (B) may be either positive or negative, $(1+\Delta)^{-n}$ being equivalent to $(1-\delta)^n$, and $(1-\delta)^{-n}$ to $(1+\Delta)^n$.

To interpolate in our specimen table the value of u for $x=$·42, we may start from $x=$·4 and put $n=\frac{1}{5}$ in (A) or $-\frac{1}{5}$ in (B). The former gives $u_0=2512$, $\Delta u_0=650$, $\Delta^2 u_0=169$, $\Delta^3 u_0=43$, $\Delta^4 u_0=12$, $n=\frac{1}{5}$, $\frac{n(n-1)}{2}=-\frac{2}{25}$, $\frac{n(n-1)(n-2)}{2\,.\,3}=\frac{6}{125}$, $\frac{n(n-1)(n-2)(n-3)}{2\,.\,3\,.\,4}=\frac{-21}{625}$; whence 2630·1 is found as the required interpoland.

To interpolate for $x=$·48 it is better to start from $x=$·5 and put $n=\frac{1}{5}$ in (B) or $-\frac{1}{5}$ in (A).

Rapid convergence is promoted by taking the starting-point as near as possible to the desired interpoland.

Exponents of Δ and δ as Co-ordinates.—The symbol $\Delta\delta u$ or its equivalent $\delta\Delta u$ indicates the number in our table which will be reached, from any selected value of u as starting-point, by taking two steps, one in the direction indicated by Δ and one in the direction indicated by δ. The number thus reached will be the "second difference" standing opposite the selected value of u. In like manner $\Delta^2\delta^2 u$ is the "fourth difference" standing opposite to u. If u is 2512, $\Delta\delta u$ is 133 and $\Delta^2\delta^2 u$ is 10. To reach $\Delta^2\delta u$ from u requires two steps in the direction Δ and one in the direction δ; and to reach $\Delta^2\delta^{-1}u$ requires two steps in the direction Δ and one opposite to the direction δ. When the two exponents (which may be regarded as oblique co-ordinates) are equal in magnitude and opposite in sign, we are carried finally to the same column from which we started. For instance, if u is 2512, the number below it (3162) is $\Delta\delta^{-1}u$, which may be written $\frac{\Delta}{\delta}u$; the number above it (1995) is $\delta\Delta^{-1}u$ or $\frac{\delta}{\Delta}u$. $\left(\frac{\Delta}{\delta}\right)^3 u$ or $\Delta^3\delta^{-3}u$ is the third number (5012) below it; and $\left(\frac{\delta}{\Delta}\right)^3$ is the third number (1259) above it.

Symbolic Law.—The position of $\Delta\delta u$ in the column of second differences, opposite the space between Δu below and δu above, shows that $\Delta\delta u=\Delta u-\delta u$. Accordingly the operation $\Delta\delta$ is equivalent to the operation $\Delta-\delta$, and we are entitled, in all transformations, to employ any substitutions derivable from

$$\Delta-\delta=\Delta\delta \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (4)$$

treated as an algebraic equation. We might have deduced it from the fact that u_1, which we have just seen is $\frac{\Delta}{\delta}u_0$, is also $(1+\Delta)u_0$; or that u_0, which is $\frac{\delta}{\Delta}u_1$, is also $(1-\delta)u_1$, or from $u_0=(1-\delta)u_1=(1-\delta)(1+\Delta)u_0$.

Any difference, of whatever order, can be expressed in terms of tabulated values of u by writing $\frac{\Delta}{\delta}-1$ for Δ. For example,

$$\Delta^3 u_0=\left(\frac{\Delta}{\delta}-1\right)^3 u_0=\left\{\left(\frac{\Delta}{\delta}\right)^3-3\frac{\Delta^2}{\delta^2}+3\frac{\Delta}{\delta}-1\right\}u_0=u_3-3u_2+3u_1-u_0.$$

Similarly, $\Delta^4 u_0=u_4-4u_3+6u_2-4u_1+u_0=\Delta^2\delta^2 u_2$. . . . . (5)

Bisection of Intervals.—The value $u_{\frac{1}{2}}$ interpolated midway between u_0 and u_1 is represented by $\left(\frac{\Delta}{\delta}\right)^{\frac{1}{2}}u_0$; and the value $u_{-\frac{1}{2}}$ midway between u_{-1} and u_0 by $\left(\frac{\Delta}{\delta}\right)^{-\frac{1}{2}}$. But we have $\left\{\left(\frac{\Delta}{\delta}\right)^{\frac{1}{2}}+\left(\frac{\delta}{\Delta}\right)^{\frac{1}{2}}\right\}^2$

$$=\left(\frac{\Delta+\delta}{\Delta^{\frac{1}{2}}\delta^{\frac{1}{2}}}\right)^2=\frac{(\Delta-\delta)^2+4\Delta\delta}{\Delta\delta},$$ which by the equivalence of $\Delta-\delta$ to $\Delta\delta$ reduces to $4+\Delta\delta$. Hence $\left(\frac{\Delta}{\delta}\right)^{\frac{1}{2}}+\left(\frac{\delta}{\Delta}\right)^{\frac{1}{2}}=2\left(1+\frac{\Delta\delta}{4}\right)^{\frac{1}{2}}$

$$=2+\frac{\Delta\delta}{4}-\frac{\Delta^2\delta^2}{64}+\frac{\Delta^3\delta^3}{512}-\&c. \quad . \quad . \quad . \quad (C^1)$$

If the operand is u_0 the first member represents $u_{\frac{1}{2}}+u_{-\frac{1}{2}}$.

If the operand is $u_{\frac{1}{2}}$ the first member represents u_1+u_0, and we have $u_0+u_1=2\left(1+\frac{\Delta\delta}{4}\right)^{\frac{1}{2}}u_{\frac{1}{2}}$, whence

$$u_{\frac{1}{2}}=\tfrac{1}{2}\left(1+\frac{\Delta\delta}{4}\right)^{-\frac{1}{2}}(u_0+u_1)$$
$$=\tfrac{1}{2}\left\{1-\frac{\Delta\delta}{8}+\frac{3\Delta^2\delta^2}{128}-\frac{5\Delta^3\delta^3}{1024}+\&c.\right\}(u_0+u_1). \quad . \quad . \quad . \quad (C)$$

This is the best formula for midway interpolation. For $x=\cdot45$ in our table it gives

$$2512+3162=5674\ ;\ -\tfrac{1}{8}(133+169)=-37\cdot75\ ;$$
$$\frac{3}{128}(10+7)=\cdot40\ ;\ \tfrac{1}{2}(5674-37\cdot75+\cdot40)=2818\cdot3.$$

Broader View of Interpolation.—The first difference $(x+h)^r-x^r$ of any positive integral power of x contains no higher power of x than the $(r-1)^{th}$; hence, if successive differences are taken of a positive integral function

$$u=a_0+a_1x+a_2x^2+\ .\ .\ .\ +a_rx^r, \quad . \quad . \quad . \quad . \quad (8)$$

the r^{th} difference will be constant and the $(r+1)^{th}$ will be zero. Conversely, if the r^{th} differences of a function of x have a constant value, the function is expressible as a rational and integral function of x of degree r. Hence all methods of interpolation by means of differences virtually assume that u can be expressed with sufficient accuracy by a series of the form (8) in which r is a small integer. A very direct method of obtaining an interpolation formula from any small number $r+1$ of given values of u (not necessarily equidistant) is to form $r+1$ equations by substituting corresponding values of u and x in (8), and to deduce from them the $r+1$ constants $a_0, a_1, \ldots a_r$; but the calculation is rendered much easier by a transformation of (8).

Let $u_0, u_1, \ldots u_r$ be the given values of u, and $x_0, x_1, \ldots x_r$ the corresponding values of x, which are not necessarily equidifferent, nor in order of magnitude. Assume

$$u=A_0(x-x_1)(x-x_2)\ldots(x-x_r)+A_1(x-x_0)(x-x_2)\ldots(x-x_r)+\&c. \quad (9)$$

the factor $x-x_0$ being omitted in the first term, $(x-x_1)$ in the second, and so on. The number of factors involving x in each term is r, and each term (and therefore also the whole series) is of the form (8). Substituting u_0 and x_0, all the terms will vanish except the first, and we shall have $u_0=A_0(x_0-x_1)(x_0-x_2)\ldots(x_0-x_r)$, which gives A_0. Substituting accordingly for A_0, the first term of (9) becomes $$\frac{(x-x_1)(x-x_2)\ldots(x-x_r)}{(x_0-x_1)(x_0-x_2)\ldots(x_0-x_r)}u_0, \quad . \quad . \quad . \quad . \quad . \quad . \quad (10)$$

and the other terms can be written down by changing suffixes. This process (commonly called Lagrange's) affords great facility for calculating the coefficients. It has the disadvantage, in common with (8), that if we wish to improve upon a first approximation by including a larger number of given values, all the coefficients must be recalculated. This inconvenience is avoided in the following method, employed by Stirling in his *Methodus Differentialis*. Assume

$$u=a_0+a_1(x-x_0)+a_2(x-x_0)(x-x_1)+a_3(x-x_0)(x-x_1)(x-x_2)$$
$$+\ .\ .\ .\ +a_r(x-x_0)(x-x_1)\ldots(x-x_{r-1}) \quad . \quad . \quad . \quad (11)$$

Then we have the equations

$$u_0=a_0\ ;\ u_1=a_0+a_1(x_1-x_0)\ ;$$
$$u_2=a_0+a_1(x_2-x_0)+a_2(x_2-x_0)(x_2-x_1)\ ; \quad . \quad . \quad . \quad (12)$$

and so on.

a_0 is given by the first equation, a_1 by the first two, a_2 by the first three, and so on.

This method is especially useful when the given values of x are equidifferent—an application to which we shall now proceed. We shall call the values of u *ordinates*, the values of x being regarded as *abscissæ*. The given ordinates will be equidistant, their common distance being h, and we shall take n to denote $\frac{x}{h}$, so that n will increase by unity from each ordinate to the next. (11) will be obviously reducible to

$$u=A_0+A_1(n-n_0)+A_2(n-n_0)(n-n_1)+A_3(n-n_0)(n-n_1)(n-n_2)$$
$$+\&c. \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (13)$$

where n_0, n_1, n_2, &c., are in random order of magnitude.

When the number of given equidistant ordinates is odd, it is best to take the origin on the middle ordinate; the values of n will then be $0, \pm1, \pm2, \pm3$, &c. Introducing them into (13) in the order $0, 1, -1, 2, -2$, &c., we shall have

$$u=A_0+A_1n+A_2n(n-1)+A_3(n+1)n(n-1)$$
$$+A_4(n+1)n(n-1)(n-2)+\&c. \quad . \quad . \quad . \quad . \quad (14)$$

whence the values of the coefficients can be deduced by the method just indicated. The following method has the advantage of more directly indicating the general expression for any coefficient. We shall operate alternately by Δ and δ, remembering that, since the common increment of n is unity, $\Delta f(n)$ is $f(n+1)-f(n)$, and $\delta f(n)$ is $f(n)-f(n-1)$. We thus obtain from (14)

$$\Delta u\ =A_1+n2A_2+(n+1)n3A_3+(n+1)n(n-1)4A_4+\&c.$$
$$\Delta\delta u\ =2A_2+n2\ .\ 3A_3+n(n-1)3.4A_4+\&c.$$
$$\Delta^2\delta u\ =2.3A_3+n2\ .\ 3\ .\ 4A_4+\&c.$$
$$\Delta^2\delta^2u=2.3.4A_4+n2\ .\ 3\ .\ 4\ .\ 5A_5+\&c.$$

From these and (14), by putting $n=0$,

$A_0=u_0,\ A_1=\Delta u_0,\ 2A_2=\Delta\delta u_0,\ 2\ .\ 3A_3=\Delta^2\delta u_0,\ 2\ .\ 3\ .\ 4A_4=\Delta^2\delta^2u_0$, &c. Hence

$$u=\left\{1+n\Delta+\frac{n(n-1)}{2}\Delta\delta+\frac{n(n^2-1)}{2\ .\ 3}\Delta^2\delta\right.$$
$$\left.+\frac{n(n^2-1)(n-2)}{2\ .\ 3\ .\ 4}\Delta^2\delta^2+\&c.\right\}u_0 \quad . \quad . \quad . \quad . \quad (D)$$

If we had introduced the values of n in the order $0, -1, 1, -2, 2$, &c., and operated first by δ, we should have obtained

$$u=\left\{1+n\delta+\frac{(n+1)n}{2}\Delta\delta+\frac{n(n^2-1)}{2.3}\Delta\delta^2\right.$$
$$\left.+\frac{n(n^2-1)(n+2)}{2\ .\ 3\ .\ 4}\Delta^2\delta^2+\&c.\right\}u_0\ . \quad . \quad . \quad . \quad . \quad (E)$$

Adding these two results and halving, we have Stirling's first formula in central differences,

$$u=\left\{1+n\frac{\Delta+\delta}{2}+\frac{n^2}{2}\Delta\delta+\frac{n(n^2-1)}{2\ .\ 3}\ \frac{\Delta^2\delta+\Delta\delta^2}{2}\right.$$
$$\left.+\frac{n^2(n^2-1)}{2\ .\ 3\ .\ 4}\Delta^2\delta^2+\&c.\right\}u_0 \quad . \quad . \quad . \quad . \quad . \quad (F)$$

The two next terms are

$$\left\{\frac{n(n^2-1)(n^2-4)}{2\ .\ 3\ .\ 4\ .\ 5}\ \frac{\Delta^3\delta^2+\Delta^2\delta^3}{2}+\frac{n^2(n^2-1)(n^2-4)}{2\ .\ 3\ .\ 4\ .\ 5\ .\ 6}\Delta^3\delta^3\right\}u_0.$$

The even differences $\Delta\delta u_0, \Delta^2\delta^2u_0\ldots\Delta^r\delta^ru_0$ are called *central differences* relative to u_0, and the same name is extended to the means $\frac{1}{2}(\Delta u_0+\delta u_0)$, $\frac{1}{2}(\Delta^2\delta u_0+\Delta\delta^2u_0)$, &c., of adjacent odd differences. In the standard arrangement, illustrated by our specimen table, the even central differences of u_0 stand at the same level as u_0, and the odd central differences are the means of the odd differences which stand nearest to this level.

When the number of given equidistant ordinates is even, take the origin at their centre, which will be midway between the two innermost. For these two n will be $\pm\frac{1}{2}$, for the two next beyond them $\pm\frac{3}{2}$, for the next two $\pm\frac{5}{2}$, and so on. Introducing them into (14) in the order $\frac{1}{2}, -\frac{1}{2}, \frac{3}{2}, -\frac{3}{2}$, &c., we have

$$u=A_0+(n-\tfrac{1}{2})A_1+(n+\tfrac{1}{2})(n-\tfrac{1}{2})A_2+(n+\tfrac{1}{2})(n-\tfrac{1}{2})(n-\tfrac{3}{2})A_3+\&c.$$
$$\Delta u=A_1+(n+\tfrac{1}{2})2A_2+(n+\tfrac{1}{2})(n-\tfrac{1}{2})3A_3+\&c.$$
$$\Delta\delta u=2A_2+(n-\tfrac{1}{2})2\ .\ 3A_3+\&c.$$

and by putting n alternately equal to $\frac{1}{2}$ and $-\frac{1}{2}$,

$$A_0=u_{\frac{1}{2}},\ A_1=\Delta u_{-\frac{1}{2}}=\delta u_{\frac{1}{2}},\ 2A_2=\Delta\delta u_{\frac{1}{2}},\ 2\ .\ 3A_3=\Delta^2\delta u_{-\frac{1}{2}}=\Delta\delta^2u_{\frac{1}{2}}$$
$$u=u_{\frac{1}{2}}+(n-\tfrac{1}{2})\delta u_{\frac{1}{2}}+\frac{n^2-\frac{1}{4}}{2}\Delta\delta u_{\frac{1}{2}}+\frac{(n^2-\frac{1}{4})(n-\frac{3}{2})}{2\ .\ 3}\Delta\delta^2u_{\frac{1}{2}}$$
$$+\frac{(n^2-\frac{1}{4})(n^2-\frac{9}{4})}{2\ .\ 3\ .\ 4}\Delta^2\delta^2u_{\frac{1}{2}}+\frac{(n^2-\frac{1}{4})(n^2-\frac{9}{4})(n-\frac{5}{2})}{2\ .\ 3\ .\ 4\ .\ 5}\Delta^2\delta^3u_{\frac{1}{2}}+\&c. \quad (G)$$

If the order of introduction is $-\frac{1}{2}, \frac{1}{2}, -\frac{3}{2}, \frac{3}{2}$, &c., we find

$$u=u_{-\frac{1}{2}}+(n+\tfrac{1}{2})\delta u_{\frac{1}{2}}+\frac{n^2-\frac{1}{4}}{2}\Delta\delta u_{-\frac{1}{2}}+\frac{(n^2-\frac{1}{4})(n+\frac{3}{2})}{2\ .\ 3}\Delta\delta^2u_{\frac{1}{2}}$$
$$+\frac{(n^2-\frac{1}{4})(n^2-\frac{9}{4})}{2\ .\ 3\ .\ 4}\Delta^2\delta^2u_{-\frac{1}{2}}+\frac{(n^2-\frac{1}{4})(n^2-\frac{9}{4})(n+\frac{5}{2})}{2\ .\ 3\ .\ 4\ .\ 5}\Delta^2\delta^3u_{\frac{1}{2}}+\&c. \quad (H)$$

Adding these two results and halving, we have Stirling's second formula in central differences,

$$u=\frac{u_{-\frac{1}{2}}+u_{\frac{1}{2}}}{2}+n\delta u_{\frac{1}{2}}+\frac{n^2-\frac{1}{4}}{2}\ \frac{\Delta\delta(u_{-\frac{1}{2}}+u_{\frac{1}{2}})}{2}+\frac{n(n^2-\frac{1}{4})}{2\ .\ 3}\Delta\delta^2u_{\frac{1}{2}}$$
$$+\frac{(n^2-\frac{1}{4})(n^2-\frac{9}{4})}{2\ .\ 3\ .\ 4}\ \frac{\Delta^2\delta^2(u_{-\frac{1}{2}}+u_{\frac{1}{2}})}{2}+\frac{n(n^2-\frac{1}{4})(n^2-\frac{9}{4})}{2\ .\ 3\ .\ 4\ .\ 5}\Delta^2\delta^3u_{\frac{1}{2}}+\&c. (K)$$

which, when n is 0, reduces to the midway-interpolation formula (C). We may change $u_{-\frac{1}{2}}$ into u_0 and $u_{\frac{1}{2}}$ into u_1 throughout the formula. The differences which enter it are "central" relative to the midway position which we have taken as origin. Each of the odd differences can be expressed indifferently as $\Delta^r\delta^r.\delta u_{\frac{1}{2}}$ or $\Delta^r\delta^r.\Delta u_{-\frac{1}{2}}$.

Reduction to Symmetrical Form.—(K) with u_0 and u_1 in place of $u_{-\frac{1}{2}}$ and $u_{\frac{1}{2}}$ is reducible, by putting $n=p-\frac{1}{2}=\frac{1}{2}-q$, to the form

$$u=pu_1+qu_0-\frac{pq}{6}\{(p+1)\Delta\delta u_1+(q+1)\Delta\delta u_0\}$$
$$+\frac{pq(p+1)(q+1)}{120}\{(p+2)\Delta^2\delta^2u_1+(q+2)\Delta^2\delta^2u_0\}-\&c., \quad . \quad (L)$$

or the more easily remembered form

$$u = pu_1 + \frac{(p+1)p(p-1)}{1.2.3}\Delta\delta u_1 + \frac{(p+2)(p+1)p(p-1)(p-2)}{1.2.3.4.5}\Delta^2\delta^2 u_1$$
$$+ \&c. \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad \text{(M)}$$
$$+ qu_0 + \frac{(q+1q)(q-1)}{1.2.3}\Delta\delta u_0 + \frac{(q+2)(q+1)q(q-1)(q-2)}{1.2.3.4.5}\Delta^2\delta^2 u_0 + \&c.,$$

where p is the distance of the interpoland from u_0, and q its distance from u_1. Each pair of terms in (L) or (M) is equivalent to the term of the same order together with the term of next higher order in (K). The mutual equivalence of (M) and (L) is established without difficulty. The equivalence of either of these to (K) is most easily shown by beginning with (L) and reducing to (K).

Deduction of Differential Coefficients.—Since n is defined as $\frac{x}{h}$, we have $\frac{d}{dn} = h\frac{d}{dx}$. Hence $h\frac{du}{dx} = \frac{du}{dn}$, $h^2\frac{d^2u}{dx^2} = \frac{d^2u}{dn^2}$, &c.

The values of $\frac{du}{dn}$, $\frac{d^2u}{dn^2}$, &c., for any of the tabulated values of u are the coefficients of $n, \frac{n^2}{1.2}$, &c., in Stirling's first formula (F). Thus we find

$$h\frac{du}{dx} = \left(\frac{\Delta+\delta}{2} - \frac{\Delta^2\delta+\Delta\delta^2}{12} + \frac{\Delta^3\delta^2+\Delta^2\delta^3}{60} - \&c.\right)u \quad . \quad \text{(N)}$$
$$h^2\frac{d^2u}{dx^2} = \left(\Delta\delta - \frac{\Delta^2\delta^2}{12} + \frac{\Delta^3\delta^3}{90} - \&c.\right)u \quad . \quad . \quad . \quad . \quad . \quad . \quad \text{(N}^1\text{)}$$

For a value of u midway between two tabulated values u_0 and u_1, we have in like manner from (K)

$$h\frac{du}{dx} = \left(\delta - \frac{\Delta\delta^2}{24} + \frac{3\Delta^2\delta^3}{640} - \&c.\right)u_1 \quad . \quad . \quad . \quad . \quad \text{(P)}$$
$$h^2\frac{d^2u}{dx^2} = \left(\Delta\delta - \frac{5\Delta^2\delta^2}{24} + \frac{259\Delta^3\delta^3}{5760} - \&c.\right)\frac{u_0+u_1}{2} \quad . \quad . \quad \text{(P}^1\text{)}$$

For general values of u, we may differentiate either (F) or (K). From (F) we find

$$h\frac{du}{dx} = \left\{\frac{\Delta+\delta}{2} + n\Delta\delta + \left(\frac{n^2}{2} - \frac{1}{6}\right)\frac{\Delta^2\delta+\Delta\delta^2}{2}\right.$$
$$\left. + \left(\frac{n^3}{6} - \frac{n}{12}\right)\Delta^2\delta^2 + \&c.\right\}u_0 ; \quad . \quad . \quad . \quad . \quad . \quad \text{(Q)}$$
$$h^2\frac{d^2u}{dx^2} = \left\{\Delta\delta + n\frac{\Delta^2\delta+\Delta\delta^2}{2} + \left(\frac{n^2}{2} - \frac{1}{12}\right)\Delta^2\delta^2 + \&c.\right\}u_0 ; \quad . \quad \text{(Q}^1\text{)}$$

n denoting the distance of u from the tabulated value u_0.

The series (A) and (B) give, for tabulated values of u,

$$h\frac{du}{dx} = (\Delta - \tfrac{1}{2}\Delta^2 + \tfrac{1}{3}\Delta^3 - \&c.)u = (\delta + \tfrac{1}{2}\delta^2 + \tfrac{1}{3}\delta^3 + \&c.)u \quad . \quad \text{(R) (S)}$$
$$h^2\frac{d^2u}{dx^2} = (\Delta^2 - \Delta^3 + \tfrac{11}{12}\Delta^4 - \&c.)u = (\delta^2 + \delta^3 + \tfrac{11}{12}\delta^4 + \&c.)u \quad \text{(R}^1\text{) (S}^1\text{)}$$

Limit of Error.—In our specimen table, the values of u are given to the nearest integer; their limit of error is therefore ·5. The sum or difference of any two of them has a limit of error double of this—a fact which we shall express by saying that its *error-ratio* is 2. For a linear function $au_0 \pm bu_1 \pm cu_2$ the error-ratio is $a+b+c$. A first difference $u_1 - u_0$ has an error-ratio 2. For a second difference $u_2 - 2u_1 + u_0$ the error-ratio is 4. For a third difference $u_3 - 3u_2 + 3u_1 - u_0$ it is 8, and in general for a difference of order r it is 2^r. We shall investigate the error-ratio of the determination of $h\frac{du}{dx}$ by the formulæ (N) (P) (R) (S), supposing fifth differences to be negligible.

(N) gives $h\frac{du}{dx} = \left(\frac{\Delta+\delta}{2} - \frac{\Delta^2\delta+\Delta\delta^2}{12}\right)u_0 = \frac{1}{2}(u_1 - u_{-1})$
$- \frac{1}{12}(u_2 - 2u_1 + 2u_{-1} - u_{-2}) = \frac{2}{3}u_1 - \frac{2}{3}u_{-1} - \frac{1}{12}u_2 + \frac{1}{12}u_{-2}$.

Error-ratio $= \frac{2}{3} + \frac{2}{3} + \frac{1}{12} + \frac{1}{12} = 1\frac{1}{2}$.

(P) gives $h\frac{du}{dx} = \left(\delta - \frac{\Delta\delta^2}{24}\right)u_1 = u_1 - u_0 - \frac{1}{24}(u_2 - 3u_1 + 3u_0 - u_{-1})$
$= 1\frac{1}{8}u_1 - 1\frac{1}{8}u_0 - \frac{1}{24}u_2 + \frac{1}{24}u_{-1}$.

Error-ratio $= 1\frac{1}{8} + 1\frac{1}{8} + \frac{1}{24} + \frac{1}{24} = 2\frac{1}{3}$.

(R) gives $(\Delta - \frac{1}{2}\Delta^2 + \frac{1}{3}\Delta^3 - \frac{1}{4}\Delta^4)u_0 = -2\frac{1}{12}u_0 + 4u_1 - 3u_2 + 1\frac{1}{3}u_3 - \frac{1}{4}u_4$.

Error-ratio $= 2\frac{1}{12} + 4 + 3 + 1\frac{1}{3} + \frac{1}{4} = 10\frac{2}{3}$, which is also the error-ratio for (S). Thus the limit of possible error is fully seven times as large with either of these formulæ as with the central-difference formula (N).

The midway-interpolation formula (C) reduces (when sixth differences are negligible) to

$u_{\frac{1}{2}} = \frac{1}{256}\{150(u_0+u_1) - 25(u_{-1}+u_2) + 3(u_{-2}+u_3)\}$ . . . (T), giving as the error-ratio $\frac{2}{256}(150+25+3) = 1\frac{25}{64}$. The formula for the same purpose obtained by putting $n = \frac{1}{2}$ in (A) reduces to $\frac{1}{128}(35u_0 + 140u_1 - 70u_2 + 28u_3 - 5u_4)$, giving $\frac{1}{128}(35+140+70+28+5) = 2\frac{11}{64}$ as the error-ratio.

The actual error in interpolation is usually very far below the theoretical limit. If the six intervals lying between ·2 and ·8 in our specimen table are bisected by means of (C) the errors will be found to be ·2, ·1, ·2, ·3, ·1, ·1; whereas the errors of the seven tabulated numbers between which they lie are ·1, ·3, ·1, ·3, ·1, ·1, ·4; so that the interpolated results are on the whole more exact than the tabulated numbers. This suggests the possibility of increasing the accuracy of a given table by interpolation. For instance, (T) can be employed to recalculate the value of u for $x = ·5$ by means of the tabulated values for ·0, ·2, ·4, ·6, ·8, 1·0. Another mode of procedure is to put the sixth difference equal to zero, thus obtaining

$$u_0 = \tfrac{1}{20}\{15(u_{-1}+u_1) - 6(u_{-2}+u_2) + u_{-3} + u_3\} \quad . \quad . \quad \text{(U)}$$

These two methods agree in giving 3162·4, the true value being 3162·3, and the tabulated value 3162.

Addendum.—Researches made since the foregoing article was written have shown that the two formulæ (F) and (K), known by Stirling's name, are really Newton's, and were first published in his *Methodus Differentialis*, 1711; also that the common formula (A) is Newton's, being given in geometrical form in Lemma 5, Book III., *Principia*. Stirling, in a paper entitled "Methodus Differentialis Newtoniana illustrata," *Phil. Trans.*, 1718, emphasizes the value of these publications; but in his own *Methodus Differentialis*, 1730, where the formulæ are more fully discussed, he does not repeat the reference to Newton. The symmetrical formula (M) was first published at the British Association, 1900 (*Report*, p. 648), and is further illustrated in *Jour. Inst. Actuaries*, January 1901. The combined use of the two operators Δ and δ was described at the British Association, 1899 (*Report*, p. 645), and in *Quar. Jour. Math.*, 1900, 1901. Modern works on practical interpolation are:—*Institute of Actuaries' Text-Book*, Part II., by George King; and *Theory and Practice of Interpolation*, by H. E. Rice, U.S. Naval Observatory, which contains full tables of numerical values of coefficients. A paper entitled "Central Difference Formulæ," by W. F. Sheppard, *Proc. Lond. Math. Soc.*, vol. xxxi., contains the fullest collection we have seen of such formulæ, and a discussion of the limits of error in interpolation. An excellent summary of the early history of interpolation is given in the introduction to the first edition of Hutton's *Mathematical Tables*. (J. D. E.)

Intra, an industrial town, province of Novara, Piedmont, Italy, on the west shore of Lago Maggiore, 9 miles east of Gravellona. It has a station on the Simplon railway, and busy cotton mills, chemical works, hat factories, and dyeworks, and a large institute of arts and sciences. The parish church (1708–51) has a monumental dome (1890) and a belfry (1877), 177 feet high. There are statues to Garibaldi and Victor Emmanuel (1887). Population (1881), 5745; (1898), 5700.

Invercargill, capital town of Southland county, South Island, New Zealand, 100 miles west-south-west of Dunedin. It is the centre of the large grazing and farming district of Southland. Amongst its chief buildings are the government offices, excellent public reading-rooms, and a number of factories. Most of its trade passes through Bluff Harbour, some miles away, which is connected with the town by rail. The exports of the two places were in 1900, £741,750; their imports in 1900, £288,170. Bluff Harbour is the port of call and departure for steamers for Melbourne and Hobart. Population, including suburbs, 10,630.

Inverness, a royal and parliamentary burgh (Inverness group) and the county town of Inverness-shire, Scotland, near the mouth of the river Ness, 165 miles north-north-west of Edinburgh by the Forth Bridge route. Recent erections include four churches, a town hall, a theatre, new public market (to replace one burned down in 1889), Highland orphanage, new academy, and new post office. The cemetery of Tomnahurich is one of the most beautifully situated burying-grounds in the United Kingdom. Inverness—"the capital of the Highlands," as it is called—is the centre of traffic in connexion with the shooting season, and is thronged with tourists every summer. The Northern Meeting and County Ball at the end of September usually indicate the close of the midsummer vacation. Inverness is the port for the passenger traffic on the Caledonian Canal, the pier being a mile or so distant from the town. The finely wooded islands in the

river are a popular resort. It is commonly said that the inhabitants speak the best English in the British Isles. The extension of the harbour was undertaken at a cost of £50,000. There were 42 vessels of 3272 tons registered at the port in 1898. In 1888, 3139 vessels of 362,953 tons entered; in 1898, 3775 vessels of 484,574 tons. Imports were valued at £58,991 in 1888, and £97,065 in 1898. Coal and wood are the chief imports. Tweed (tartan) manufacture is the leading industry. Inverness is a great distributing centre of trade to the Highlands. The academy is an endowed secondary school. Valuation, 1889–90, £90,280; 1899–1900, £118,845. Population (1881), 17,385; (1901), 21,193.

Inverness-shire, a maritime Highland county of North Scotland, bounded on the N. by Ross-shire, on the N.E. by Nairn and Elgin, on the E. by Banffshire and Aberdeenshire, on the S.E. by Perthshire, on the S. by Argyllshire, and on the W. by the Atlantic.

Area and Population.—In 1891 the Argyll portion of Small Isles was placed in Inverness, as were the Nairn parts of Daviot and Dunlichty and Petty; Cawdor was placed wholly in Nairn; the parish of Urray with a portion of Kilmorack added was restricted to Ross; and the boundary was also altered between Inverness and Elgin, in the parish of Cromdale, which became an Elgin parish, its Inverness portion being added to another Inverness parish. The area of the county (foreshore excluded) is 2,784,884 acres, or 4351·5 square miles. The population was in 1881, 90,454; in 1891, 89,317; in 1891, on the above area, 90,121, of whom 43,585 were males and 46,536 females; in 1901, 90,182, of whom 43,810 were males and 46,372 females. On the old area, taking land only (2,616,545 acres or 4088·3 square miles), the number of persons to the square mile in 1891 was 22, and the number of acres to the person 29·3. In the registration county, which had a population of 85,535 in 1891, the population decreased between 1881 and 1891 by 1·37 per cent. Between 1881 and 1891 the excess of births over deaths was 7700, and the decrease of the resident population 1193. The following table gives particulars of births, deaths, and marriages in 1880, 1890, and 1899:—

Year.	Deaths.	Marriages.	Births.	Percentage of Illegitimate.
1880	1422	366	2313	8·5
1890	1424	346	2033	7·43
1899	1479	420	2004	8·4

The birth-rate, death-rate, and marriage-rate are all below the rates for Scotland. The following table gives the birth-rate, death-rate, and marriage-rate per thousand of the population for a series of years:—

	1880.	1881–90.	1890.	1891–98.	1899.
Birth-rate . .	26·83	25·41	23·83	24·06	23·78
Death-rate . .	16·49	16·44	16·69	17·64	17·55
Marriage-rate .	4·24	4·51	4·05	5·05	4·98

The number of Gaelic-speaking persons in the county in 1891 was 44,814, of whom 17,316 spoke Gaelic only; and there were 86 foreigners. Valuation in 1889–90, £316,411; 1899–1900, £366,237.

Administration.—The county returns a member to Parliament. Inverness (21,193) is the only royal burgh, and one of the Inverness group of parliamentary burghs. There are 33 civil parishes, with poorhouses at Inverness and in Skye and the Long Island. The number of paupers and dependants in September 1899 was 3372. Inverness forms a sheriffdom with Elgin and Nairn, and there are resident sheriffs-substitute at Inverness, Fort-William, Portree in Skye, and Lochmaddy in North Uist.

Education.—Thirty-seven school boards manage 168 schools, which had an average attendance of 12,289 in 1898–99, while 14 voluntary schools (8 Roman Catholic, 3 Episcopal) had 684. There are 2 secondary schools in Inverness, and 24 other schools in the county earned grants in 1898 for giving higher education. The county council hands over the "residue" grant to the county committee on secondary education, which allocates it among district committees for expenditure on local technical classes; Inverness town council subsidizes the burgh technical and art school.

Agriculture.—In 1898 the percentage of land under crops was only 5·38, being higher than that in Sutherland alone, but since 1852 the cultivated area has increased more than 300 per cent. An immense majority of the holdings are crofts, the average size of the 6951 holdings in 1895 being 22 acres; 2780 or 39·99 were under 5 acres, 3590 or 51·65 were between 5 and 50 acres, and only 8·36 were above 50 acres. The number between 50 and 100 acres was 295; between 100 and 300, 249; between 300 and 500, 26; between 500 and 1000, 6; and there were 5 over 1000. Oats are the predominant crop, and are about stationary in acreage; and the same may be said of barley since it reached its maximum in the 'eighties. The wheat acreage is trifling. The following table gives the principal acreages, as far as possible, at intervals of five years from 1880:—

Year.	Area under Crops.	Corn Crops.	Green Crops.	Clover.	Permanent Pasture.	Fallow.
1880	126,306	39,584	19,513	27,155	39,140	914
1885	149,521	36,966	19,493	29,976	58,924	1432
1890	150,529	39,777	18,645	32,256	58,995	830
1895	150,725	37,883	17,344	29,927	65,132	388
1899	148,766	38,333	16,827	31,365	61,740	464

The following table gives particulars of the live stock during the same years:—

Year.	Total Horses.	Total Cattle.	Cows or Heifers in Milk or Calf.	Sheep.	Pigs.
1880	8938	51,287	20,208	711,910	2897
1885	8692	51,279	21,035	684,246	3488
1890	8744	48,602	21,046	675,148	3809
1895	8872	51,799	21,261	645,900	3019
1899	8952	52,321	22,362	628,695	2669

From the commencement of the operations of the Crofters' Commission in 1886 to the end of 1898, 5269 applications to fix fair rent were dealt with in the county, and rents amounting to £21,036 were reduced to £15,336, while of £69,944 of arrears £49,365 was cancelled; 890 applications for enlargement of holdings were dealt with, and 8354 acres were added to existing holdings. In 1895, 150,929 acres were under wood, of which 5944 had been planted since 1881. At the census of 1891 there were 11,958 men and 1835 women in the county engaged in agriculture. Deer forests covered 713,491 acres in 1899, an increase of 149,451 acres since 1883, and their annual value was £47,440.

Industries and Trade.—The ports and creeks of Inverness-shire are distributed among five fishery districts—Findhorn, Stornoway, Barra, Lochcarron and Skye, and Fort-William—and number 65, having in 1898, 1091 boats of 3058 tons, with 3077 resident fishermen and boys, and a catch valued at £27,001. Barra is an exclusively Inverness district, and comparative statistics may best be given for it and Lochcarron and Skye together:—

Year.	Boats.			Value of Gear.	Resident Fishermen and Boys.	Total Value of all Fish.
	No.	Tons.	Value.			
1890	962	3198	£7,615	£26,223	2915	£20,940
1898	962	3544	£10,618	£18,469	2511	£28,144
1899	940	3444	£10,451	£18,219	2482	£108,650

Of the total value of fish caught in 1899, £90,617 was the value of the herring catch and £11,863 the value of shell-fish. In 1899 there were 3987 persons employed in the two districts in connexion with the various branches of the fishing industry. A number of new railways were built during the last twenty-five years of the 19th century, including the West Highland (Glasgow to Banavie), opened in 1894–95, and the Aviemore–Inverness direct line, opened in 1898. These two added 70 miles to the railway mileage; and there are also the Mallaig extension of the West Highland and the Invergarry and Fort-Augustus line (1900).

Authorities.—J. Cameron Lees. *History of the County of Inverness.* Edinburgh, 1897.—Isabel H. Anderson. *Inverness before Railways.* Inverness, 1885.—Alexander Cameron. *History and Traditions of the Isle of Skye.* Inverness, 1871.—C. Fraser-Mackintosh. *Letters of Two Centuries.* Inverness, 1890.—Sir William Fraser. *Chiefs of Grant.* Edinburgh, 1883.—Alexander Mackenzie. *Histories* of the Mackenzies, Camerons, &c. Inverness, 1874–96.—A. Stewart. *Nether Lochaber.* Edinburgh, 1883.—*Inverness Field Club Transactions.*—*Gaelic Society of Inverness Transactions.*—Alexander Carmichael. "Grazing and Agrestic Customs of the Outer Hebrides" (*Crofters' Commission Report,* 1884).—William Macdonald. "The Agriculture of Inverness-shire" (*Transactions of the Highland and Agricultural Society,* 1872).—Alexander Mackenzie. *History of the Highland Clearances.* Inverness, 1883.—Archibald Craig. *The Scenery and Bird Life of Glen Urquhart.* Inverness.—Alexander MacBain. *Personal Names and Surnames of the Town of Inverness.* Inverness, 1895. (W. Wa.)

Inverurie, a royal and parliamentary burgh (Elgin group) of Aberdeenshire, Scotland, at the confluence of the rivers Don and Ury, 16¼ miles north-west of Aberdeen by rail. Paper and mineral waters are the only manufactures, but the town is an important centre of the cattle trade for the London market. The workshops of the Great North of Scotland Railway Company are here, and a new station was opened in 1900. There is a town hall. Population (1881), 3048; (1901), 3454.

Ionia, a city and the capital of Ionia county, Michigan, U.S.A., on Grand river, and on the Detroit, Grand Rapids, and Western, and the Grand Trunk Railways, at an altitude of 650 feet. It is in a farming and lumber region, and contains the state asylum for insane criminals and the house of correction. Population (1880), 4190; (1890), 4482; (1900), 5209, of whom 864 were foreign-born.

Ionian Islands. See Greece.

Iowa, one of the states of the American Union, situated on the western bank of the Mississippi river, the sixteenth admitted, and the tenth in population according to the censuses of 1880, 1890, and 1900. The area is 56,025 square miles, of which 550 miles is water surface. It is the twenty-second of the states in size. The population in 1900 was 2,231,853, giving 39·84 to the square mile, a gain of 319,957, or 16·74 per cent., since the census of 1890. Of the total, 1,156,849 (51·8 per cent.) were males and 1,075,004 (48·2 per cent.) females; 1,925,933 were native-born and 305,920 (13·7 per cent.) foreign-born; 2,218,667 were white and 13,186 (0·6 per cent.) coloured, of whom 12,693 were negroes, 104 Chinese, 7 Japanese, and 382 Indians. The urban population in 1900, classing as such all persons residing in cities of 8000 inhabitants or more, was 374,725, or 16·8 per cent. of the total population, as against 14·1 per cent. in 1900. The death-rate in 1900 was about 8·7 per cent.

The city of Des Moines is situated near the centre of the coal-bearing area. The annual output of coal ranges in value from $5,000,000 to $6,000,000. The coal mines gave employment in 1899 to 10,736 persons, of whom 7829 were miners. Clays suitable for a great variety of uses are found in the state. Extensive beds of gypsum occurring near Fort Dodge are probably of Cretaceous age. The manufacture of stucco from Fort Dodge gypsum has become an important industry, the annual value of the product approximating a quarter of a million dollars. The Pleistocene deposits include five successive drift-sheets, which give a great variety of remarkably productive soils. The loess is a peculiar silt-like deposit, a secondary product of the drift, covering more than half the area, and possessing characteristics which make it for many purposes one of the most desirable of soils. Rich alluvial deposits occurring in the wider stream valleys are also secondary products of the drift. Lead is found to some extent in the vicinity of Dubuque. The first enterprise ever set on foot in any part of what is now Iowa was that of mining lead, which was begun over a hundred years ago by Julien Dubuque.

Education.—Liberal provision is made for common schools. In 1900 there were 12,615 ungraded schools and 5766 rooms in graded schools. The number enrolled in the schools during the previous school year was 566,223, and the average attendance 373,474. The number of instructors was 28,789, of whom 23,840 were women. The expenditure during that year on account of teachers was $5,606,932, and for all other purposes $3,421,986. There were 13,861 school-houses valued at $17,655,992, with over $700,000 worth of apparatus and more than 300,000 volumes in district libraries. The permanent school fund amounts to $4,746,632. The amount of interest apportioned to the counties during 1900 was $237,400. The number of illiterates over ten years of age in 1895 was 11,102, or about 0·54 per cent. of the entire population. The clear proceeds of all fines collected, and the proceeds of a county tax of not less than $1 or more than $3 on the $1000 of the taxable value of property, together with the apportionment of the income of the permanent school fund, constitute what is known as the temporary school fund, which is distributed twice a year among the school districts according to the number of youths therein between five and twenty-one years of age, and is used altogether for the payment of teachers. In 1900 the number of persons of school age (five to twenty years inclusive) was 767,870. Out of 635,298 males of voting age, 17,061 were illiterate (unable to write), of whom 8273 were foreign-born and only 975 were negroes. The state university is at Iowa City, the former capital. It has a collegiate department with a faculty of forty-eight professors; a law department with six; a medical department with twenty-three; a homœopathic medical department with thirteen; a dental department with three; and a pharmacy department with nine. The number of students in attendance in 1900 was 1438. It has an annual income from the state treasury amounting to $125,500, besides interest on trust funds and other sources of revenue. The university is governed by a board of regents, consisting of the governor of the state, the superintendent of public instruction, and eleven other members chosen by the general assembly for six years. The Iowa state college of agriculture and mechanic arts at Ames has a tract of land comprising 840 acres, on which are forty-three farm and college buildings besides the equipment of the several departments, the whole being valued at $755,327. The endowment fund amounts to $683,000, mainly derived from the proceeds of the sale of 240,000 acres of land granted the state in 1862 by the Federal Government. The college is governed by a board of trustees constituted similarly to the board of regents. The Iowa state normal school is at Cedar Falls, Blackhawk county. It had in 1900 forty instructors and 1610 students. It draws from the state treasury annually for support and contingent expenses $59,000. There are also a number of denominational and undenominational colleges.

Charities, &c.—There are several institutions of an eleemosynary and penal character. The Iowa soldiers' home at Marshalltown, with a membership of 646; the orphans' home and home for destitute children at Davenport, with 436 inmates; the college for the blind at Vinton, with an attendance of 131; the school for the deaf at Council Bluffs, with 251 pupils; the institution for feeble-minded children at Glenwood, with 879 under its care. There are three hospitals for the insane, situated at Mount Pleasant, Independence, and Clarinda, with 2905 patients. The penitentiaries are at Fort Madison and Anamosa, and have 943 prisoners. There is an industrial school at Eldora for boys, and one at Mitchellville for girls. They have 630 inmates. The property connected with all these institutions comprises 4190 acres of ground. They are all under the direction of a board of control, consisting of three persons appointed by the governor and Senate for a term of six years.

Religion.—The number of church organizations at the last state census was 4862, with 571,264 church members, owning 4498 church edifices, with a seating capacity of 1,303,804, and valued at $15,105,085. The leading denominations, in the order of the number of church edifices, are: the Methodist, with 1382; the Presbyterian, with 454; the Lutheran, with 424; the Catholic, with 411; the Baptist, with 398; the "Disciples of Christ" and "Christian Connection" (not distinguished, but mostly of the former), with 325; Congregational, with 251; United Brethren, with 156; Friends, with 82; Reformed, with 66; Protestant-Episcopal, with 65; Adventist, with 56.

Agriculture.—Of its 35,000,000 acres of land there is very little which is not susceptible of cultivation. Indian corn is the principal staple. The agricultural products for 1900 were as follows:—

Crop.	Amount.	Per Acre.
	Bushels.	
Corn	353,365,000	40·3
Fall wheat	1,018,070	13·3
Spring wheat	20,280,280	14·3
Oats	138,832,330	34·7
Rye	1,621,630	15·6
Barley	12,695,200	25·3
Buckwheat	180,000	16·0
Flaxseed	1,222,980	11·7
Potatoes	10,850,900	72·0
	Tons.	
Hay, cultivated	3,609,010	1·4
Hay, wild	1,530,050	1·1

Other products of the soil were valued as follows:—Timothy seed, $825,000; clover seed, $350,000; sorghum, $275,000; broom corn, $35,000; corn fodder, $9,500,000; pasturage, $30,000,000; straw and other forage, $4,000,000; fruits and vegetables, $8,500,000; sweet potatoes, $275,000.

The whole aggregated $229,805,058 in value. The cereals amounted in volume to an average of more than five tons for each inhabitant. The increment gained by converting soil products into beef, pork, mutton, dairy and poultry products, horses, &c., added materially to the foregoing value.

The number and value of live stock in 1900 were as follows :—

Stock.	Number.	Value
		Dollars.
Horses	979,389	48,810,774
Mules	31,232	1,708,906
Milch cows	1,263,283	44,088,577
Other cattle	2,178,129	72,930,788
Sheep	419,218	1,333,113
Goats	10,869	31,163
Swine	3,534,833	18,466,739
Total	8,416,953	187,370,060

The total number of creameries was 779, and there were 188 "skim stations," their total value being $2,320,727. Estimating for some creameries not reported, the aggregate product in 1899 was 87,972,470 ℔, of which 77,013,875 ℔ were shipped. There were 69 cheese factories, with an estimated value of $105,915, with a total annual production, in 1899, of 3,669,109 ℔. For the production of cheese, butter, and condensed milk at factories, see the following paragraph.

Manufactures.—The statistics of manufactures in 1890 and 1900, with the percentage of increase during the decade, are shown by the following table :—

	1890.	1900.	Per cent. of Increase.
Number of manufacturing establishments	7,440	14,819	99·2
Capital	$77,513,097	$102,733,103	32·5
Salaried officials, clerks, &c.	8,137[1]	5,664[2]	30·4[3]
Salaries	$5,449,377[1]	$4,486,117	17·7[3]
Wage-earners, average number	51,037	58,553	14·7
Total wages	$20,429,620	$23,931,680	17·1
Miscellaneous expenses	$5,732,206	$7,988,767	39·4
Cost of materials used	$79,292,407	$101,170,357	27·6
Value of products, including custom work and repairing	$125,049,183	$164,617,877	31·6

Four of the most important manufacturing industries in the state in 1900, with the value of their products, were: Slaughtering and meat packing (wholesale), $25,296,518 ; cheese, butter, and condensed milk (factory product), $15,846,077 ; flouring and grist mill products, $13,823,083 ; lumber and timber products, $8,677,058.

Railways.—In the early history of Iowa much of the transportation was by boats on the Mississippi, Missouri, and Des Moines, and occasionally the Cedar, Iowa, and other rivers. Now the interior rivers are entirely abandoned as commercial highways, and the Missouri river nearly so, while the traffic on the Mississippi is greatly diminished in volume. Railways have come in to supply the vastly greater facilities which are now needed for moving the products and crops. The first railway in any part of Iowa was constructed in Davenport and Scott county in 1854, but there was no locomotive in the state until the next year. There are now 9400 miles of railway, valued at $185,000,000. The most extensive is that of the Chicago, Milwaukee, and St Paul Railway system, which has 1775 miles. The next is the Chicago and North-western Railway system, with 1418 miles, followed by the Chicago, Burlington, and Quincy Railway system, with 1333 miles ; the Chicago, Rock Island, and Pacific Railway system, with 1200 ; the Burlington, Cedar Rapids, and Northern Railway system, with 967 ; and the Dubuque and Sioux City Railway, which is a part of the Illinois Central Railway system, with 836 miles.

Finances.—Property is assessed at presumably its full value, and local, county, and state boards of review are required to consider the assessment thus made, and bring it to what in their judgment is its true value. When the latter is thus ascertained, one-fourth of it is taken for the taxable value of the property. Upon this basis the average rate of taxation for all purposes is about three and one-third per cent., or eight and one-half mills on the dollar of the ascertained value of all property. This value in 1900, on one-fourth of which the taxes would be collected in the following year, was $2,158,693,096, or $967 for each person in the population. The levy for state purposes to be collected during 1901 was $2.60 on the $1000 of taxable valuation, besides 20 cents on each $1000 for improvements at the university and at the college of agriculture. In addition to the direct tax on property the state derives considerable revenue from other sources. The receipts into the treasury for the fiscal year ending 30th June 1900 amounted to $2,592,496, and the disbursements to $2,056,027 ; and there was a balance in the treasury over and above all outstanding obligations of $946,001. The state is entirely out of debt, excepting the amount of $10,936, which it owes to its own school fund, and on which it pays 6 per cent. interest.

Banks.—On the 5th day of September 1900 there were 196 national banks, having capital approximately of $14,500,000, and individual deposits aggregating $49,440,759. At the same time there were 216 incorporated state banks other than savings banks, having capital of $9,474,800, and deposits amounting to $33,921,531. There were also 232 "savings banks," a large proportion of which, however, did a commercial banking business. Their capital amounted to $8,835,100, and their deposits to $60,751,672, making the aggregate of deposits in incorporated banks $144,113,962. There are no official statistics of private banks, but the number is not far from 400. The total number of banks and banking-houses is greater than in any other state in the Union. There are also something like 20 loan and trust companies, statistics of which are not collected. Their capital varies from $50,000 to $500,000. On the 31st of December 1900 there were 87 building and loan associations in the state, with assets amounting to $8,208,405.

Government.—The General Assembly, as the legislative body is called, is composed of a Senate of fifty members, elected for four years from as many districts, and a House of Representatives, consisting of 100, elected for two years from 84 counties and 6 districts (each composed of two or three counties). The state officers are governor, lieutenant-governor, secretary of state, auditor of state, treasurer of state, attorney-general, and superintendent of public instruction, each elected by the people for a term of two years, and three railway commissioners, chosen for three years. The governor has a qualified veto on all legislative acts. The governor, secretary, auditor, and treasurer constitute the executive council, which body is clothed with quite extensive powers, among them being that of assessing the property of railway, express, telegraph, and telephone corporations. The supreme court consists of six judges chosen by the popular vote for six years. The clerk of this court and the reporter of its decisions are each elected by the people for four years. There are fifty-three district judges, in twenty districts, elected for four years. All incorporated places having a population of 2000 or over are known as cities ; all other incorporated places are designated as towns. A platted town-tract, which is not incorporated, is called a village. The principal cities, with their population, are: Des Moines, the capital, 62,139 ; Dubuque, 36,297 ; Davenport, 35,254 ; Sioux City, 33,111 ; Council Bluffs, 25,802 ; Cedar Rapids, 25,656 ; Burlington, 23,201 ; Clinton, 22,698 ; Ottumwa, 18,197 ; Keokuk, 14,641 ; Muscatine, 14,073. All cities and towns may establish waterworks, or gas or other lighting works, or they may give franchises to private individuals therefor, or for street railways, but the establishment of such on the part of the city, or the granting of franchises, must first be approved by a vote of the people. Cities and towns are limited in their current expenses to an amount not exceeding 1 per cent. of the taxable value of property. Additional amounts may be levied for waterworks or improvements, and also to pay the principal and interest of public debt. All counties, cities, towns, and school districts are restricted as to public indebtedness to 5 per cent. of the taxable value of the property within their limits respectively.

History.—Politically the Democratic party controlled the state during most of its first decade, and until the slavery question became the overshadowing one. Since the organization of the Republican party in 1856, that party has had a majority of the legislature, and with the exception of a period of four years the governors have been of that party, while the electoral vote of the state has uniformly from 1852 to 1900 been cast for the same party's candidates for President and Vice-President. At the election of 1900 President McKinley (Republican) received 307,808 votes ; Bryan (Democrat), 209,265 ; Wooley (Prohibitionist), 9502 ; four other candidates, 3780 ; McKinley's plurality was 98,543, his majority 85,261. The state raised four regiments of infantry and two batteries of artillery at the time of the Spanish war (1898), but the early close of hostilities prevented more than one regiment from seeing active service. (L. M. S.)

[1] Includes proprietors and firm members, with their salaries; in 1900 their salaries were not reported, but their number was 16,619.

[2] Greatest number reported employed at any one time during the year.

[3] Decrease.

Iowa City, capital of Johnson county, Iowa, U.S.A., on the Iowa, at an altitude of 654 feet. It has an undulating site and a regular plan. It is served by the Chicago, Rock Island, and Pacific, and the Burlington, Cedar Rapids, and Northern Railways. It is the seat of the state university, a non-sectarian, co-educational institution, opened in 1855. The university has collegiate, professional, and graduate departments, the professional departments including law, medical, homœopathic, dental, and pharmaceutical schools. In 1899 the professors and other instructors numbered 100, and the attendance of students was 1339, of whom one-fifth were women. Its property was valued at $982,000, and its total income from all sources was $151,300. Population (1880), 7123; (1890), 7016; (1900), 7987, of whom 1355 were foreign-born.

Ipswich, a municipal, county, and parliamentary borough of England, capital of Suffolk county, on the estuary of the Orwell, 69 miles by rail north-east of London. Several of the churches have been wholly or partly restored since 1880—St Mary at the Elms, St Matthew's, St Peter's, St Stephen's, Holy Trinity, and the Presbyterian church. All Saints' was built in 1892, the new St John the Baptist's in 1898–99, and St Bartholomew's in 1900–1. A new cemetery was laid out in 1893–96. In 1887 the library was enlarged, and in 1892 the science and art schools. The Eastern Counties Dairy Institute, which was established at Akenham in 1888, was transferred to Gipperswyk Park at Ipswich in 1895. The Lyceum Theatre was built in 1890–91. New corporation baths were opened in 1894. The public institutions embrace a public library of nearly 20,000 volumes, and a small medical library, the East Suffolk hospital and dispensary, the fever hospital, the borough lunatic asylum, the nurses' home for the sick poor, and the borough of Ipswich science, art, and technical schools. These last have a picture gallery and college in Christchurch mansion. There are also the middle school for boys, a high school for girls and an endowed school for girls, and a scientific society. The corporation consists of a mayor, 10 aldermen, and 30 councillors. In 1880–81 Ipswich was provided with a system of sewage with outfall works $1\frac{1}{2}$ miles below the town; and in 1892 a new reservoir in connexion with the waterworks was purchased by the corporation. The spring assizes are held here; the summer assizes at Bury St Edmunds. Amongst the industries may be mentioned engineering, the manufacture of railway plant, of boots and shoes, clothing, corsets, bricks, and tobacco, and malting. The navigation of the port was facilitated by the completion of a new lock entrance in 1881. In 1895 the imports amounted to £247,349 in value, and the exports to £31,155; in 1900 to £541,014 and £27,933 respectively. The latter consist chiefly of agricultural machines, railway plant, artificial manures, oils and oil-cake, bricks, grain and flour, and roots. In 1900 the port was entered by 213 vessels of 69,006 tons engaged in foreign trade. There is also a coasting trade of 600,000 tons annually, entered and cleared together. At the same date 124 vessels of 7647 tons were registered as belonging to this port, and 49 fishing boats of 350 tons. The parliamentary borough returns two members to the House of Commons. Population (1891), 57,433; (1901), 66,622. Birth-rate, 29·5 (1898); death-rate, 16·6 (1898).

See N. Bacon, *Annalls of Ipswche*. Ipswich, 1884.

Ipswich, a town in the county of Stanley, Queensland, Australia, on the river Bremer, $23\frac{1}{2}$ miles west of Brisbane. The river is here crossed by two bridges, the newer built to carry the railway. The district is a mining, manufacturing, and agricultural one; coal is worked with little labour, being near the surface. Population (1891), 7625; (1901), 8637.

Iquique, or Puerto de Iquique, a town and port in Chile, capital of the province and department of the same name, in 20° 12′ 15″ S. and 70° 11′ 15″ W. The population in 1895 was 33,031. It has railway communication with Pisagua, and is 820 miles north of Valparaiso. It was occupied by the Chilian forces in 1879 during the war with Peru, and finally ceded to the former country by the treaty of 20th October 1883. Iquique exists under the most artificial conditions, being entirely dependent on outside sources for all its supplies of food, water, and fuel. Practically the whole population is engaged in the manufacture of iodine and nitrate of soda, Iquique being the centre of trade. Nevertheless it disputes with Valparaiso the position of having the largest foreign trade of any seaport in the country. In 1899 Valparaiso led, having £6,327,427, as compared with £6,155,300 for Iquique; whereas in 1900 Iquique came first with £7,194,570, as compared with £6,892,660 for Valparaiso. In the latter year no less than 33 per cent. of the total foreign trade of Chile entered and cleared at Iquique. (See Chile.)

Irák, a province of Persia, situated west of Kum and Kashán and east of Burújird, and paying a yearly revenue of about £15,000. Its capital is Sultánábád, situated in 34° 6′ N. and 48° 25′ E., at an elevation of 5880 feet, and 77 miles from Kum. It was founded in the beginning of the 19th century, and is still occasionally spoken of as Shahr-i-No, the "new city." Its population is about 8000. The province produces much grain, and supplies neighbouring districts, particularly those situated eastwards, but its greatest income is derived from the carpets which are made in many of its villages and mostly exported to Europe, and the value of which is estimated at about £100,000 per annum. Two British firms are established at Sultánábád solely for this trade.

Irawadi, or Irrawaddy, the principal river in the province of Burma, traversing the centre of the country, and probably running throughout its entire course in British territory. It is formed by the confluence of the Mali and N'mai rivers (usually called Mali-kha and N'mai-kha, the *kha* being the Kachin word for river) in 25° 45′ N. The N'mai is the eastern branch. The definite position of its source is still uncertain, and it seems to be made up of a number of considerable streams, all rising within a short distance of each other in about 28° 30′ N. It is shown on some maps as the Lu river of Tibet, but it is now quite certain that the Tibetan Lu river is the Salween, and that the N'mai has its source or sources near the southern boundary of Tibet, to the north-east or east of the source of the Mali. At the confluence the N'mai is larger than the Mali. The general width of its channel seems to be 350 or 400 yards during this part of its course. In the rains this channel is filled up, but in the cold weather the average breadth is from 150 to 200 yards. The N'mai is practically unnavigable. The Mali is the western branch. Like the main river, it is called Nam Kiu by the Shans. It rises in the hills to the north of the Hkam Ti country, probably in about 28° 30′ N. Between Hkam Ti and the country comparatively close to the confluence little or nothing is known of it, but it seems to run in a narrow channel through continuous hills. The highest point on the Mali reached from the south by Major Hobday in 1891 was Ting Sa, a village a little off the river, in 26° 15′ N. About a mile above the confluence it is 150 yards wide in January and 17 feet deep, with a current of $3\frac{3}{4}$ miles an

hour. Steam launches can only ascend from Myit Kyina to the confluence in the height of the rains. Native boats ascend to Laikaw or Sawan, 26° 2′ N., all the year round, but can get no farther at any season. From the confluence the river flows in a southerly direction as far as Bhamo, then turns west as far as the confluence of the Kaukkwe stream, a little above Katha, where it again turns in a southerly direction, and maintains this in its general course through Upper and Lower Burma, though it is somewhat tortuous immediately below Mandalay. Just below the confluence of the Mali and N'mai rivers the Irawadi is from 420 to 450 yards wide and about 30 feet deep in January at its deepest point. Here it flows between hills, and after passing the Manse and Mawkan rapids, reaches plain country and expands to nearly 500 yards at Sakap. At Myit Kyina it is split into two channels by Naungtalaw island, the western channel being 600 yards wide and the eastern 200. The latter is quite dry in the hot weather. At Kat-kyo, five or six miles below Myit Kyina, the width is 1000 yards, and below this it varies from 600 yards to three-quarters of a mile at different points. Three miles below Sinbo the Third Defile is entered by a channel not more than 50 yards wide, and below this, throughout the defile, it is never wider than 250 yards, and averages about 100. At the "Gates of the Irawadi" at Poshaw two prism-shaped rocks narrow the river to 50 yards, and the water banks up in the middle with a whirlpool on each side of the raised pathway. All navigation ceases here in the floods. The defile ends at Hpatin, and below this the river widens out to a wet-weather channel of 2 miles, and a breadth in dry weather of about 1 mile. At Sinkan, below Bhamo, the Second Defile begins. It is not so narrow nor is the current so strong as in the Third Defile. The narrowest place is more than 100 yards wide. The hills are higher, but the defile is much shorter. At Shwegu the river leaves the hills and becomes a broad stream, flowing through a wide plain. The First Defile is tame compared with the others. The river merely flows between low hills or high wooded banks. From Mandalay up to Bhamo the river is navigable a distance of nearly a thousand miles for large steamers all the year round, but small launches and steamers with weak engines are often unable to get up the Second Defile in the months of July, August, and September, owing to the strong current. The Irawadi Flotilla Company's steamers go up and down twice a week all through the rains, and the mails are carried to Bhamo on intermediate days by a ferry-boat from the railway terminus at Katha. During the dry season the larger boats are always liable to run on sandbanks, more especially in November and December, when new channels are forming after the river has been in flood. From Bhamo up to Sinbo no steamers can ply during the rains, that is to say, usually from June to November. From November to June small steamers can pass through the Third Defile from Bhamo to Sinbo. Between Sinbo and Myit Kyina small launches can run all the year round. Above Myit Kyina small steamers can reach the confluence at the height of the flood with some difficulty, but when the water is lower they cannot pass the Mawkan rapid, just above Mawme, and the navigation of the river above Myit Kyina is always difficult. The journey from Bhamo to Sinbo can be made during the rains in native boats, but it is always difficult, and sometimes dangerous. It is never done in less than five days, and often takes twelve or more.

For the Irawadi in its lower course see the earlier volume of the *Encyclopædia Britannica*, ninth edition. (J. G. Sc.)

Irbit, a district town of Russia, government of Perm, 110 miles north-east of Ekaterinburg, on the Nitsa, 72 miles from Kamyshloff railway station. It is famous for a great fair, which lasts for two months, and at which all sorts of European and Asiatic goods are offered, the yearly returns of articles sold representing a value of over £4,000,000:—Cottons, £1,850,000; woollens, £254,000; flax and hemp, £261,000; silks, leather, as well as all sorts of metals, metallic and other manufactured goods from Russia, furs, £260,000; hides, felt, raw wool, representing an aggregate value of £522,000, from Siberia and the Kirghiz Steppe; while tea (£495,000) and various other goods (£52,000) are brought from China and Turkestan. These are average figures, but there have been years when goods to the value of nearly £6,000,000 have been brought to the fair. The Irbit ironworks are 41 miles to the south-west. Population, 20,064.

IRELAND.

Geography and Statistics.

IRELAND, an island to the west of Great Britain, together with it forming the United Kingdom, extends from 51° 26′ to 55° 21′ N. and from 5° 25′ to 10° 30′ W. It is bounded on the north, south, and west by the Atlantic Ocean, and on the east is separated from Great Britain by the North Channel, the Irish Sea, and St George's Channel. Its greatest length is 302 miles, and its greatest breadth 174 miles.

Area and Population.—The total area comprises 20,825,596 acres, which includes 492,252 acres under the larger rivers, lakes, and tideways, and 129,681 acres under the smaller rivers and lakes. Territorially the island is divided into 4 provinces and 32 counties, Leinster having 12 counties, Munster 6, Ulster 9, and Connaught 5. Excluding the extent of land under the larger rivers, lakes, and tideways, the table on the following page shows the area in square miles by provinces and counties, the population in 1881, 1891, and 1901, and the average number of persons to a square mile in 1901. The 1901 populations are of the administrative counties under the Local Government (Ireland) Act, 1898.

Of the total population in 1891, 2,318,953 were males and 2,385,797 females. It will be seen that between 1881 and 1891 the total population decreased by 470,086 or 9·08 per cent., the population of Leinster by 87,207 or 6·8 per cent., of Munster by 157,472 or 11·8 per cent., of Ulster by 123,261 or 7·07 per cent., and of Connaught by 102,146 or 12·4 per cent. Only one county showed an increase of population during the decennial period—Antrim with 2·1 per cent. increase, due to the growth of Belfast. All the other counties showed a decline, varying from 16·1 per cent. in Monaghan to ·87 per cent. in Down. In 1891 Dublin, with an average of 1177 persons to the square mile, was the most densely populated county, and Wicklow, with an average of only 82 to the square mile, was the least densely populated. The total rural population was 3,460,637, being an average of 110 persons to the square mile, or of 148 persons to each square mile under crops and pasture, and the urban population 1,244,113. Of the total population in 1901, 2,197,739 were males and 2,258,807 females. Between 1891 and 1901 the total population decreased by 248,204 or 5·3 per cent., the population of Leinster by 41,297 or 3·5 per cent., of Munster by 98,568 or 8·4 per cent., of Ulster by 38,463 or 2·4 per cent., and of Connaught by 69,876 or 9·7 per cent. Three counties showed an increase—Dublin and Down of 7·3 per cent. each, and Antrim of 7·0 per cent. All the others showed a decline, varying from 13·6 per cent. in Monaghan to 5·1 per cent. in Londonderry. Between 1881 and 1891 the population of towns of 10,000 inhabitants and upwards increased by 30,375, this increase being altogether owing to the growth of Belfast, Londonderry, and a few other industrial towns in the north, and to the extension of the Dublin suburbs.

Counties and Provinces.	Area in Square Miles.	Population. 1881.	Population. 1891.	Population. 1901.	Average Number of Persons to Square Mile in 1901.
LEINSTER	7566	1,278,989	1,191,782	1,150,485	152
Carlow	345	46,568	41,964	37,723	109
Dublin	354	418,910	416,860	447,266	1263
Kildare	654	75,804	70,206	63,469	97
Kilkenny	793	99,531	87,496	78,821	82
King's County	771	72,852	65,563	60,129	78
Longford	403	61,009	52,647	46,581	115
Louth	315	77,684	71,914	65,741	209
Meath	904	87,469	76,111	67,463	74
Queen's County	664	73,124	63,855	57,226	85
Westmeath	678	71,798	68,611	61,527	91
Wexford	904	123,854	112,063	103,860	115
Wicklow	781	70,386	64,492	60,679	78
MUNSTER	9295	1,331,115	1,173,643	1,075,075	115
Clare	1201	141,457	126,244	112,129	93
Cork	2874	495,607	438,432	404,813	140
Kerry	1832	201,039	179,136	165,331	90
Limerick	1036	180,632	158,912	146,018	141
Tipperary	1639	199,612	175,217	159,754	97
Waterford	713	112,768	95,702	87,030	122

Counties and Provinces.	Area in Square Miles.	Population. 1881.	Population. 1891.	Population. 1901.	Average Number of Persons to Square Mile in 1901.
ULSTER	8314	1,743,075	1,619,814	1,581,351	190
Antrim	1111	421,943	430,865	461,240	415
Armagh	489	163,177	137,877	125,238	256
Cavan	729	129,476	111,917	97,368	133
Donegal	1859	206,035	185,635	173,625	93
Down	956	272,107	269,734	289,335	303
Fermanagh	653	84,879	74,170	65,243	99
Londonderry	802	164,991	152,009	144,329	180
Monaghan	498	102,748	86,206	74,505	149
Tyrone	1217	197,719	171,401	150,468	123
CONNAUGHT	6616	821,657	719,511	649,635	98
Galway	2347	242,005	211,227	192,146	81
Leitrim	589	90,372	78,618	69,201	117
Mayo	2059	245,212	218,698	202,627	98
Roscommon	915	132,490	116,552	101,639	111
Sligo	706	111,578	94,416	84,022	119
IRELAND	31,791	5,174,836	4,704,750	4,456,546	140

Between 1891 and 1901 the population of the same towns increased by 160,076, the increase being largely due to the extension of the municipal boundaries of Dublin and Belfast. All other towns either remained practically stationary or seriously diminished during both decennial periods, because they are not centres of industry, but mainly markets for the agricultural produce of the vicinity. The following table shows the population of the six county boroughs in 1881, 1891, and 1901:—

Year.	Dublin.	Belfast.	Cork.	Limerick.	Londonderry.	Waterford.
1881	249,602	208,122	80,124	38,562	29,162	22,457
1891	268,587	273,079[2]	75,345	37,155	33,200	26,203
1901	289,108[1]	348,965	75,978	38,085	39,873	26,743

[1] The municipal area was extended in 1900.
[2] By the extension of the municipal area in 1897 the population of Belfast was largely increased.

The table given below proves that the number of Irish-speaking persons decreased between 1881 and 1891:—

Provinces.	1881. Who spoke Irish only.	1881. Who spoke Irish and English.	1881. Total who could speak Irish.	1891. Who spoke Irish only.	1891. Who spoke Irish and English.	1891. Total who could speak Irish.	Percentage of Population who could speak Irish. 1881.	Percentage of Population who could speak Irish. 1891.
Leinster	50	27,402	27,452	8	13,669	13,677	2·1	1·2
Munster	18,422	427,344	445,766	9,060	298,573	307,633	33·5	26·2
Ulster	12,360	98,163	110,523	7,053	77,099	84,152	6·3	5·2
Connaught	33,335	332,856	366,191	22,071	252,712	274,783	44·6	37·8
Ireland	64,167	885,765	949,932	38,192	642,053	680,245	18·2	14·5

The number of families in 1891 was 932,113, of which 97,317 inhabited 1st class, 499,033 2nd class, 315,034 3rd class, and 20,729 4th class houses. The number of families in 1901 was 910,508, a decrease of 2·3 per cent. It will be seen from the tables given below that between 1881 and 1891 both the number of 4th class houses and the number of families with 4th class house-accommodation were largely diminished.

The numbers of the different classes[1] of inhabited houses and the number of uninhabited houses in 1881 and 1891 were:—

Provinces.	Number of Inhabited Houses. 1881.	Number of Inhabited Houses. 1891.
Leinster—		
1st class	26,972	27,072
2nd ,,	104,294	113,624
3rd ,,	75,576	61,882
4th ,,	9,383	5,036
Total	216,225	207,614
Munster—		
1st class	15,735	16,603
2nd ,,	100,109	110,485
3rd ,,	88,329	67,959
4th ,,	15,458	7,361
Total	219,631	202,408
Ulster—		
1st class	19,471	22,361
2nd ,,	172,595	189,707
3rd ,,	133,724	110,762
4th ,,	7,042	3,717
Total	332,832	326,547

Provinces.	Number of Inhabited Houses. 1881.	Number of Inhabited Houses. 1891.
Connaught—		
1st class	4,549	4,704
2nd ,,	45,243	52,816
3rd ,,	86,846	71,986
4th ,,	8,782	4,503
Total	145,420	134,009
Ireland—		
1st class	66,727	70,740
2nd ,,	422,241	466,632
3rd ,,	384,475	312,589
4th ,,	40,665	20,617
Total	914,108	870,578
Uninhabited Houses.		
Built	58,257	69,320
Building	1,710	2,602
Total	59,967	71,922

[1] The 4th class includes all single-room houses built of mud or perishable material; the 3rd, houses with from two to four rooms and windows; the 2nd, good farmhouses or small town houses having 5 to 7 rooms and windows; the 1st, all houses of a better description than the preceding.

In 1901 there were altogether 858,503 houses inhabited, thus distributed: 205,867 in Leinster, 193,663 in Munster, 332,106 in Ulster, and 126,867 in Connaught, and in addition 72,582 uninhabited houses and 2592 building.

The number of families in each class[2] of house-accommodation in 1881 and 1891 was:—

Class of House-accommodation.	Number of Families in 1881.	Number of Families in 1891.
1st class	57,673	62,613
2nd ,,	403,862	454,870
3rd ,,	443,247	359,308
4th ,,	90,292	55,322
Total	995,074	932,113

If we take into consideration the number of inhabited houses in the whole of Ireland, it will be found that in 1881 there were 5·6 persons in each house, in 1891 there were 5·4 persons, and in 1901, 5·2.

The table which follows on the next page shows the number of persons returned as belonging to different occupations in 1881 and 1891:—

[2] 1st class accommodation consists of 1st class houses occupied by 1 family; 2nd class of 2nd class houses occupied by 1 family, or of 1st class houses occupied by 2 or 3 families; 3rd class of 3rd class houses with 1 family each, 2nd class houses with 2 or 3 families, and 1st class houses occupied by 4 or 5 families; and 4th class of all 4th class houses, 3rd class houses with more than 1 family, 2nd class houses with 4 or more families, and 1st class houses occupied by 6 or more families.

Year.	Pro-fessional.	Domestic.	Com-mercial.	Agri-cultural.	Industrial.	Indefinite and Non-Productive.
1881	198,684	426,161[1]	72,245	997,956	691,509	2,788,281
1891	214,243	255,144	83,173	936,759	656,410	2,559,021[1]

The numbers of permanently and of temporarily diseased persons and percentage to population in 1871, 1881, and 1891, were thus returned :—

Nature of Disablement.	Years.		
	1871.	1881.	1891.
Dumb, and deaf and dumb	5,554	5,13[illegible]	4,464
Blind	6,347	6,111	5,341
Lunatic and idiotic	16,505	18,413	21,188
Total, permanently diseased	28,406	29,660	30,993
Sick at home	23,923	17,805	16,466
Sick in infirmaries and hospitals	3,625	4,170	4,490
Sick in workhouse hospitals	16,485	18,115	14,789
Total temporarily diseased	44,033	40,090	35,745
Sum total	72,439	69,750	66,738
Percentage to population	1·3	1·3	1·4

The increase in the number of insane is marked: in 1871 the proportion to the total population was 1 in 678 ; in 1891, 1 in 535.

Movement of Population.—The births and deaths registered in the different provinces from 1897 to 1900 were :—

Provinces.	Births.				Deaths.			
	1897.	1898.	1899.	1900.	1897.	1898.	1899.	1900.
Leinster	27,305	27,108	26,870	26,089	24,058	23,524	23,338	25,157
Munster	24,899	24,544	24,109	23,500	18,520	19,085	17,991	20,518
Ulster	39,567	39,542	38,982	38,109	30,987	29,771	29,353	31,880
Connaught	14,893	14,263	13,939	13,761	10,274	10,024	9,017	10,051
Total	106,664	105,457	103,900	101,459	83,839	82,404	79,699	87,606

Thus the number of births registered in Ireland exceeded the number of deaths in 1897 by 22,825, in 1898 by 23,053, in 1899 by 24,201, and in 1900 by 13,853 ; but the decrease of population, which still continues, is explained by the fact that the number of emigrants is always larger than the excess of births over deaths, and the number of immigrants is altogether insufficient to redress the balance. The number of illegitimate births in 1900 was 2702.

The number of marriages registered in the different provinces from 1890 to 1900 was :—

Provinces.	1890.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.
Leinster	5,868	5,958	5,901	6,167	6,030	6,403	6,409	6,207	6,207	6,221	5,934
Munster	4,640	4,653	4,783	4,777	4,606	4,921	4,773	4,951	4,818	4,849	4,431
Ulster	8,146	8,504	8,455	8,412	8,600	9,171	9,347	9,279	9,226	8,917	8,623
Connaught	2,336	2,360	2,391	2,358	2,366	2,625	2,526	2,454	2,329	2,324	2,342
Total	20,990	21,475	21,530	21,714	21,602	23,120	23,055	22,891	22,580	22,311	21,330

Of the total population in 1891 (of those of seventeen years and upwards), 47 per cent. were unmarried, 42 per cent. married, and 11 per cent. widowed. In 1900, 14,795 Roman Catholic marriages were celebrated, and 6535 Protestant and other marriages. The number of marriages in 1900 was equal to 4·78 per 1000 of the estimated population, being ·05 below the average of the previous ten years.

The number of emigrants — natives of Ireland — from each province and from all Ireland, from 1st May 1851 to 31st December 1900, is shown by the following table :—

Provinces.	Number from 1st May 1851 to 31st Dec. 1896.	Number in each Year.				Total Number from 1st May 1851 to 31st Dec. 1900.			Per cent. of Emigration in 1898 to Population in 1891.
		1897.	1898.	1899.	1900.	Males.	Females.	Total.	
Leinster	669,260	3,210	3,340	3,542	3,857	359,045	324,164	683,209	0·3
Munster	1,287,387	12,798	13,013	15,758	17,933	689,525	657,364	1,346,889	1·5
Ulster	1,054,232	6,266	5,577	8,701	9,438	599,363	484,851	1,084,214	0·5
Connaught	568,576	10,261	10,311	13,231	14,060	293,645	322,794	616,439	1·9
Unclassified	110,668	..	..	..	..	61,766	48,902	110,668	..
Total, Ireland	3,690,123	32,535	32,241	41,232	45,288	2,003,344	1,838,075	3,841,419	0·9

In the four separate years for which statistics are given above the emigrants were scattered as follows :—

Year.	Colonies and Foreign Countries.					Great Britain.	
	U.S.A.	Australia.	New Zealand.	Canada.	Other Countries.	England and Wales.	Scotland.
1897	28,760	676	61	397	360	1454	827
1898	27,855	837	36	456	248	1667	1142
1899	35,433	1005	56	397	200	2633	1508
1900	37,765	834	64	472	103	4123	1927
Total	129,813	3352	217	1722	911	9877	5404

Emigration continues to be the chief drain on the population of Ireland, and, as the above tables show, the numbers considerably increased in 1899 and 1900 as compared with the two previous years. The largest number that emigrated from any individual county from 1851–1900 was 500,239 from Cork. In 1900 there were 1819 emigrants not of Irish nationality, making the total number of emigrants for 1900, 47,107. Of these the Irish emigrants from Leinster formed 8·2 per cent. ; from Munster, 38·1 per cent. ; from Ulster, 20·0 ; from Connaught, 29·8 per cent. ; while the non-Irish emigrants formed the remaining 3·9 per cent. The vast majority—82·2 per cent—of the emigrants were persons between fifteen and thirty-five years of age. The males numbered 23,295, and the females 23,812.

Constitution and Government.—The Redistribution of Seats Act, 1885, entirely altered the parliamentary representation of Ireland. The following twenty-two boroughs were disfranchised: Armagh, Athlone, Bandon, Carlow, Carrickfergus, Clonmel, Coleraine, Downpatrick, Drogheda, Dundalk, Dungannon, Dungarvan, Ennis, Enniskillen, Kinsale, Lisburn, Mallow, New Ross, Portarlington, Tralee, Wexford, and Youghal. Galway, Limerick, and Waterford lost one member each. Dublin and Belfast were divided into four divisions, each returning one member. In all, 85 members represent the counties, 16 the cities and towns, and 2 Dublin University—a total of 103. Excluding the University of Dublin, the number of registered electors in 1901 was 731,132—counties 622,465, and boroughs 108,667; while in 1891 the number was 736,259—counties 642,533, and boroughs 93,726. By section 2 of the Representation of the People Act, 1884, a uniform household franchise and a uniform lodger franchise were established in all counties and boroughs of the United Kingdom, and by section 3 the service franchise was introduced.

By the Local Government (Ireland) Act, 1898, the system of local government in Ireland was entirely remodelled. A county council, consisting of a chairman and councillors, was established in each administrative county. For this purpose new administrative counties were formed, in some cases by the alteration of existing boundaries, in other cases by the adoption without alteration of the old judicial counties. Thus, the judicial counties of Antrim, Armagh, Carlow, Clare, Down, Dublin, Galway, Kilkenny, Londonderry, Louth, Mayo, Queen's County, Roscommon, Sligo, Westmeath, Wexford, and Wicklow, have been either diminished or increased in area; Cavan, Cork, Donegal, Fermanagh, Kerry, Kildare, King's County, Leitrim, Limerick, Longford, Meath, Monaghan, and Tyrone, retain their boundaries unaltered, and Tipperary has been divided into two administrative counties almost identical with the old North and South Ridings. To the county council the Act transferred all the fiscal and administrative duties of the grand jury, with the exception of the power of making presentments for malicious injury, which passed over to the

[1] Housekeepers who were wives or other near relations of heads of families were tabulated in 1881 in Class II. and in 1891 in Class VI.

county courts. Besides these powers of the grand jury, the county council has now the power of the board of guardians with regard to raising and levying the poor rate; that is to say, all the rates in so much of the county as is not included in an urban district are now raised by the county council in one general rate. In addition, the administration of the Diseases of Animals Act, the Explosives Act, and the Acts relating to technical education and the management of lunatic asylums, was vested in the county council, upon which were also conferred extensive powers for acquiring land for county purposes, and a number of other duties. The county council is elected by the parliamentary electors of the county, with the addition of women and peers otherwise qualified to vote. Subordinate bodies, called district councils, were established by the same Act to manage the affairs of the various local areas within each county. It was provided (1) that, where an urban sanitary authority existed at the passing of the Act, an urban district council should be formed, having within its own area all the powers of the grand jury with regard to roads, &c., and with the right to raise its own rates, but subject to some general control by the county council, and liable for certain contributions; and (2) that, in the areas where no urban sanitary authority existed at the passing of the Act, rural districts, governed by rural district councils, should be formed, corresponding, as far as possible, with the existing poor-law unions. The rural district councillors elected for each division also act as the poor-law guardians for that division, so that in all rural unions, situated wholly within the county, which do not include any town that is an urban district, there are now two bodies having the same members, but discharging different functions. But where an urban district is included within the limits of a union, or where a union extends over more than one county, and particularly where both these conditions are present, the constitution of the board of guardians is very complex, and would require a more detailed explanation than can be given here. In order to facilitate the working of the Act in this respect, the Local Government Board was given power to alter the boundaries of poor-law unions. With regard to the effect of the Act on cities and towns, these may now be grouped in five classes: (1) county boroughs—Dublin, Belfast, Cork, Limerick, Londonderry, and Waterford—governed by separate county councils; (2) five boroughs—Kilkenny, Sligo, Clonmel, Drogheda, and Wexford—which retain their corporations, but practically rank as urban sanitary districts; (3) urban sanitary districts, governed by urban district councils; (4) towns having town commissioners who are not sanitary authorities; and (5) non-municipal towns with populations of over 1500, and entitled to petition for town commissioners. The Act provides special facilities for the conversion of any of the two latter classes of towns into urban districts.

Justice.—By the Act of 1887, to amend the Supreme Court of Judicature (Ireland) Act, 1877, the office of Chief Justice of the Common Pleas, from the passing of the Act, was reduced to an equality with the office of puisne judge; the rank and title were abolished. It was provided that the office of Chief Baron of the Exchequer should be similarly treated on the occasion of the first vacancy, and that the Lord-Lieutenant should have the power to consolidate by an Order in Council the Common Pleas Division with the King's Bench Division. By a further amending Act in 1897 the Exchequer Division was amalgamated with the King's Bench Division—the chief baron to rank after the lord chief justice—the Court of Bankruptcy was consolidated with the Supreme Court, and it was enacted that on the next vacancy in the judgeship, the Probate and Matrimonial Division should be abolished and the division amalgamated with the King's Bench Division. By the Land Law (Ireland) Act, 1881, a Land Commission was established, consisting of a judicial commissioner, who was to become an additional judge of the Supreme Court of Judicature, and two other commissioners. By subsequent enactments the commission was made perpetual, and the number of commissioners other than the judicial commissioner was increased to four. As a result of all these changes the Supreme Court of Judicature in Ireland is now constituted as follows:—The Court of Appeal, which consists of the Lord Chancellor, the Lord Chief Justice, the Master of the Rolls, and the Chief Baron of the Exchequer as *ex-officio* members, and three lords justices of appeal; and the High Court of Justice, which includes (1) the Chancery Division, composed of the Lord Chancellor, the Master of the Rolls, the Vice-Chancellor, and a land judge; (2) the King's Bench Division, composed of the Lord Chief Justice, the Chief Baron of the Exchequer, and eight justices, who include the Probate, the Admiralty, and the Bankruptcy judges; and (3) the Land Commission, the judicial commissioner alone ranking as a member of the Supreme Court. By the County Officers and Courts (Ireland) Act, 1877, it was provided that the chairmen of quarter sessions should be called "county court judges and chairmen of quarter sessions," and that their number should be reduced to twenty-one, which number was to include the recorders of Dublin, Belfast, Cork, Londonderry, and Galway. At the same time the jurisdiction of the county courts was largely extended. There are now 70 resident (stipendiary) magistrates in Ireland, and 4 police magistrates for the Dublin police district. On 30th September 1900 the Royal Irish Constabulary was composed of an inspector-general, a deputy-inspector-general, 2 assistant-inspector-generals, a surgeon, a veterinary surgeon, a barrack-master and store-keeper, a police instructor and schoolmaster, a town inspector (Belfast), 36 county inspectors, 214 district inspectors, 251 head constables, 1869 sergeants, 423 acting-sergeants, and 8371 constables. The expenditure on the force in 1901–2 was £1,376,406.

The following table gives the number of persons committed for trial, convicted, and acquitted in Ireland in 1881, 1886, 1891, and 1900:—

Year.	Committed for Trial.	Convicted.	Acquitted.
1881	5311	2698	2443
1886	3028	1619	1286
1891	2112	1255	669
1900	1682	1087	331

Of the 1682 persons committed in 1900, 639 were charged with offences against the person, 132 with offences against property with violence, 606 with similar offences without violence, 104 with malicious offences against property, 35 with forgery and offences against the currency, and 166 with other offences.

The number and nature of agrarian offences between 1881 and 1900 are thus returned:—

Year.	Against Person.	Against Property.	Against Public Peace.	Threatening Letters, &c.	Total.
1881–90	917	2595	3795	6793	14,100
1888	53	161	197	249	660
1889	37	155	148	194	534
1890	48	121	151	199	519
1891	22	145	90	215	472
1892	31	115	67	192	405
1893	24	116	67	173	380
1894	18	82	40	136	276
1895	48	82	14	117	261
1896	17	92	28	114	251
1897	18	81	44	104	247
1898	14	90	39	100	243
1899	16	85	35	110	246
1900	15	75	52	138	280

It will be seen that between 1888 and 1898 the number steadily declined. Between 1881 and 1890, when the land agitation was at its height, agrarian crime enormously increased, the number of offences being nearly treble the number in the previous ten years.

In 1899, 98,401 cases of drunkenness were brought before the Irish magistrates, as compared with 214,298 in England and Wales, and 44,351 in Scotland.

Pauperism.—For the reconstitution of the poor-law authorities, see the paragraph on local government, above.

The aggregate number of persons relieved, and total poor relief expenditure in each year from 1889 to 1898, are shown on the following page.

During 1898–99 the average daily number in receipt of in-door relief was 42,728, and in receipt of out-door relief, 64,604. The corresponding figures during 1899–1900 were 41,980 and 58,012.

On 1st January 1898 the ratio of pauperism to population in Ireland was 1 in every 45 persons, or 2·2 per cent. of the population; and in England and Wales on the same date the ratio was 1 in every 37 persons, or 2·7 per cent. of the population.

Year ending 29th Sept.	Aggregate Number relieved continuously or successively.[1] In-door.	Out-door.	Total.	Total Poor Relief Expenditure. £	Year ending 29th Sept.	Aggregate Number relieved continuously or successively.[1] In-door.	Out-door.	Total.	Total Poor Relief Expenditure. £
1889	369,570	120,655	490,225	853,912	1894	328,094	108,335	436,429	869,674
1890	334,168	120,010	454,178	856,008	1895	316,733	116,633	433,366	863,944
1891	311,604	125,343	436,947	871,424	1896	334,170	99,053	433,223	868,969
1892	315,818	117,708	433,526	869,192	1897	351,828	106,513	458,341	894,846
1893	324,388	107,735	432,123	857,910	1898	375,915	149,189	525,104	981,333

Religion.—In 1891, 3,547,307 or 75·4 per cent. of the inhabitants were Roman Catholics; 600,103 or 12·7 per cent. Protestant Episcopalians; 444,974 or 9·5 per cent. Presbyterians; 55,500 or 1·2 per cent. Methodists; and 56,866 or 1·2 per cent. adherents of other denominations. In 1901 the corresponding figures were 3,310,028 or 74·3 per cent., 579,385 or 13·0 per cent., 443,494 or 10·0 per cent., 61,255 or 1·4 per cent., and 62,384 or 1·3 per cent. Antrim, Down, Armagh, and Londonderry are the only counties in which less than half the inhabitants are Roman Catholics. As compared with 1891, Roman Catholics showed a decrease of 237,279 or 6·7 per cent; Protestant Episcopalians a decrease of 20,718 or 3·5 per cent.; Presbyterians a decrease of 1480 or 0·3 per cent.; and Methodists an increase of 5755 or 10·4 per cent. Jews increased from 1779 to 3769.

The number of bishoprics in the Church of Ireland is now eleven, as the see of Clogher was revived in 1886. In 1899 the clergy numbered 1650, and the churches 1400. For the year ending 31st December 1900 the accounts of the representative body show that the interest on investments amounted to £311,342, 6s. 11d., contributions to diocesan stipend, general and episcopal funds, to £115,012, 3s. 6d., parochial endowments to £41,125, 18s. 8d., and glebe rents to £18,595, 10s.; while, on the side of expenditure, £291,453, 15s. 4d. was paid to diocesan financial schemes, and £35,987, 8s. 7d. in commutations and annuities. On 31st December 1900 there were in the hands of the representative body various capital sums, amounting to more than £8,000,000, derived from the following sources:—£1,500,000, the balance of the commutation money received to pay the annuities of the clergy, £500,000 received in lieu of private endowments, £1,500,000 derived from the composition of annuitants, and £5,000,000 voluntarily contributed.

The whole of the clergy of the Roman Catholic Church in Ireland are supported by various forms of voluntary contributions. In addition to the secular clergy, 70 or 80 communities of different religious orders are scattered throughout the country, ministering in their own churches, but without parochial jurisdiction. At the census of 1891 the total clergy, including archbishops, bishops, private chaplains, and professors, amounted in number to 3502.

From the minutes of the General Assembly of the Presbyterian Church in Ireland in 1900 it appears that in the year ending in March there were 658 ministers, besides 88 licentiates and ordained ministers without charge, 570 congregations, and 481 manses. The following figures show the revenue and expenditure of the Church for the same year:—Pew rents, £53,447; raised for building or repairing churches, manses, and schools, £39,425; raised for the sustentation fund, £23,072; Sabbath collections, £26,904; mission collections, £21,591; other charitable collections, £45,081; stipends paid to ministers, £55,265. The Wesleyan Methodist body in the United Kingdom forms one connexion, but has two conferences, one for Great Britain and the other for Ireland. The president of the British conference is also president of the Irish conference. The number of ministers in Ireland is about 250.

Education.—The following table shows for each province and all Ireland, by religious professions, the percentage of the population, five years old and upwards, who could read and write, read only, and neither read nor write, in 1881 and 1891:—

Provinces.		Roman Catholics. Read and Write.	Read only.	Neither Read nor Write.	Protestant Episcopalians. Read and Write.	Read only.	Neither Read nor Write.	Presbyterians. Read and Write.	Read only.	Neither Read nor Write.	Methodists. Read and Write.	Read only.	Neither Read nor Write.	Other Denominations. Read and Write.	Read only.	Neither Read nor Write.	Totals. Read and Write.	Read only.	Neither Read nor Write.
Leinster	1881	61·2	15·9	22·9	89·6	5·1	5·3	92·4	4·2	3·4	93·5	2·9	3·6	92·3	2·8	4·9	65·3	14·4	20·3
	1891	71·4	11·3	17·3	92·5	3·3	4·2	94·7	2·4	2·9	95·2	1·9	2·9	90·5	2·3	7·2	74·6	10·0	15·4
Munster	1881	57·9	12·0	30·1	89·4	4·9	5·7	93·7	3·1	3·2	93·1	3·1	3·8	93·2	2·4	4·4	59·9	11·6	28·5
	1891	70·5	8·5	21·0	92·7	3·1	4·2	95·0	2·4	2·6	93·4	3·0	3·6	91·4	1·7	6·9	71·9	8·2	19·9
Ulster	1881	47·4	21·5	31·1	65·2	20·3	14·5	75·4	17·3	7·3	80·9	12·8	6·3	82·4	12·1	5·5	60·0	19·7	20·3
	1891	60·2	15·8	24·0	74·4	14·2	11·4	82·9	11·4	5·7	86·2	8·9	4·9	86·7	8·8	4·5	70·7	13·9	15·4
Connaught	1881	45·2	15·3	39·5	85·2	7·3	7·5	90·6	5·6	3·8	94·3	3·3	2·4	93·6	3·7	2·7	47·2	14·9	37·9
	1891	60·5	11·0	28·5	89·2	5·6	5·2	93·5	3·6	2·9	94·5	3·3	2·2	92·8	2·5	4·7	61·8	10·8	27·4
Ireland	1881	54·1	15·8	30·1	74·9	14·2	10·9	76·2	16·7	7·1	84·6	9·9	5·5	84·5	10·2	5·3	59·3	15·5	25·2
	1891	66·7	11·3	22·0	81·5	9·9	8·6	83·4	11·0	5·6	88·4	7·2	4·4	87·6	7·4	5·0	70·6	11·0	18·4

It will be seen that the percentage of illiterates sensibly diminished all over Ireland, and that the provinces occupied the same relative positions, as regards standard of education attained, in 1891 as in 1881. During the week ending 30th May 1891 the proportion per cent. of the total population, between five and sixteen years of age, attending school was 54·1, and not attending school 45·9.

In 1881 the number of universities and other colleges in Ireland was 16, attended by 4288 students, of whom 1919 were Roman Catholics, 1364 Protestant Episcopalians, and 1005 belonged to the Presbyterian and other denominations; in 1891 there were 15 colleges, with 3498 students, of whom 1658 were Roman Catholics, 1046 Protestant Episcopalians, and 794 Presbyterians and other denominations. In 1900 Trinity College, Dublin, had 1076 students on its books, and in the previous year the university conferred 421 degrees. In 1887 medical school buildings were completed at a cost of £20,000. The Royal University of Ireland was founded in 1880, and since 1882 has superseded the old Queen's University. The government is vested in a senate, consisting of a chancellor and not more than 36 senators, with power to confer degrees upon male and female students in all the usual subjects except theology. No residence in any college, nor attendance at lectures, or any other course of instruction, is obligatory. There are fellowships and examinerships attached to the university. At the first matriculation examination in December 1881, 508 candidates, including 25 females, passed; in 1900 the number was 688, which included 170 females. The entire number of persons who passed the academic examinations in 1900 was 1783 out of 2658 candidates. The revenue of the university for the year 1900–1 was £39,488, and the expenditure £24,847. The three Queen's Colleges of Belfast, Cork, and Galway, which formed the Queen's University, still exist as university colleges. The buildings of the college at Belfast have been largely increased of recent years. The number of students attending the three colleges in 1899–1900 was 635—Belfast 347, Cork 178, and Galway 110. In the same year the number that entered was 197—Belfast 99, Cork 51, and Galway 47. Practically all the students graduate in the Royal University. In 1882 the Roman Catholic bishops resolved to place the buildings of the Roman Catholic University in Dublin, which is wholly supported by voluntary contributions, under the control of the archbishop of Dublin, who undertook to maintain a college where instruction would be given in arts and medicine according to the requirements of the Royal University. In 1883 the direction of the college was entrusted to the Jesuit Fathers. Several of the fellows of the Royal University are professors in the college. In 1881 the faculty of the Presbyterian General Assembly's College, Belfast, and the theological professors of the Magee College, Londonderry, were incorporated by Royal Charter, and constituted as a faculty, with power to grant degrees in divinity. The Magee College, whose professors must all sign the Westminster Confession of Faith, though no religious test is prescribed for

[1] Exclusive of persons in institutions for the blind, deaf and dumb, and for idiots or imbeciles. During the ten years 1889–98 these persons averaged about 950 in each year.

students, provides literary and scientific education as well as theological.

In 1900 the examinations of the Intermediate Education Board were held at 247 centres. The number of candidates for examination was 7608 (boys 5611, and girls 1997), of whom 5314 passed (boys 3799, and girls 1515). 84 boys and 24 girls gained exhibitions (£20 for one year) in the preparatory grade, 190 boys and 83 girls exhibitions (£20 for three years) in the junior grade, 60 boys and 24 girls exhibitions (£30 for two years) in the middle grade, and 20 boys and 11 girls exhibitions (£50 for one year) in the senior grade, while 651 boys and 292 girls were awarded prizes. In 1880 the number of candidates was 5561 (boys 4114, and girls 1447), of whom 4010 passed (boys 2899, and girls 1111). The amount of results fees paid to managers of schools in 1900 was £56,158—£41,098 for boys and £15,060 for girls.

The following table shows the number of primary and superior schools, with details of their pupils, for 1881 and 1891 :—

Schools.		Number of Schools.				Number of Pupils and Religious Professions.						Total Pupils, Male and Female.
		Male.	Female.	Mixed.	Total.	Roman Catholics.		Protestant Episcopalians.		Presbyterians and Others.		
						M.	F.	M.	F.	M.	F.	
Primary	1881	2088	1745	5318	9151	259,631	261,187	42,056	39,132	37,903	35,127	675,036
	1891	2143	1684	5350	9177	258,830	263,968	42,105	39,255	41,938	38,938	685,034
Superior	1881	205	117	166	488	5,218	4,927	3,985	2,505	2,100	1,670	20,405
	1891	199	91	185	475	8,198	5,574	3,607	2,627	2,108	2,157	24,271
Total	1881	2293	1862	5484	9639	264,849	266,114	46.041	41,637	40,003	36,797	695,441
	1891	2342	1775	5535	9652	267,028	269,542	45,712	41,882	44,046	41,095	709,305

The number of National schools, the number of pupils on the rolls, and the amount of parliamentary grants from 1881 to 1900, are thus returned :—

Years.	Number of Schools.	Number of Pupils.	Amount of Grant.
			£
1881	7648	1,066,259	729,868
1885	7936	1,075,604	814,003
1891	8346	1,022,361	866,539
1896	8606	808,939 [1]	1,186,187
1897	8631	798,972	1,276,560
1898	8651	794,818 [2]	1,304,734
1899	8670	785,139	1,299,117
1900	8684	745,861	1,387,503

On 31st December 1900 the National Board had in their service 8244 principal teachers and 3684 assistants, 897 work-mistresses and industrial teachers, 13 junior literary assistants, 32 temporary assistants, 5 temporary work-mistresses. The total emoluments from all sources, available for the teaching staff for the year ending 31st March 1901, was £1,174,690. The total receipts of the National Board for the same year were £1,492,172 (including a parliamentary grant of £1,387,503), and the expenditure was £1,465,480.

The following table gives details for 31st December 1900 :—

Province.	Number of Schools.	Number of Pupils.				Average Daily Attendance.
		Roman Catholics.	Protestant Episcopalians.	Others.	Total.	
Leinster .	1795	146,176	15,629	2,767	164,572	107,088
Munster .	2115	182,170	6,840	1,351	190,361	126,964
Ulster .	3249	111,383	62,284	92,838 [3]	266,605	172,593
Connaught	1525	119,791	3,922	610	124,323	71,629
Total .	8684	559,520	88,675	97,666	745,861	478,224

In 1900 the average number of inmates in the six reformatory schools was 584, and the cost of maintenance and management was £13,780. In the same year the number of schools having certificates under the Irish Industrial Schools Act, 1868, was 70—8 Protestant (3 for boys and 5 for girls), and 62 Roman Catholic (17 for boys, 44 for girls, and 1 mixed). The total number of inmates was 7802.

On 31st December 1900 there were, throughout Ireland, 30 model schools, with 8871 pupils on the rolls and an average daily attendance of 6547; 150 workhouse schools, with 4422 pupils on the rolls and an average daily attendance of 3747.

The Irish Education Act of 1892 provided that the parents of children of not less than 6 nor more than 14 years of age should cause them to attend school, unless there was a reasonable excuse for non-attendance, on at least 150 days in the year in municipal boroughs and in towns or townships under commissioners. It was also enacted that any county council which might be established by any future Act might by resolution, and should, on application made by any baronial council (now rural district council), apply the foregoing provision to any part of their county. The commissioners were empowered by the same Act to acquire land for school-houses and teachers' residences, and provisions were made for the partial or total abolition of fees in specified circumstances, and for a parliamentary school grant, in lieu of abolished school fees, for the augmentation of the salaries of the National teachers.

Under the Educational Endowments (Ireland) Act, 1885, a scheme was prepared for altering the constitution of the old "Commissioners of Education," who had the management of the endowed and diocesan schools, and for the future control of the Ulster royal schools. A Protestant and a Roman Catholic Board were constituted for each of the following districts: Armagh, Tyrone (with part of Londonderry), Fermanagh (with part of Monaghan), Cavan, and Donegal. The endowments are now distributed in equal shares. In 1900 the receipts of the commissioners amounted to £8098.

Finance.—The amount of imperial revenue collected in Ireland during the five years ending 31st March 1900 was :—

Years.	Customs.	Excise.	Stamps.	Property and Income Tax.	Post Office and Telegraphs.	Miscellaneous.	Total Revenue.	Estimated True Revenue.	Per Head of Estimated Population.
	£	£	£	£	£	£	£	£	£ s. d.
1896	2,152,000	5,299,000	917,000	703,000	795,000	164,000	10,030,000	8,034,000	1 15 1
1897	2,176,000	5,361,000	1,010,000	666,000	809,000	168,000	10,190,000	8,146,000	1 15 9
1898	2,221,000	5,449,000	943,000	670,000	824,000	146,000	10,253,000	8,114,000	1 15 8
1899	2,002,000	5,518,000	1,035,000	687,000	846,000	159,000	10,247,000	8,202,000	1 16 1
1900	2,159,000	6,274,000	945,000	694,900	878,000	167,500	11,117,500	8,664,500	1 18 2

The amount of imperial revenue expended in Ireland during the same five years was :—

Years.	Consolidated Fund.	Voted.	Local Taxation Accounts.		Civil Charges.	Collection of Taxes.	Post Office Services.	Total Expenditure.	Estimated True Revenue.	Contribution.
			Local Taxation Revenue.	Exchequer Revenue.						
	£	£	£	£	£	£	£	£	£	£
1896	177,000	4,330,000	353,000	40,000	4,902,000	228,000	807,000	5,937,000	8,034,000	2,097,000
1897	177,000	4,297,000	401,000	40,000	4,915,000	232,000	823,000	5,970,000	8,146,000	2,176,000
1898	174,000	4,302,000	511,000	40,000	5,027,000	241,000	866,000	6,134,000	8.114,000	1,980,000
1899	176,000	4,265,000	447,000	404,000	5,292,000	242,000	943,000	6,477,000	8,202,000	1,725,000
1900	179,000	4,072,000	409,000	1,053,000	5,713,000	242,000	1,025,000	6,980,000	8,664,500	1,684,500

From a variety of circumstances it is extremely difficult to arrive at even an approximate estimate of the wealth of Ireland. The following statistics, however, may serve as a sort of summary estimate of Irish property in 1900–1, though many important factors, such as the amount of capital invested in the linen industry, cannot be included owing to the uncertainty of the figures: —Tenement valuation, £14,933,524; value of crops, £30,104,392;

[1] Number of pupils on the rolls on 31st December.

[2] Number of pupils on the rolls on 30th September. Prior to 1896 the basis of the returns was the total number on the rolls who had made at least one attendance in the year.

[3] 81,149 Presbyterians.

value of live stock, £82,145,137; paid-up capital and reserve funds of joint-stock banks, £10,910,512; deposits in joint-stock banks, in trustee savings banks, and in P.O. savings banks, £52,197,000; investments in Government stock, transferable at the Bank of Ireland, £30,395,000; paid-up share and debenture capital of railways, £39,765,573; paid-up stock and share capital of tramway companies, £1,833,003; fisheries—value of exports, £367,655; mines—value of productions, £239,840; total, £262,891,636. In this connexion it may be noted that deposits in joint-stock banks rose from £28,289,000 in 1881 to £41,568,000 in 1901; deposits in trustee savings banks from £2,078,707 in 1881 to £2,340,000 in 1901; and deposits in P.O. savings banks from £1,645,000 in 1881 to £8,289,000 in 1901. The amount of Government and other stock on which dividends are paid at the Bank of Ireland rose from £28,289,000 in 1881 to £30,395,000 in 1901. In the year ending 5th April 1900 the net annual value of property and profits assessed to the income tax was £24,439,941.

In 1897 the local taxation of Ireland amounted to £3,978,136, as compared with £3,559,093 in 1890. More than 75 per cent. of the total amount was raised by rates on real property. The Local Government (Ireland) Act, 1898, effected considerable changes in local finance. Each county council has now three sources of revenue: (1) The agricultural grant; (2) the licence duties and other imperial grants; and (3) the poor rate,—which it will be convenient to consider separately. (1) It was provided by the Act that the Local Government Board should ascertain the amount of county cess and poor rate levied off agricultural land in Ireland during the year ending, as regards the poor rate, on 29th September, and, as regards the county cess, on 21st June, 1897, and that half this amount, to be called the agricultural grant, should be paid annually, without any variation from the original sum, out of the consolidated fund to a local taxation account. The amount of the agricultural grant has now been ascertained to be £727,655. Elaborate provisions were also made in the Act for fixing the proportion of the grant to which each county should be entitled, and the Lord-Lieutenant was empowered to pay half-yearly the proportion so ascertained to the county council. (2) Previous to the passing of the Act, grants were made from the imperial exchequer to the grand juries in aid of the maintenance of lunatics, and to the boards of guardians for medical and educational purposes, and for salaries under the Public Health (Ireland) Act. In 1897 these grants amounted to £236,483. Under the Local Government Act they ceased, and in lieu thereof it was provided that there should be annually paid out of the consolidated fund to the local taxation account a sum equal to the duties collected in Ireland on certain specified local taxation licences. In addition, it was enacted that a fixed sum of £79,000 should be forthcoming annually from the consolidated fund. (3) The county cess was abolished, and the county councils now levy a single rate for the rural districts and unions, called by the name of poor rate, for all the purposes of the Act. It is made upon the occupier and not upon the landlord, and the occupier is not entitled, save in a few specified cases, to deduct any of the rate from his rent. The total amount raised by the poor rate in the year ending 29th September 1898 was £1,087,920.

The total amount issued on loan, exclusive of closed services, by the Commissioners of Public Works in Ireland up to 31st March 1900 was £24,228,037, which included the loans granted under the Land Improvement Acts, the Seed Supply Acts, and section 31 of the Land Act, 1881 (*Agriculture* below). On the same date there had been repaid of the principal sum £13,531,079, £7,141,423 had been paid by way of interest, and £1,597,050 had been remitted. The balance outstanding was—principal £9,099,908, and interest £193,892. Exclusive of the loans already mentioned, the following were the chief items of the total amount: —Railways £1,200,127, lunatic asylum buildings £2,620,385, public health £2,690,278, Labourers' Acts £1,830,188, river drainage and navigation £2,082,052, grand juries for roads, &c., £807,667.

In 1894 a Royal Commission was appointed to consider the financial relations between Great Britain and Ireland and the taxable capacity of the two countries, and presented a voluminous final report in 1896. The commissioners differed on several points, but were practically agreed on the following five conclusions: (1) That Great Britain and Ireland must, for the purposes of this inquiry, be considered as separate entities; (2) that the Act of Union imposed upon Ireland a burden which, as events showed, she was unable to bear; (3) that the increase of taxation laid upon Ireland between 1853 and 1860 was not justified by the then existing circumstances; (4) that identity of rates of taxation did not necessarily involve equality of burden; (5) that, whilst the actual tax revenue of Ireland was about one-eleventh of that of Great Britain, the relative taxable capacity of Ireland was very much smaller, and was not estimated by any of the commissioners as exceeding one-twentieth. Since its publication the report has become a standing subject of political and economic controversy. (See *History* below.)

Defence.—The militia has been reorganized under recent army regulations, and now consists of the 3rd and 4th battalions of certain of the territorial regiments.

Production and Industry.

By the Purchase of Land Act, 1891, a body was constituted, called the Congested Districts Board, composed of the Chief Secretary, a member of the Land Commission, and five other members. The Act placed at the disposal of the Board the Irish Reproductive Loan Fund, the Sea and Coast Fisheries Fund (except the sum of £20,000—see *Fisheries* below), and the interest, at the rate of $2\frac{1}{2}$ per cent., on a sum of £1,500,000 charged on the Irish Church Temporalities Fund. It was provided that where more than 20 per cent. of the population of a county lived in electoral divisions of which the total rateable value, when divided by the number of the population, gave a sum of less than £1, 10s. for each individual, these divisions should, for the purposes of the Act, form a separate county, called a congested districts county, and should be subject to the operations of the Board. In order to ameliorate the condition of affairs in these separate counties, the Board was empowered (1) to amalgamate small holdings (within certain specified limits), either by directly aiding migration or emigration of occupiers from one holding to another, or by recommending the Land Commission to facilitate amalgamation, and (2) generally to aid and develop, out of its resources, agriculture, forestry, the breeding of live stock, weaving, spinning, fishing (including the construction of piers and pontoons, and the supply of boats and gear), and any other suitable industries. Further provisions regulating the operations of the Board were made by an Act of 1893, and by the Land Law Act, 1896. By its constituting Act, the new Department of Agriculture, &c., was empowered to exercise and discharge, at the request of the Board, any of its powers and duties in a congested districts county. For the year ending 31st March 1899 the receipts of the Board were £111,152, and the expenditure £106,165. By an Act of 1899, a Department of Agriculture and other Industries and Technical Instruction was established in Ireland. The Chief Secretary is president of the department, to which have been transferred the powers and duties of the Lord-Lieutenant, under the Diseases of Animals Acts, 1894 and 1896; under the Destructive Insects Act, 1877, and the Fertilizers and Feeding Stuffs Act, 1893; the powers and duties of the Registrar-General and of the Land Commission with reference to the collection of statistics; the powers and duties of the Land Commission under the Markets and Fairs (Weighing of Cattle) Acts, 1887 and 1891; the administration of the grant for science and art in Ireland; the administration of the grant for technical education; the powers and duties of the Department of Science and Art in relation to any public building or institution under their control, and also any property held by them; and the powers and duties of the inspectors of Irish fisheries, who are henceforth to be officers of the department. To assist the department, the Act also provided for the establishment of a Council of Agriculture, an Agricultural Board, and a Board of Technical Instruction, specifying the constitution of each of the three bodies. Certain moneys (exceeding £180,000 per annum) were placed by the Act at the disposal of the department, provisions were made for their application, and it was enacted that local authorities might contribute funds.

Minerals.—The mineral output of Ireland is still very limited, and the production of lead and copper, the combined value of which in 1876 was over £50,000, has now practically ceased, as has the production of silver. In 1900 the coal mines in Kilkenny,

Mineral.	1899.		1900.	
	Quantity.	Value.	Quantity.	Value.
	Tons.	£	Tons.	£
Coal	125,420	51,460	124,699	62,249
Iron ore	102,262	16,015	99,641	17,670
Salt	47,055	13,319	44,194	7,554
Slate	5,443	13,410	5,637	14,433
Other minerals	...	125,926	...	137,834
Total	...	220,130	...	239,740

Queen's County, Tipperary, Antrim, Tyrone, Leitrim, and Roscommon produced 124,699 tons, of the value of £62,249, Kilkenny having the largest output, with 62,817 tons of anthracite coal. In the same year eleven iron ore mines were worked in County Antrim, and produced 99,641 tons, valued at the mines at £17,610. In 1892 the output of iron ore was 76,739 tons, of the value of £11,625. Rock salt of a superior quality is raised at Carrickfergus in County Antrim, the production in 1900 having

been 44,194 tons, valued at £7554. Alum clay or bauxite is found in beds between sheets of Tertiary basalt in the same county. The quantity raised from five mines in 1900 was 5779 tons, valued at the mines at £1350. The alumina is prepared at works near Larne, and the quantity extracted in 1900 was 1600 tons, value £30,500, which produced 560 tons of aluminium, value £72,800. The preceding table contains a general summary of the mineral output of Ireland in 1899 and 1900.

Agriculture.—The Land Act of 1881 provided that a fair rent

Method of Procedure.	Number of Holdings.	Extent in Acres.	Old Rents.	Judicial Rents.	Reduction per cent.
FIRST STATUTORY TERM.			£	£	
By chief commission and sub-commissions	171,718	5,711,509	4,016,429	3,123,828	24·9
On reports of valuers	1,562	67,072	43,901	35,099	20·0
By civil bill courts	18,271	552,315	350,377	263,161	24·9
By agreements between landlords and tenants	137,131	3,525,785	2,311,076	1,901,348	17·7
By arbitration	38	3,289	3,266	2,304	29·4
Total of first statutory term	328,720	9,859,970	6,725,049	5,325,740	20·8
SECOND STATUTORY TERM.					
By chief commission and sub-commissions	26,844	788,027	524,352	396,098	24·4
On reports of valuers	291	12,814	7,263	5,702	21·4
By civil bill courts	1,954	68,831	38,290	29,366	25·9
By agreements between landlords and tenants	23,307	562,943	289,075	234,942	18·8
Total of second statutory term	52,396	1,432,615	858,980[1]	666,108	22 4

when fixed could not be raised or altered for fifteen years—the first statutory term—and that a second term could be fixed in the last year of that period at a revised rent. The table above shows the number of fair rents fixed between 22nd August 1881 and 31st March 1900. The judicial rents fixed for the first statutory term show a reduction of a fraction over 20 per cent. on the old rents; those fixed for the second statutory term, a still further reduction of over 22 per cent. In addition, 154 judicial leases (*i.e.*, leases approved by the court to exclude the Act of 1881) were executed during the same period, and 45 fixed tenancies (*i.e.*, tenancies to which the Act of 1881 does not apply) were sanctioned. Since the Land Act of 1881, which seemed to the tenant a near approximation to the "three f's"—free sale, fair rent, and fixity of tenure,—several measures have been passed dealing with the tenure and purchase of land in Ireland. By the Purchase of Land (Ireland) Act, 1885, which was described as "an Act to provide greater facilities for the sale of land to occupying tenants," elaborate provisions were made for advances by the Land Commission (established by the Act of 1881) in order to enable tenants to purchase their holdings either from the Land Commission itself or from their landlords, and for the repayment of such advances. For the purpose of advances, or of purchases of estates by the Land Commission, it was further enacted that any sum or sums, not exceeding in all £5,000,000, might be issued out of the consolidated fund. The Acts of 1881 and 1885 were amended and extended by the Land Law (Ireland) Act, 1887. By the Purchase of Land Amendment Act, 1889, the Land Commission was empowered to advance money to tenants to purchase lands to increase the size of their holdings. The Purchase of Land Act, 1891, provided further funds for the purchase of land by tenants, established the Land Commission as a permanent tribunal, and constituted a body called the Congested Districts Board (see above). The Land Law Act of 1896 contained further provisions for the fixing of fair rents and certain regulations as to the duties of the Land Judge and the Judicial Commissioners, and amended in some respects the previous law as to the purchase of land. There is no provision for compulsory sale in any of the Acts.

The following table shows, by provinces, applications for loans

Provinces.	Under Act of 1885. From August 1885 to March 1900.				Under Acts of 1891 and 1896. From August 1891 to March 1900.				Total Loans Issued.	
	Applications.		Loans Issued.		Applications.		Loans Issued.			
	No.[2]	Amount.	No.[2]	Amount.	No.[2]	Amount.	No.[2]	Amount.	No.[2]	Amount.
		£		£		£		£		£
Leinster	5,062	2,758,639	4,222	2,358,183	6,084	2,599,400	4,117	1,793,327	8,339	4,151,510
Munster	5,893	3,637,301	5,204	3,222,056	5,940	2,664,859	4,195	1,826,430	9,399	5,048,486
Ulster	14,528	4,171,513	12,954	3,749,421	12,426	2,758,336	8,406	1,955,886	21,360	5,705,307
Connaught	3,426	799,342	2,988	662,980	5,053	962,429	2,509	508,574	5,497	1,171,554
Total—Ireland	28,909	11,366,795	25,368	9,992,640	29,503	8,985,024	19,227	6,084,217	44,595	16,076,857

and loans issued under the Land Purchase Acts, 1885, 1891, and 1896, from 22nd August 1885 to 31st March 1900.

[1] Judicial rents for first statutory term.
[2] The number of tenants is the same as the number of loans.

Under an act of 1898 money can be lent to Boards of Guardians for the supply of seed potatoes, seed oats, and potato spraying machines and spraying material to occupiers of land unable through poverty to obtain such supplies. Up to 31st March 1900, £78,670 had been so advanced. Under the previous Seed Supply Acts a sum of nearly £1,000,000 has been advanced by the Commissioners of Public Works.

The amount *sanctioned* under the Act of 1885 was £9,992,640 to 25,368 tenants. In the first year the purchase money actually issued was 18·3 years' purchase on the rental, the highest figure ever reached. In 1897 it fell to 15·2 years' purchase, and the average for the entire period was 17 years' purchase. The amount *sanctioned* under the Acts of 1891 and 1896 was £7,550,765 to 24,337 tenants. The purchase money actually issued was 17·3 years' purchase on the rental.

Below are given the number and amount of loans issued in each county and province under the Land Improvement Acts from 1847 to 1900.

Over £4,000,000 was applied for drainage purposes. During the year ending 31st March 1900, 294 applications were received under these Acts, and £38,900 was issued. Under sect. 19 of the Land Act 1881, 260 loans, amounting to £15,275, to tenant farmers for labourers' dwellings, were sanctioned up to 31st March 1900. A large number of loans are made under sect. 31 of the same Act, and the

Provinces and Counties.	No. of Loans.	Amount Issued.	Provinces and Counties.	No. of Loans.	Amount Issued.
LEINSTER.		£	ULSTER.		£
Carlow	235	109,969	Antrim	224	138,203
Dublin	321	98,770	Armagh	8	22,363
Kildare	338	146,252	Cavan	205	55,690
Kilkenny	270	76,825	Donegal	332	190,129
King's	255	71,524	Down	179	99,765
Longford	343	183,986	Fermanagh	200	87,158
Louth	122	47,794	Londonderry	201	74,578
Meath	486	211,852	Monaghan	114	46,563
Queen's	386	161,648	Tyrone	322	149,245
Westmeath	332	105,467			
Wexford	383	135,610			
Wicklow	274	127,380			
Total	3745	1,477,077	Total	1785	863,694
MUNSTER.			CONNAUGHT.		
Clare	514	177,819	Galway	839	392,919
Cork	1546	451,533	Leitrim	204	76,486
Kerry	856	479,626	Mayo	526	232,761
Limerick	956	395,630	Roscommon	490	231,550
Tipperary	815	231,406	Sligo	302	139,900
Waterford	296	88,819			
			Total	2361	1,073,616
Total	4983	1,824,833	Total—Ireland	12,874	5,239,220

following table gives a summary by provinces of the number and amounts of loans issued for drainage, fencing, erecting of farmhouses, cottages, scutch mills, &c.

Provinces.	Loans Sanctioned.		Total Issued.
	Number.	Amount.	
		£	£
Leinster	2,715	290,980	247,822
Munster	6,784	557,150	480,062
Ulster	2,025	150,322	126,895
Connaught	3,332	246,985	216,327
Total—Ireland	14,856	1,245,437	1,071,106

The following table gives the number of different holdings in each province and in all Ireland in 1881, 1891, and 1900, with, in each case, the increase or decrease between 1881 and 1900.

As the holdings not exceeding 1 acre consist to a large extent merely of small gardens, the increase in their number cannot be regarded as a very important factor in an agricultural estimate. As regards other holdings, the general tendency has been for those between 1 acre and 30 acres to decrease, and for those over 30 acres to increase. So far as the first class is concerned, this applies to all the provinces without exception. But as regards the second class, while there was an increase between 1881 and 1900 in holdings over 30 acres in Munster of 1120, in Ulster of 1959, and in Connaught of 1605,

Provinces.		Holdings not exceeding								Above 500 Acres.	Total.
		1 Acre.	5 Acres	15 Acres	30 Acres.	50 Acres	100 Acres.	200 Acres.	500 Acres.		
Leinster	1881	17,289	18,804	26,048	22,623	15,527	14,044	6,776	2765	363	124,239
	1891	17,696	18,034	25,881	22,258	15,206	13,865	6,867	2785	415	123,007
	1900	24,301	17,426	25,255	21,952	15,222	14,039	6,890	2829	411	128,325
Increase or decrease between 1881 and 1900		+7,012	−1,378	−793	−671	−305	−5	+114	+64	+48	+4,086
Munster	1881	11,828	11,096	19,747	25,030	21,953	22,054	9,035	2752	347	123,842
	1891	14,922	11,207	19,254	24,368	22,176	22,068	9,143	2768	363	126,269
	1900	21,949	11,493	19,349	24,288	22,271	22,602	9,325	2680	383	134,340
Increase or decrease between 1881 and 1900		+10,121	+397	−398	−742	+318	+548	+290	−72	+36	+10,498
Ulster	1881	14,733	21,971	68,362	55,227	24,370	13,562	3,367	968	243	202,803
	1891	17,026	21,287	64,760	53,825	25,013	14,090	3,654	1041	259	200,955
	1900	18,962	20,672	63,555	53,622	24,989	14,461	3,725	1031	263	201,280
Increase or decrease between 1881 and 1900		+4,229	−1,299	−4,807	−1,605	+619	+899	+358	+63	+20	−1,523
Connaught	1881	7,146	15,200	49,888	32,913	10,535	5,941	3,036	1719	477	126,855
	1891	5,984	12,936	46,766	33,496	11,526	6,338	3,147	1686	530	122,409
	1900	6,636	12,563	46,592	33,688	11,567	6,474	3,111	1679	482	122,792
Increase or decrease between 1881 and 1900		−510	−2,637	−3,296	+775	+1,032	+533	+75	−40	+5	−4,063
Ireland	1881	50,996	67,071	164,045	135,793	72,385	55,601	22,214	8204	1430	577,739
	1891	55,628	63,464	156,661	133,947	73,921	56,361	22,811	8280	1567	572,640
	1900	71,848	62,154	154,751	133,530	74,049	57,576	23,051	8219	1539	586,717
Increase or decrease between 1881 and 1900		+20,852	−4,917	−9,294	−2,263	+1,664	+1,975	+837	+15	+109	+8,978

Leinster showed a decrease of 84. Taking the whole of Ireland, the decrease in the first class was 16,474, and the increase in the second class was 4600.

The following table shows the number of occupiers in 1881 and 1900 resident in each province, classified according to the total extent of land held, without reference to the townland, poor law union, county, or province in which the portions of land are situated:—

Provinces.		Number of Occupiers holding Land.									Total.
		Not exceeding 1 acre.	Between 1 and 5.	Between 5 and 15.	Between 15 and 30.	Between 30 and 50.	Between 50 and 100.	Between 100 and 200.	Between 200 and 500.	Above 500.	
Leinster	1881	16,975	16,983	22,218	19,052	13,299	12,313	6,099	2895	717	110,551
	1900	24,065	15,893	21,632	18,840	13,160	12,442	6,391	2989	692	116,104
Increase or decrease		+7,090	−1,090	−586	−212	−139	+129	+292	+94	−25	+5,553
Munster	1881	11,635	9,738	16,614	21,505	19,196	20,032	8,629	3195	638	111,182
	1900	21,752	10,278	16,193	20,972	19,629	20,957	9,283	3164	552	122,780
Increase or decrease		+10,117	+540	−421	−533	+433	+925	+654	−31	−86	+11,598
Ulster	1881	14,480	19,711	62,102	50,701	23,125	13,762	3,815	1195	317	189,208
	1900	18,816	19,080	58,244	49,357	23,851	14,539	4,141	1200	331	189,559
Increase or decrease		+4,336	−631	−3,858	−1,344	+726	+777	+326	+5	+14	+351
Connaught	1881	6,865	13,836	46,862	31,366	9,997	5,376	2,371	1413	657	118,743
	1900	6,470	11,401	43,765	32,186	11,145	6,144	2,803	1586	616	116,116
Increase or decrease		−395	−2,435	−3,097	+820	+1,148	+768	+432	+173	−41	−2,627
Ireland	1881	49,955	60,268	147,796	122,624	65,617	51,483	20,914	8698	2329	529,684
	1900	71,103	56,652	139,834	121,355	67,785	54,082	22,618	8939	2191	544,559
Increase or decrease		+21,148	−3,616	−7,962	−1,269	+2,168	+2,599	+1,704	+241	−138	+14,875

From the above it is seen that, as might have been expected from the previous table, the occupiers of holdings not exceeding 1 acre largely increased; those occupying holdings between 1 acre and 30 acres decreased (by 12,847), and occupiers of holdings over 30 acres increased (by 6574).

The following table gives in statute acres the distribution of land during 1900 in the various counties, alphabetically arranged under their provinces. The totals for the provinces and for all Ireland are collected into a separate table for the purpose of comparison with the figures for 1881; in this table, below the acreage occupied by each kind of land, is given the percentage it forms of the whole province or county as the case may be.

From the table it will be seen that between 1881 and 1900 the area under crops, including meadow and clover, decreased by 536,643 acres. Each of the four provinces showed a decline, the largest—184,742 acres—being in Ulster, and the smallest—81,105 acres—in Connaught. On the other hand, the area under grass (pasture) increased by 487,948 acres. Each of the four provinces showed an increase, the largest—212,846 acres—being in Ulster, and the smallest—18,919 acres—in Munster. Taking the areas under crops and grass (pasture) together, we find that the total number of acres in use for agricultural purposes decreased by 48,695 acres. Owing, however, to a more than proportionate decline in the population, the census returns of 1881 and 1891 show that the average number of acres of arable and pasture land to each person of the rural population was 3·5 in the former year and 3·9 in the latter year. Turning to the other headings, it will be seen that "woods and plantations" declined by 17,055 acres, but the decrease is to a large extent more apparent than real, as a stricter method of enumeration was adopted in 1891. "Bog and marsh" showed a decline of 142,035 acres, which would seem to point to a considerable reclamation of land. As has been seen from the figures given above, large sums of money have been advanced to tenants for the purpose of draining. In 1900

Counties.	Crops including Meadow and Clover.	Grass.	Fallow.	Woods and Plantation.	Turf, Bog.	Marsh.	Barren Mountain Land.	Water, Roads, Fences, &c.	Total.
LEINSTER.									
Carlow . .	71,486	122,649	114	3,240	688	2,367	10,647	10,267	221,458
Dublin . .	68,913	122,373	502	3,986	55	1,194	13,305	16,358	226,686
Kildare . .	101,628	260,290	199	6,288	30,581	2,891	1,474	15,145	418,496
Kilkenny . .	140,216	313,021	417	9,963	2,539	5,125	13,537	24,427	509,245
King's County .	108,647	239,858	400	6,870	96,129	14,774	5,752	20,833	493,263
Longford . .	62,953	140,427	129	3,595	30,642	4,842	1,511	13,671	257,770
Louth . .	82,394	89,398	190	4,524	1,138	1,219	12,924	10,387	202,174
Meath . .	114,812	414,837	498	9,811	8,649	2,369	347	26,420	577,743
Queen's County .	127,305	228,397	147	10,685	18,914	4,338	17,009	17,895	424,690
Westmeath .	78,489	286,542	194	7,915	35,127	5,219	880	20,260	434,626
Wexford . .	193,160	321,393	204	10,206	794	7,694	17,090	28,177	578,718
Wicklow . .	89,532	238,481	308	17,957	4,446	11,937	119,444	17,852	499,957
MUNSTER.									
Clare. . .	145,959	478,411	243	7,840	28,312	8,098	79,432	36,661	784,956
Cork . . .	415,766	971,221	1608	29,099	24,996	68,997	213,688	83,546	1,808,921
Kerry . .	154,881	533,696	161	15,019	62,819	39,404	311,318	42,058	1,159,356
Limerick . .	160,191	427,367	293	9,069	9,343	4,067	24,950	27,693	662,973
Tipperary . .	246,353	623,874	403	26,469	35,788	9,819	67,471	39,953	1,050,130
Waterford . .	77,016	245,465	181	19,455	1,347	15,410	75,140	18,910	452,924
ULSTER.									
Antrim . .	228,251	347,184	1111	5,920	22,121	7,246	61,820	37,834	711,487
Armagh . .	133,747	139,646	564	3,106	5,949	2,063	8,139	19,445	312,659
Cavan . .	132,391	261,104	127	5,281	13,493	4,685	12,375	37,569	467,025
Donegal . .	220,864	422,862	995	5,890	102,465	28,614	346,289	62,289	1,190,268
Down . .	255,745	262,237	763	13,573	1,688	4,129	41,495	32,463	612,093
Fermanagh .	98,287	249,574	83	5,777	18,680	1,774	21,196	22,294	417,665
Londonderry .	176,663	219,269	367	4,484	25,944	4,232	58,352	24,077	513,388
Monaghan . .	113,311	169,112	450	4,291	5,646	1,184	1,514	23,298	318,806
Tyrone . .	235,479	332,667	463	9,658	47,598	6,843	109,997	36,238	778,943
CONNAUGHT.									
Galway . .	196,365	755,888	851	25,166	141,925	54,876	221,259	67,100	1,463,430
Leitrim . .	76,879	216,457	44	3,074	20,488	4,070	30,159	25,339	376,510
Mayo . .	157,279	534,764	429	8,870	278,151	44,517	232,644	71,123	1,327,777
Roscommon .	120,406	358,090	69	7,444	75,431	9,875	6,213	29,474	607,002
Sligo . . .	73,364	236,818	82	7,123	35,716	6,517	65,382	17,203	442,205

Provinces.		Crops, including Meadow and Clover.	Grass.	Total Land in use for Agriculture.	Fallow.	Woods and Plantations.	Bog and Marsh.	Barren Mountain Land.	Water, Roads, Fences, &c.	Total.
Leinster	1881	1,439,381	2,567,796	4,007,177	6,445	99,362	334,652	190,685	200,189	4,838,510
		29·8	53·1	82·9	·1	2·1	6·9	3·9	4·1	
	1900	1,239,535	2,777,666	4,017,201	3,302	95,040	293,671	213,920	221,692	4,844,826
		25·6	57·3	82·9	·1	2·0	6·0	4·4	4·6	
Munster	1881	1,271,116	3,261,115	4,532,231	2,821	113,210	321,114	732,157	233,149	5,934,682
		21·5	55·0	76·5	·0	1·9	5·4	12·3	3·9	
	1900	1,200,166	3,280,034	4,480,200	2,889	106,951	308,400	801,999	248,821	5,949,260
		20·2	55·1	75·3	·0	1·8	5·2	13·5	4·2	
Ulster	1881	1,779,480	2,190,809	3,970,289	10,169	62,968	356,900	675,776	246,219	5,322,321
		33·4	41·2	74·6	·2	1·2	6·7	12·7	4·6	
	1900	1,594,738	2,403,655	3,998,393	4,923	57,980	304,354	661,177	295,507	5,322,334
		30·0	45·2	75·2	·1	1·1	5·7	12·4	5·5	
Connaught	1881	705,398	2,055,704	2,761,102	1,769	53,163	707,360	519,054	190,792	4,233,240
		16·7	48·6	65·3	·0	1·2	16·7	12·3	4·5	
	1900	624,293	2,102,017	2,726,310	1,475	51,677	671,566	555,657	210,239	4,216,924
		14·8	49·9	64·7	·0	1·2	15·9	13·2	5·0	
Ireland	1881	5,195,375	10,075,424	15,270,799	21,204	328,703	1,720,026	2,117,672	870,349	20,328,753
		25·6	49·6	75·2	·1	1·6	8·4	10·4	4·3	
	1900	4,658,732	10,563,372	15,222,104	12,589	311,648	1,577,991	2,232,753	976,259 [1]	20,333,344 [2] [3]
		22·9	52·0	74·9	·1	1·5	7·7	11·0	4·8	

five counties had over 100,000 acres of bog and marsh—Mayo, 322,688; Galway, 196,801; Donegal, 131,079; King's County, 110,903; and Kerry, 102,223. On the other hand, "barren mountain land" showed an increase of 115,081 acres. The explanation of this increase probably lies in the fact that between 1841 and 1871 over 2,000,000 acres of waste land were reclaimed, or, at all events, brought into agricultural use, and that since 1871, with a steadily declining population, a portion of this reclaimed land has proved to be useless either for grazing or cultivation.

The returns for the whole of Ireland, showing the extent in statute acres under each of the *principal* crops, the percentages—these are of the area under *all* crops—the average yield per acre, and the total produce for a series of years, are given in the table on the following page.

The area under green crops fell from 1,270,026 acres in 1881, or 24·5 of the total extent under crops, to 1,098,377 acres in 1900, or 23·6 of the total extent, a decline of 171,649 acres. The decline was almost entirely due to the large fall in the area under potatoes, for turnips, mangel and beet, and cabbage all exhibited an increase, while vetch and rape only fell from 0·3 per cent. to 0·2 per cent., and the percentage of other green crops remained the same. The decline in potatoes is no doubt largely due to the fact that in the interval a large proportion of that part of the population whose staple food is the potato had left the country. But considering the existence of the linen industry, the most remarkable decline during the period under review was in flax, which decreased by about 100,000 acres. As was to be expected, the number of scutching-mills also decreased from 1172 in 1881 to 815 in 1900, of which 804 were in Ulster. Efforts are at present being made in the north of Ireland, to which the growing of flax is practically confined, to restore and improve its cultivation, but in face of the competition from foreign countries, especially Belgium, it is very

[1] Including 129,681 acres under water.

[2] Exclusive of 492,252 acres under the large rivers, lakes, and tideways.

[3] The difference between the total areas for 1881 and 1900 is owing to the adoption in 1891 of revised areas for certain counties, and the inclusion of some slob lands in the county of Wexford.

Years.	Wheat.	Oats.	Barley.	Bere.	Rye.	Potatoes.	Turnips.	Mangel and Beet.	Cabbage.	Flax.	Hay.
	Extent under *Principal* Crops.										
1881	153,794	1,393,312	210,093	474	7,588	855,293	295,212	44,838	28,496	147,145	2,001,029
1886	60,546	1,321,983	181,598	298	10,576	799,847	299,323	37,413	40,112	127,810	2,094,209
1891	80,870	1,215,396	177,966	353	13,443	753,332	300,326	51,757	43,049	74,665	2,059,529
1896	38,019	1,193,581	173,032	383	13,715	705,665	308,471	54,301	44,198	72,253	2,202,424
Average 1888–97	66,350	1,227,074	174,047	303	13,451	740,015	303,311	50,059	42,540	85,103	2,162,859
1900	53,821	1,105,050	173,996	177	11,407	654,079	297,859	68,803	42,913	47,451	2,165,715
	Percentages of Area under *all* Crops.										
1881	3·0	26·8	4·0	0·2		16·3	5·8	0·9	0 5	2 8	38 5
1900	1·2	23·7	3·7	0·3		14·0	6 4	1·5	0·9	1·0	46·5
	Average Produce per Acre.										
	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Tons	Tons.	Tons.	Tons.	Stones.	Tons.
1881	14·9	14·1	15 8	14 5	10·5	4·0	12·0	13·4	9·8	30·8	2 0
1886	14·5	13·9	15 3	13 8	11 6	3 3	13·3	13·5	9·7	29 2	2·1
1891	17·3	15·5	18 6	13·4	13·6	4·0	14·5	15 6	10·1	29 5	2·1
1896	16·8	14·2	18·2	12·3	12·7	3·8	15 5	14·4	10·3	22·8	2·1
Average 1888–97	15·9	14·7	16 9	13·3	12·7	3·4	14 0	14 6	9·8	28 1	2·2
1900	16·7	15·8	16·0	14 1	12·8	2·8	14·9	17 2	10·4	34·3	2·4
	Total Produce.										
	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Tons	Tons.	Tons	Tons.	Tons.	Tons.
1881	2,297,131	19,703,074	3,326,916	6880	79,946	3,433,593	3,820,940	601,792	279,588	28,332	3,989,834
1886	1,007,136	18,378,613	2,772,386	4104	122,722	2,667,724	3,974,475	505,588	388,344	23,379	4,428,732
1891	1,401,127	18,833,576	3,310,459	4717	182,206	3,036,586	4,349,464	807,204	435,981	13,763	4,342,852
1896	639,673	17,008,134	3,142,580	4708	174,673	2,701,000	4,782,759	782,572	455,021	10,292	4,731,455
Average 1888–97	1,047,790	18,014,155	2,934,518	4042	170,628	2,541,192	4,244,608	731,740	415,378	15,027	4,764,711
1900	901,224	17,511,579	2,779,367	2501	146,545	1,841,832	4,426,427	1,186,582	447,205	10,181	5,213,968

doubtful whether the flax-bearing area will ever be raised to its former proportions. The total extent of land under cereals, green crops, and flax thus showed a decrease during the twenty years of 701,329 acres, or 21·2 per cent. The extent of land under meadow and clover, or hay, increasing, on the other hand, by 164,686 acres, the total decline was brought down to 536,643 acres as originally stated. Of the 2,165,715 acres returned in 1900 as under hay, 590,753 were in Leinster, 663,536 in Munster, 592,923 in Ulster, and 318,503 in Connaught, the first-mentioned province being the only one in which a falling-off was exhibited. The total value of the cereal and other crops in 1900 was estimated at £34,230,892. The decrease of 536,643 acres was largely balanced by the increase of 487,948 acres in the area under pasture. Thus, with the exception of 48,695 acres, all the land that was withdrawn in the interval from the cultivation of cereal and green crops appears to have been devoted to the raising of live stock, which it will now be shown did indeed largely increase in quantity between 1881 and 1900.

Crops and Pasture.—As has been already stated, the extent of land under crops, including meadow and clover, decreased by 536,643 acres between the years 1881 and 1900. The chief decline was in cereals, which fell from 1,777,175 acres, or 34·2 per cent. of the total area under crops, to 1,347,189 acres, or 28·9 of the total area under crops. The only cereal crop which showed an increase was rye, and the total acreage of that was very small. The acreage of beans and pease decreased from 11,914 acres to 2738 acres. The several acreages covered by wheat, oats, and barley in 1900 were thus distributed among the provinces:—

Province.	Wheat.	Oats.	Barley.
Leinster	14,782	245,734	125,063
Munster	15,529	206,765	41,353
Ulster	17,535	535,255	4,384
Connaught	5,975	117,296	3,196

Live Stock.—The following table shows the quantity and description of live stock in each province and all Ireland in 1881, 1891, and 1900:—

Province.		Horses.	Mules.	Asses.	Cattle.	Sheep.	Pigs.	Goats.	Poultry.
Leinster	1881	171,348	8,509	49,504	1,012,421	1,125,690	275,373	65,724	3,409,020
	1891	185,003	8,385	52,845	1,120,110	1,577,676	343,845	81,990	3,660,228
	1900	175,119	8,800	57,245	1,177,968	1,494,127	297,724	65,105	4,218,216
Munster	1881	138,529	9,410	54,476	1,297,805	760,309	402,728	88,563	3,419,029
	1891	154,201	11,297	66,114	1,465,209	1,127,724	435,106	106,337	3,468,805
	1900	147,725	13,064	82,165	1,513,157	950,208	387,009	108,035	4,136,826
Ulster	1881	170,832	2,394	23,672	1,028,486	378,915	249,298	74,202	4,585,779
	1891	182,052	2,328	26,554	1,174,374	677,740	383,192	92,234	5,332,245
	1900	178,398	1,869	28,816	1,203,459	644,555	341,498	80,326	6,896,032
Connaught	1881	67,665	6,079	59,491	617,883	991,271	168,431	37,589	2,558,598
	1891	71,563	6,650	70,755	688,818	1,339,478	205,569	55,776	2,814,850
	1900	65,736	6,945	74,021	713,966	1,297,986	242,290	52,612	3,296,233
Ireland	1881	548,374	26,392	187,143	3,956,595	3,256,185	1,095,830	266,078	13,972,426
	1891	592,819	28,660	216,268	4,448,511	4,722,618	1,367,712	336,337	15,276,128
	1900	566,978	30,678	242,247	4,608,550	4,386,876	1,268,521	306,078	18,547,307

In 1900 the number of cattle was 101,093 higher than in the previous year, and formed the highest total ever recorded in the agricultural statistics; the number of sheep was 66,422 higher than the average of the preceding ten years, though lower than the figures for 1890, 1891, 1892, and 1893. Taking for purposes of comparison three sheep as equal to one head of cattle, the total increase in the twenty years amounted to 1,028,852 head, or 20·4 per cent., as compared with an increase of only 4·8 per cent. in the extent of pasture. To put the comparison in a different way, in 1881 the average number of acres to one head of cattle was 2·0; in 1900 it was 1·7. Although there have been variations in intervening years, it will be seen that between 1881 and 1900 the increase in cattle and sheep was shared by all the four provinces. The total value of horses, cattle, sheep, and pigs in 1900 was

estimated as £81,159,732. The figures respecting the number of horses used for agricultural purposes, the number of milch cows, and the number of ewes were thus returned in 1881 and 1900 :—

		Leinster	Munster	Ulster.	Con-naught.	Ireland.
Horses used in agriculture	1881 .	103,702	92,846	136,398	42,433	375,379
	1900 .	99,469	92,133	135,838	42,245	369,685
Milch cows .	1881 .	227,690	532,475	423,157	188,690	1,372,012
	1900 .	230,966	577,578	444,808	204,727	1,458,074
Ewes .	1881 .	453,902	329,714	167,351	386,904	1,337,871
	1900 .	602,326	396,359	284,493	514,900	1,798,078

It will be observed that there is a general decrease in the number of horses used in agriculture. For the exports of cattle, &c., to Great Britain, see *Shipping* and *Commerce*, below.

Dairy Industries.—In consequence of the growing importance of the dairy industries in Ireland, statistics bearing on the subject have been embodied in the agricultural reports in recent years. In 1891 the number of factories for which returns were made was 152 (107 in Munster, 35 in Leinster, 6 in Ulster, and 4 in Connaught), 129 of which were worked by steam power, and the number of hands permanently employed amounted to 1213. The quantity of butter produced during the year ending 30th September 1891 was 121,309 cwts., and of cheese 1048 cwts., while the number of cans of condensed milk amounted to 8,646,173. In 1900 the number of factories had risen to 506—333 in Munster, 52 in Leinster, 92 in Ulster, and 29 in Connaught—and the number of hands permanently employed to 3656 (190 factories belonged to co-operative societies; see below). There were 985 milk-separators in the factories, of which 889 were worked by steam power. During the year ending 30th September 1900, 401,490 cwts. of butter and 439 cwts. of cheese were produced.

Agricultural Co-operation.—In 1894 the efforts of a number of Irishmen, drawn from all political parties, were successfully directed towards the formation of the Irish Agricultural Organization Society, which has for its object the organizing of groups of farmers on co-operative principles, and the provision of instruction in proper technical methods. The society had at first many difficulties to confront, but after the first two or three years of its existence its progress became more rapid. The chief success of the movement has lain in the direction of co-operative dairy societies. For the year 1900, 171 of these societies made complete returns, from which it appears that they received over 35½ millions of gallons of milk at an average price to the suppliers of 3⅜d. a gallon, from which were produced over 13½ million lb of butter, realizing an average of 10·84d. per lb. Milk payments absorbed £570,075, and working expenses amounted to £74,259; the amount realized by sales was £703,826. A net profit of £12,472 was earned on the year's trading. The Organization Society also aims at the establishment of agricultural societies, agricultural banks, and home industries societies. The following is a provincial summary showing the number of the various societies and the membership on 31st December 1900 :—

Description of Society.	Leinster.		Munster.		Ulster.		Connaught.		Total.	
	Societies.	Members.	Societies.	Members.	Societies.	Members.	Societies.	Members.	Societies	Members.
Dairy Societies (with auxiliaries)	25	1 903	69	5,474	109	10,825	33	8,375	236	26,577
Agricultural Societies .	26	2,776	17	1,811	9	545	54	6,829	106	11,961
Poultry Societies . .	2	234	4	404	9	744	6	1,187	21	2,569
Banks	7	310	8	251	17	556	44	2,021	76	3,138
Miscellaneous . . .	11	701	3	83	15	467	9	710	38	1,961
Total .	71	5,924	101	8,023	159	13,137	146	19,122	477	46,206

Fisheries.—A number of Acts were passed during the last twenty years of the 19th century with a view of promoting the fishing industry in Ireland. In 1882 the Commissioners of Public Works were given further powers under the Irish Reproductive Loan Fund Act, 1874, to lend money to fishermen on the recommendation of the Inspectors of Fisheries. In 1883 the Land Commission were authorized to pay from time to time such sums, not exceeding in all £250,000, as the Commissioners of Public Works might require, for the creation of a Sea Fisheries Fund, such fund to be expended on the construction of piers and harbours. A sum of about £230,000 has been thus expended up to the present time. In 1889 the Inspectors of Fisheries were empowered to prohibit steam trawling within 3 miles of the Irish coast. Specific Acts were also passed in 1884 for the establishment of oyster fisheries, in 1890 for the promotion of pollan fisheries, and in 1898 for the development of mussel fisheries. In accordance with the terms of the Purchase of Land and Congested Districts (Ireland) Act, 1881, a portion of the Sea Fisheries Fund was reserved for administration by the Inspectors of Fisheries in non-congested districts. Of this amount £20,985 was advanced up to 31st December 1898, the repayments amounting to £13,240. The powers and duties of the Inspectors of Fisheries have been transferred to the Department of Agriculture and Other Industries, which is to apply annually the sum of £10,000 to the promotion of sea fisheries.

In 1900 there were 31 deep-sea and coast fishing districts, in which 6500 vessels with 26,073 hands were engaged, as compared with 5646 vessels with 21,940 hands in 1891, and 6458 vessels with 24,528 hands in 1881. The number of salmon-fishing districts in 1900 was 24, in which 11,366 persons were employed, and the amount of licence duty paid was £9522, as compared with 13,112 persons and £10,543 in 1897, and 13,179 persons and £10,448 in 1895. At the end of 1900 the number of licences in operation for oyster-beds was 62; the estimated value of the catch of shell-fish in the same year was £61,426.

Manufactures, &c.—The linen industry is still practically confined to the north-east portion of Ireland. It cannot be said that the

Years.	In Working Factories.	In Closed Factories.	Total.
1880	839,191	43,884	883,075
1885	810,456	63,454	873,910
1890	815,685	11,766	827,451
1895	849,410	...	849,410
1900	827,882	10,700	838,582

trade has undergone much alteration since 1881. There have naturally been fluctuations—some years bad and some good—but, as will be seen from the foregoing table, the number of spindles in factories actively at work in 1900 was very much the same as in 1881. The power-looms in separate factories, however, considerably increased in number :—

Years.	Attached to Mills.	In Separate Factories.	Total.
1880	10,283	10,894	21,177
1885	11,103	13,197	24,300
1890	10,270	16,322	26,592
1900	8,941	23,304	32,245

The statistics relating to the persons employed were considerably changed in consequence of the Act of 1895, which requires an annual enumeration. The tables put the flax, hemp, and jute makers together, and give no separate details. In 1881 the number of persons employed in the flax-mills and factories of Ireland was 61,749, and in 1890, 64,475, while in 1898–99 the number of persons employed in the flax, hemp, and jute trades was returned as 67,957.

From the report of the Chief Inspector of Factories for 1898–99 it appears that in that year in Ireland 809 persons were employed in the cotton industry, 3323 in the wool, worsted, and shoddy industries, 71 in the silk industry, and 602 in the manufacture of hosiery. The total number of textile factories or departments was 553, employing 72,762 persons. The number of persons employed in non-textile factories was 116,317.

Next to linen, the production of alcoholic drinks, in the forms of whisky, porter, ale, and beer, is the most important manufacturing industry in Ireland. Porter, ale, and beer are classed under the general title of "beer" by the Inland Revenue Department. Though the number of distilleries remained practically the same between 1880 and 1900—28 in the former year and 29 in the latter—the production of whisky largely increased, rising from 9,721,000 gallons in 1880 to 14,480,871 gallons in 1900. This large increase, however, does not imply a corresponding increase of the amount consumed by the inhabitants of Ireland, since the quantity consumed as a beverage in Ireland fell from 5,184,953 gallons in 1881 to 4,713,178 gallons in 1900. The increase in the production of whisky between 1880 and 1900 was accompanied by an increase in the production of beer (including ale and porter). In 1880 2,066,000 barrels of beer were brewed, while in 1900 the number of barrels charged with duty was 3,041,009. The net annual amount of excise duties received in Ireland in a series of years is shown in the following table :—

Articles.	1896.	1897.	1898.	1899.	1900.
	£	£	£	£	£
Beer[1]	874,249	873,815	919,359	939,786	983,841
Licences	198,752	200,954	203,596	207,321	209,577
Spirits[1]	4,098,596	4,156,941	4,212,226	4,252,818	4,952,061
Other Articles	479	467	441	419	487
Total	5,172,076	5,232,177	5,335,622	5,400,344	6,145,966

The following table gives the number and tonnage of the vessels built in Ireland (exclusive of those for foreign firms) in various years since 1881. Since that year shipbuilding in Ireland has largely increased.

Year.	Sailing.		Steam.	
	No.	Net Tonnage.	No.	Net Tonnage.
1881	2	199	12	13,694
1886	11	8,929	10	9,863
1891	17	22,331	20	49,312
1896	4	2,528	12	40,033
1898	13	239	17	68,284
1899	12	669	16	78,273
1900	8	361	21	94,666

This increase, however, has not been due to any wide extension of the industry, but solely to the growth of two Belfast firms. In the five years 1895–99, 97 vessels of 579,467 gross tonnage were launched at Belfast, including the *Oceanic* passenger steamer—the largest vessel then afloat.

Commerce.—The export of animals to Great Britain is the most important department of Irish trade. The following table, giving the number of cattle, sheep, and swine exported in various years between 1881 and 1900, shows how much the trade has grown in that time :—

Years.	Cattle.	Sheep.	Swine.	Total.
1881	571,557	577,627	382,995	1,532,179
1886	717,389	734,213	421,285	1,872,887
1891	630,802	893,175	505,584	2,029,561
1896	681,560	737,306	610,589	2,029,455
1900	745,519	862,263	715,202	2,322,984

In 1891 the number of horses exported to Great Britain was 33,396 ; in 1900, 35,606.

The quantity and value at fixed prices of the fish exported annually to the principal English markets from 1895 to 1899 were thus returned :—

Years.	Salmon.		Herrings		Mackerel.		Cod.		Total Value Exported.
	Boxes 150 lb each.	Value 1s. 3d. a lb.	Boxes 2 cwt. each.	Value £2 a Box.	Boxes 2 cwt. each.	Value 21s. a Box.	Boxes 2 cwt. each.	Value £3 a Box.	
		£		£		£		£	£
1895	61,315	574,828	69,638	139,276	88,585	93,014	42,555	127,665	934,783
1896	61,343	575,091	72,880	145,760	91,026	95,577	43,152	129,456	945,884
1897	55,635	522,047	74,085	148,170	95,495	100,270	44,041	132,123	902,610
1898	52,317	490,473	67,901	135,802	85,714	90.000	40,438	121,314	837,589
1899	54,676	512,587	69,259	138,518	90,446	94,968	40,209	120,627	866,700

The average annual export of linen yarns from Belfast, which is the headquarters of the industry, and provides employment for some 40,000 workers, during the ten years ending 1900, was 19,750,304 lb, with a value exceeding £1,000,000. Other statistics can be given only for the United Kingdom, and the following table shows the amount and value in various years of imports of flax and tow thereinto, and exports of linen yarns and manufactures therefrom, between 1889 and 1900 :—

Years	Imports of Flax and Tow.		Exports of Linen Yarns and Manufactures.							Total Value of Exports £.
	Tons.	Value £.	Yarns lb.	Value £.	Piece Goods yds.	Value £.	Thread lb.	Value £	Unenumerated. Value £.	
1889	89,153	3,066,328	13,944,700	849,263	180,630,200	4,309,980	2,800,200	365,080	1,102,405	6,626,728
1892	86,655	2,743,305	15,460,600	890,142	171,302,500	3,882,650	2,548,400	309,613	973,639	6,056,044
1895	102,622	3,270,840	17,045,600	965,926	203,587,600	4,080,261	2,401,500	263,947	1,006.817	6,316,951
1900	71,586	2,509,810	16,347,100	934,201	154,708,200	3,851,615	1,838,100	237,154	1,135,825	6,158,795

The following returns show the total annual value of imports from foreign countries and British possessions, and exports to foreign countries and British possessions, for a series of years between 1886 and 1900 :—

Year.	Total Imports.	Exports.		
		Declared Value, British and Irish Produce and Manufactures.	Computed Real Value, Foreign and Colonial Merchandise.	Total Value.
	£	£	£	£
1886	6,802,638	815,996	9,183	825,179
1891	9,868,973	253,799	8,469	262,268
1896	9,366,485	235,276	80,966	316,242
1900	12,014,597	344,328	967,720	1,312,048

It will be seen that the imports increased by over £5,000,000, and that the exports, as the result of the creation of a flourishing trade in foreign and colonial merchandise, also increased, although there was a fall of about 60 per cent. in the value of the exports of British and Irish goods.

Shipping.—The number of steam vessels registered at Irish ports considerably increased between the years 1881 and 1900. The returns at intervals of five years from 1881 are given in the following table :—

Year.	Under 50 Tons.		Above 50 Tons.	
	No.	Ton.	No.	Ton.
1881	78	1770	175	59,062
1886	73	1555	196	82,101
1891	65	1414	218	122,121
1896	73	1575	249	150,278
1900	90	1927	267	192,548

The following tables give for a series of years (1) the number and tonnage of vessels that entered and cleared with cargoes in the coasting trade ; (2) the same for those engaged in the foreign trade ; and (3) the totals for both trades. Repeated voyages are included.

Coasting Trade.

Year.	Entered.				Cleared.			
	Sailing.		Steam.		Sailing.		Steam.	
	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.
1886	10,334	991,132	16,399	4,202,214	4432	378,698	12,203	3,512,697
1891	8,568	740,511	18,835	4,765,994	4666	345,057	13,054	3,795,488
1896	6,391	482,176	22,171	5,199,860	3686	249,793	14,680	4,098,028
1900	4,708	344,587	22,763	5,129,571	3343	245,057	15,423	4,156,004

Foreign Trade.

Year.	Entered.				Cleared.			
	British.		Foreign.		British.		Foreign.	
	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.
1886	769	550,403	381	192,462	113	42,594	23	12,201
1891	813	617,366	346	189,392	91	38,980	12	7,013
1896	829	751,496	357	208,066	143	54,083	8	5,015
1900	780	856,407	256	173,383	135	69,300	5	5,389

[1] After deducting portion of beer duty (3d. per barrel) and additional duty on spirits (6d. per gallon), surrendered to local taxation. In 1899–1900 the amount of beer duty so surrendered was £41,150, and of spirit duty £87,101.

Coasting and Foreign Trade.

Year.	Entered.				Cleared.			
	British.		Foreign.		British.		Foreign.	
	No.	Ton.	No.	Ton.	No.	Ton.	No.	Ton.
1886	27,482	5,737,428	401	198,783	16,717	3,921,522	54	24,668
1891	28,189	6,117,819	373	195,444	17,791	4,176,761	32	9,777
1896	29,376	6,429,474	372	212,129	18,490	4,396,356	27	10,563
1900	28,232	6,325,173	275	178,775	18,887	4,467,434	19	8,316

The number and tonnage of vessels engaged in trade between Great Britain and Ireland were thus returned in various years between 1881 and 1900:—

Year.	Entered and Cleared.			
	British.		Foreign.	
	No.	Ton.	No.	Ton.
1881	82,816	18,114,334	78	23,624
1886	79,061	17,484,389	90	34,614
1891	81,959	18,808,017	87	15,923
1896	83,481	19,370,658	55	15,706
1900	81,235	18,430,729	55	12,762

Railways.—The total amount of capital and loans authorized by Parliament for all classes of railways up to 31st December 1900 was £45,293,090. The paid-up capital (including that raised by loans and debentures) in 1890 was £36,269,000; and in 1900, £39,765,573. Some eighteen short lines, with a total mileage in 1898 of 229 miles, have been authorized at different times under the Tramways (Ireland) Acts, 1860 to 1883. In 1889 an Act was passed to facilitate the construction of light railways in Ireland, and further enactments were made with the same object in 1890 and 1896. Under these Acts fourteen lines, with a mileage of nearly 300 miles, had been constructed up to 1898, principally in the more backward districts of the west, from Donegal to Kerry. The total length of lines open, the passenger traffic, and the total receipts are severally shown below at intervals of five years from 1881:—

Years.	Length of Lines open.	Passengers (exclusive of Season-Ticket Holders).				Receipts.		
		1st Class.	2nd Class.	3rd Class.	Total.	Passenger Traffic.	Goods Traffic.	Total.
						£	£	£
1881	2441	1,675,876	4,021,240	11,946,144	17,643,260	1,425,284	1,176,193	2,601,477
1886	2632	1,384,682	4,034,745	13,300,868	18,720,295	1,482,538	1,270,145	2,752,683
1891	2863	1,512,544	4,196,426	16,493,288	22,202,258	1,696,082	1,463,125	3,159,207
1896	3178	1,628,977	4,384,517	20,551,776	26,565,270	1,858,653	1,555,067	3,413,720
1900	3183	1,496,145	3,927,553	22,226,117	27,649,815	2,034,717	1,698,909	3,733,626

Reference has been made throughout to various official and semi-official publications such as the *Census Reports* (1881, 1891, and 1901), *Agricultural Returns*, *Reports of the Registrar-General*, *Reports of the Congested Districts Board*, *Reports of the Irish Agricultural Organization Society*, *Board of Trade Returns*, *Annual Reports of the Flax Supply Association* and of other local bodies. THOM'S *Official Almanac* contains a useful summary of official statistics. For further information upon the economic and industrial condition of Ireland reference may be made to the following:—GRIMSHAW (late Registrar-General), *Facts and Figures about Ireland*, London, 1893; DENNIS, *Industrial Ireland*, London, 1887; *The Report of the Recess Committee of 1896*. The latter was published in Dublin, and is now very difficult to procure. See also *Report of the Financial Relations Commission*, 1897.

(W. H. Po.)

HISTORY SINCE 1879.

During the last twenty years of the 19th century Irish history was chiefly concerned with the two questions of the land and legislative independence. Isaac Butt (*q.v.*) died in May 1879. He had led a parliamentary party of fifty-four, but the Conservatives had been strong enough to outvote them and the Liberals together. His procedure was essentially lawyer-like, for he respected the House of Commons and dreaded revolutionary violence. His death left the field clear for younger and bolder men. W. Shaw succeeded him as chairman of the Irish party in Parliament; but after the election of 1880, Parnell (*q.v.*), who had the Land League at his back, ousted him by 23 votes to 18.

The Land Law of 1860, known as Deasy's Act, was based on the principle that every tenancy rested on contract either expressed or implied. The Act of 1870, admitting the divergence between theory and practice, protected the tenants' improvements and provided compensation for disturbance within certain limits, but not where the ejectment was for non-payment of rent. In good times this worked well enough, but foreign competition began to tell, and 1879 was the worst of several bad seasons. A succession of wet summers told against all farmers, and in mountainous districts it was difficult to dry the turf on which the people depended for fuel. A famine was feared, and in the west there was much real distress. The Land League, of which Michael Davitt was the founder, originated in Mayo in August, and at a meeting in Dublin in October the organization was extended to all Ireland, with Parnell as president. The country was thickly covered with branches before the end of the year, and in December Parnell went to America to collect money. He was absent just three months, visiting over sixty cities and towns; and 200,000 dollars were subscribed. Parnell had to conciliate the Clan-na-Gael and the Fenians generally, both in Ireland and America, while abstaining from action which would make his parliamentary position untenable. He did not deny that he would like an armed rebellion, but acknowledged that it was an impossibility. Speaking at Cincinnati on 23rd February 1880, he declared that the first thing necessary was to undermine English power by destroying the Irish landlords. Ireland might thus become independent. "And let us not forget," he added, "that that is the ultimate goal at which all we Irishmen aim. None of us, whether we be in America or in Ireland, or wherever we may be, will be satisfied until we have destroyed the last link which keeps Ireland bound to England." At Galway in October of the same year he said that he "would not have taken off his coat" to help the tenant farmers had he not known that that was the way to legislative independence. Fenianism and agrarianism, essentially different as they are, might be worked to the same end.

The Land League.

To meet the partial failure of the potatoes in Connaught and Donegal, very large sums were subscribed and administered by two committees, one under the duchess of Marlborough and the other under the lord mayor of Dublin. When Lord Beaconsfield appealed to the country in March 1880, he reminded the country in a letter to the Viceroy, the duke of Marlborough, that there was a party in Ireland "attempting to sever the constitutional tie which unites it to Great Britain in that bond which has favoured the power and prosperity of both," and that such an agitation might in the end be "scarcely less disastrous than pestilence and famine." But the general election did not turn mainly upon Ireland, and the result gave Gladstone a majority of 50 over Conservatives and Home Rulers combined. Lord Cowper became lord-lieutenant, with W. E. Forster as chief secretary, and Parnell remained chairman of his own party in Parliament. The Compensation for Disturbance Bill, even where the ejectment was for non-payment of rent, passed the House of Commons, but the Lords threw it out, and this has often been represented as the great cause of future trouble. Probably it made little real difference, for the extreme party in Ireland were resolved to stop at nothing. It is not easy to defend the principle that a landlord who has already lost his rent should also have to pay the defaulter

before getting a new tenant or deriving a profit from the farm by working it himself. Speaking at Ennis on 19th September, Parnell told the people to punish a man for taking a farm from which another had been evicted "by isolating him from his kind as if he was a leper of old." The advice was at once taken and its scope largely extended. For refusing to receive rents at figures fixed by the tenants, Captain Boycott, Lord Erne's agent in Mayo, was severely "boycotted," the name of the first victim being given to the new system. His servants were forced to leave him, his crops were left unsaved, even the post and telegraph were interfered with. The Ulster Orangemen resolved to get in the crops, and to go in armed force sufficient for the purpose. The Government had to let 50 of them go under the protection of about 900 soldiers. The cost seemed great, but the work was done and the law vindicated. In Cork Mr Bence-Jones was attacked. The men in the service of the steam-packet companies refused to put his cattle on board, and they were eventually smuggled across the Channel in small lots. Several associations were formed which had more or less success against the League, and at last a direct attack was made. Parnell with four other members of Parliament and the chief officers of the Land League were indicted for conspiracy in the Queen's Bench. No means of intimidating the jurors was neglected, and in the then state of public feeling a verdict was hardly to be expected. On 25th January 1881 the jury disagreed, and Parnell became stronger than ever.

Boycotting.

Then followed a reign of terror which lasted for years. No one was safe, and private spite worked freely in the name of freedom. The system originated by Parnell's Ennis speech became an all-devouring tyranny. In the House of Commons, on 24th May 1882, Gladstone said that boycotting required a sanction like every other creed, and that the sanction which alone made it effective "is the murder which is not to be denounced." The following description by a resident in Munster was published in *The Times* of 5th November 1885 :—"Boycotting means that a peaceable subject of the Queen is denied food and drink, and that he is ruined in his business; that his cattle are unsaleable at fairs; that the smith will not shoe his horse, nor the carpenter mend his cart; that old friends pass him by on the other side, making the sign of the Cross; that his children are hooted at the village school; that he sits apart like an outcast in his usual place of public worship: all for doing nothing but what the law says he has a perfect right to do. I know of a man who is afraid to visit his own son. A trader who is even suspected of dealing with such a victim of tyranny may be ruined by the mere imputation; his customers shun him from fear, and he is obliged to get a character from some notorious leaguer. Membership of the National League is, in many cases, as necessary a protection as ever was a certificate of civism under Robespierre. The real Jacobins are few, but the masses groan and submit." Medicine was refused by a shopkeeper even for the sick child of a boycotted person. A clergyman was threatened for visiting a parishioner who was under the ban of the League. Sometimes no one could be found to dig a grave. The League interfered in every relation of life, and the mere fact of not belonging to it was often severely punished. "The people," says the report of the Cowper Commission, "are more afraid of boycotting, which depends for its success on the probability of outrage, than they are of the judgments of the courts of justice. This unwritten law in some districts is supreme."

The session of 1881 was chiefly occupied with Ireland. "With fatal and painful precision," Gladstone told the House of Commons on 28th January, "the steps of crime dogged the steps of the Land League," and the first thing was to restore the supremacy of the law. In 1871 there had been an agrarian war in Westmeath, and an Act had been passed authorizing the arrest of suspected persons and their detention without trial. The ringleaders disappeared and the county became quiet again. It was now proposed to do the same thing for the whole of Ireland, the power of detention to continue until 30th September 1882. Parnell cared nothing for the dignity of the House of Commons. His leading idea was that no concession could be got from England by fair means, and he made himself as disagreeable as possible. Parliamentary forms were used with great success to obstruct parliamentary action. The "Coercion Bill" was introduced on 24th January. There was a sitting of 22 hours and another of 41 hours, and on 2nd February the debate was closured by the Speaker on his own responsibility and the Bill read a first time. The Speaker's action was approved by the House generally, but acrimonious debates were raised by Irish members. Parnell and 35 of his colleagues were suspended, and the Bill became law on 2nd March, but not before great and permanent changes were made in parliamentary procedure. An Arms Bill, which excited the same sort of opposition, was also passed into law.

Coercion.

That a Land Act should be passed was a foregone conclusion as soon as the result of the general election was known. There were many drafts and plans which never saw the light, but it was at last resolved to adopt the policy known as the "Three F's"—free sale, fixity of tenure, and fair rents. By the first tenants at will were empowered to sell their occupation interests, the landlord retaining a right of pre-emption. By the second the tenant was secured from eviction except for non-payment of rent. By the third the tenant was given the right to have a "fair rent" fixed by a newly formed Land Commission Court, the element of competition being entirely excluded. There were several exceptions and qualifying clauses, but most of them have been swept away by later Acts. The Act of 1881 can scarcely be said to have worked well or smoothly, but it is not easy to see how any sort of settlement could have been reached without accepting the principle of having the rent fixed by a third party. Drastic as the Bill was, Parnell refused to be a party to it, and on the second reading, which was carried by 352 to 176, he walked out of the House with 35 of his followers. When the Bill became law in August he could not prevent the tenants from using it, but he did what he could to discourage them in order to please his American paymasters, who repudiated all parliamentary remedies. In September a convention was held in Dublin, and Parnell reported its action to the American Land League :—"Resolutions were adopted for national self-government, the unconditional liberation of the land for the people, tenants not to use the rent-fixing clauses of the Land Act, but follow old Land League lines, and rely on the old methods to reach justice. The executive of the League is empowered to select test cases, in order that tenants in surrounding districts may realize, by the results of cases decided, the hollowness of the Act" (Barry O'Brien, *Life of C. S. Parnell*, i. 306). His organ *United Ireland* declared that the new courts must be cowed into giving satisfactory decisions. The League, however, could not prevent the farmers from using the fair-rent clauses. It was more successful in preventing free sale, maintaining the doctrine that, rent or no rent, no evictions were to be allowed. At the first sitting of the Land Commission in Dublin the crier, perhaps by accident, declared "the court of the Land League to be open." Speaking at Leeds on

Land Act, 1881.

7th October, Gladstone said "the resources of civilization were not exhausted," adding that Parnell "stood between the living and the dead, not like Aaron to stay the plague, but to spread the plague." Two days later Parnell called the prime minister a "masquerading knight-errant," ready to oppress the unarmed, but submissive to the Boers as soon as he found "that they were able to shoot straighter than his own soldiers." Four days after this Parnell was arrested under the Coercion Act and lodged in Kilmainham gaol. The Land League having retorted by ordering the tenants to pay no rent, it was declared illegal, and suppressed by proclamation. Parnell is said to have disapproved of the no-rent manifesto, as also Mr Dillon, who was in Kilmainham with him, but both of them signed it (*ib.* i. 319). At Liverpool on 27th October Gladstone described Parnell and his party as "marching through rapine to the disintegration and dismemberment of the empire." In 1881, 4439 agrarian outrages were reported; nothing attracted more attention in England than the cruel mutilations of cattle, which became very frequent. The Ladies' Land League tried to carry on the work of the suppressed organization, and there was even an attempt at a Children's League. Sex had no effect in softening the prevalent style of oratory, but the Government thought it better to take no notice. The imprisonment of suspects under the Coercion Act had not the expected result, and outrages were incessant, the agitation being supported by constant supplies of money from America. Gladstone resolved on a complete change of policy. It was decided to check evictions by an Arrears Bill, and the three imprisoned members of Parliament—Messrs Parnell, Dillon, and O'Kelly—were released on 2nd May 1882, against the wishes of the Irish Government. This was known as the Kilmainham Treaty. Lord Cowper and Forster at once resigned, and were succeeded by Lord Spencer and Lord Frederick Cavendish, who entered Dublin on 6th May.

Kilmainham "Treaty."

That same evening Lord Frederick and the permanent under-secretary Thomas H. Burke were murdered in the Phœnix Park in broad daylight, under the new lord-lieutenant's windows. The weapons were amputating knives imported for the purpose. The assassins drove rapidly away; no one, not even those who saw the deed from a distance, knew what had been done. A Dublin tradesman named Field, who had been a juror in a murder trial, was attacked by the same gang and stabbed in many places. He escaped with life, though with shattered health, and it was the identification of the man who drove his assailants' car that afterwards led to the discovery of the whole conspiracy. The clue was obtained by a private examination of suspected persons under the powers given by the Crimes Act. To obtain convictions the evidence of an informer was wanted, and the person selected was James Carey, a member of the Dublin Corporation and a chief contriver of the murders. He swore that they had been ordered immediately after the appearance of an article in the *Freeman's Journal* which declared that a "clean sweep" should be made of Dublin Castle officials. The evidence disclosed the fact that several abortive attempts had been previously made to murder Forster. Out of twenty persons subsequently arraigned, five were hanged, and others sentenced to long terms of imprisonment. Carey embarked for South Africa in the following July, and was murdered on board ship by Patrick O'Donnell, who was brought to England, convicted, and hanged on 17th December 1883.

Phœnix Park murders.

Mr G. O. Trevelyan had been appointed chief secretary in May 1882, and in July the Crimes Prevention Act was passed for three years on lines indicated by Lord Cowper. In the first six months of the year 2597 agrarian outrages were reported, and in the last six months 836. They fell to 834 in 1883, and to 744 in 1884. The Arrears Bill also became law. Money enough was advanced out of the surplus property of the Irish Church to pay for tenants of holdings under £30 one year's rent upon all arrears accruing before November 1880, giving them a clear receipt to that date on condition of their paying another year themselves; of the many reasons against the measure the most important was that it was a concession to agrarian violence. But the same could be and was said of the Land Act of 1881. That had been passed, and it was probably impossible to make it work at all smoothly without checking evictions by dealing with old arrears. The Irish National League was, however, founded in October to take up the work of the defunct Land League, and the country continued to be disturbed. The law was paralysed, for no jury could be trusted to convict even on the clearest evidence, and the National League branches assumed judicial functions. Men were openly tried all over the country for disobeying the revolutionary decrees, and private spite was often the cause of their being accused. "Tenants," to quote the Cowper Commission again, "who have paid even the judicial rents have been summoned to appear before self-constituted tribunals, and if they failed to do so, or on appearing failed to satisfy those tribunals, have been fined or boycotted." In February 1883 Mr Trevelyan gave an account of his stewardship at Hawick, and said that all law-abiding Irishmen, whether Conservative or Liberal, were on one side, while on the other were those who "planned and executed the Galway and Dublin murders, the boycotting and firing into houses, the mutilation of cattle, and intimidation of every sort." In this year the campaign of outrage in Ireland was reinforced by one of dynamite in Great Britain. The home secretary, Sir W. Harcourt, brought in an Explosives Bill on 9th April, which was passed through all its stages in one day and received the royal assent on the next. The dynamiters were for the most part Irish-Americans, who for obvious reasons generally spared Ireland, but one land-agent's house in Kerry was shaken to its foundations in November 1884. At Belfast in the preceding June Lord Spencer, who afterwards became a Home Ruler, had announced that the secret conspirators would "not terrify the English nation." On 22nd February 1883 Forster made his great attack on Parnell in the House of Commons, accusing him of moral complicity with Irish crime. A detailed answer was never attempted, and public attention was soon drawn to the trial of the "Invincibles" who contrived the Phœnix Park murders. On the 11th of December Parnell received a present of £37,000 from his followers in Ireland. The tribute, as it was called, was raised in spite of a papal prohibition. As a complement to the Land Act and Arrears Act, boards of guardians were this year empowered to build labourers' cottages with money borrowed on the security of the rates and repayable out of them. Half an acre of land went with the cottage, and by a later Act this was unwisely extended to one acre. That the labourers had been badly housed was evident, and there was little chance of improvement by private capitalists, for cottage property is not remunerative. But the working of the Labourers Acts has been very costly, and cottages are often assigned to people who are not agricultural labourers at all. In many districts the building has been quite overdone, and the rent obtainable being far less than enough to recoup the guardians, the system operates as out-door relief for the able-bodied and as a rate in aid of wages.

National League.

Dynamite.

Labourers Act.

The Explosives Act, strong as it was, did not at once effect its object. In February 1884 there was a plot to blow up four London railway stations by means of clockwork infernal machines containing dynamite, brought from America. Three Irish-Americans were convicted, of whom one, John Daly, who was sentenced to penal servitude for life, lived to be mayor of Limerick in 1899. In January 1885 Parnell visited Thurles, where he gave a remarkable proof of his power by breaking down local opposition to his candidate for Tipperary. In April the prince and princess of Wales visited Ireland. At Dublin they were well received, and at Belfast enthusiastically, but there were hostile demonstrations at Mallow and Cork. In May it was intended to renew the Crimes Prevention Act, but before that was done the Government was beaten on a financial question by 264 to 252, Parnell and 39 of his followers voting with the Conservatives. The Crimes Prevention Act expired on the 12th July, and the want of it was at once felt. The number of agrarian outrages reported in the first six months of the year was 373; in the last six months they rose to 543, and the number of persons boycotted was almost trebled. Lord Salisbury came into office, with Lord Carnarvon as lord-lieutenant and Sir W. Hart Dyke as chief secretary. The lord-lieutenant had an interview with Parnell, of which very conflicting accounts were given, but the Irish leader issued a manifesto advising his friends to vote against the Liberals as oppressors and coercionists, who promised everything and did nothing. The constitutional Liberal party in Ireland was in fact annihilated by the extension of the franchise to agricultural labourers and very small farmers. The most important Irish measure of the session was the Ashbourne Act, by which £5,000,000 was allotted on the security of the land for the creation of an occupying proprietary. Later the same sum was again granted, and there was still a good deal unexpended when the larger measure of 1891 became law. In December, when the general election was over, an anonymous scheme of Home Rule appeared in some newspapers, and in spite of disclaimers it was at once believed that Gladstone had made up his mind to surrender. In October 1884, only fourteen months before, he had told political friends that he had a sneaking regard for Parnell, and that Home Rule might be a matter for serious consideration within ten years (Sir A. West's *Recollections*, 1899, ii. 206). The shortening of the time was perhaps accounted for by the fact that the new House of Commons consisted of 331 Liberals, 249 Conservatives, 86 Home Rulers and Independents, Parnell thus holding the balance of parties. In Ireland there had been 66 elections contested, and out of 451,000 voters 93,000 were illiterates (Parliamentary Return, 6th May 1886). Such were the constituencies to whom it was proposed to hand Ireland over. On 26th January 1886 the Government were defeated by a combination of Liberals and Nationalists on an issue not directly connected with Ireland, and their resignation immediately followed. Gladstone became prime minister, with Lord Aberdeen as lord-lieutenant and Mr John Morley as chief secretary. Lord Hartington and Mr Goschen were not included in this administration. In February Parnell again showed his power by forcing Captain O'Shea upon the unwilling electors of Galway. He introduced a Land Bill to relieve tenants from legal process if they paid half their rent, and foretold disorder in consequence of its rejection. In April the Government of Ireland Bill was brought in, Mr Chamberlain, Mr Trevelyan, and others leaving the ministry. The bill attempted to safeguard British interests, while leaving Ireland at the mercy of the native politicians. Irish members were excluded from the Imperial Parliament. The local legislature was to consist of two orders sitting and voting together, but with the power of separating on the demand of either order present. The 28 representative peers, with 75 other members having an income of £200, or a capital of £4000, elected for ten years by £25 occupiers, were to constitute the first order. The second was to have 204 members, returned for five years by the usual parliamentary electorate. The status of the lord-lieutenant was unalterable by this legislature. Holders of judicial offices and permanent civil servants had the option of retiring with pensions, but the constabulary, whom the Home Rulers had openly threatened to punish when their time came, were to come after an interval under the power of the Irish Parliament. Parnell accepted the Bill, but without enthusiasm.

Ashbourne Act.

Home Rule Bill, 1886.

The Government of Ireland Bill gave no protection to landowners, but as the crisis was mainly agrarian, it would have been hardly decent to make no show of considering them. A Land Purchase Bill was accordingly introduced on 16th April by the prime minister under "an obligation of honour and policy," to use his own words. Fifty millions sterling in three years was proposed as payment for what had been officially undervalued at 113 millions. It was assumed that there would be a rush to sell, the choice apparently lying between that and confiscation, and priority was to be decided by lot. The Irish landlords, however, showed no disposition to sell their country, and the Purchase Bill was quickly dropped, though Gladstone had declared the two measures to be inseparable. He reminded the landlords that the "sands were running in the hour-glass," but this threat had no effect. The Unionists of Ireland had been taken by surprise, and out of Ulster they had no organization capable of opposing the National League and the Government combined. Individuals went to England and spoke wherever they could get a hearing, but it was uphill work. In Ulster the Orange lodges were always available, and the large Protestant population made itself felt. The police were looked upon as the emissaries of a ministry who had abandoned Ireland to the rebels. Terrible riots took place at Belfast in June, July, and August. In October there was an inquiry by a royal commission with Mr Justice Day at its head, and on the report being published in the following January there were fresh riots. Foolish and criminal as these disturbances were, they served to remind the English people that Ireland would not cease to be troublesome under Home Rule. In Parliament the Home Rule Bill soon got into rough water; John Bright declared against it. The "dissentient Liberals," as Gladstone always called them, were not converted by the abandonment of the Purchase Bill, and on 7th June 93 of them voted against the second reading, which was lost by 30 votes. A general election followed in July, and 74 Liberal Unionists were returned, forming with the Conservatives a Unionist party, which outnumbered Gladstonians and Parnellites together by over a hundred. Gladstone resigned, and Lord Salisbury became prime minister, with Lord Londonderry as lord-lieutenant and Sir M. Hicks-Beach as chief secretary.

The political stroke having failed, agrarianism again occupied the ground. The "plan of campaign" was started, against Parnell's wishes, towards the end of 1886. The gist of this movement was that tenants should offer what they were pleased to consider a fair rent, and if it was refused, should pay the money into the hands of a committee. In March 1887 Sir M. Hicks-Beach resigned on account of illness, and Mr Arthur Balfour became chief secretary. The attempt to govern Ireland under what was called "the ordinary law" was necessarily abandoned, and a

The "plan of campaign."

perpetual Crimes Act was passed which enabled the lord-lieutenant to proclaim disturbed districts and dangerous associations, and substituted trial by magistrates for trial by jury in the case of certain acts of violence. In August the National League was suppressed by proclamation. The conservative instincts of the Vatican were alarmed by the lawless state of Ireland, and an eminent ecclesiastic, Monsignor Persico, arrived in the late summer on a special commission of inquiry. He made no secret of his belief that the establishment of an occupying proprietary was the only lasting cure, but the attitude of the clergy became gradually more moderate. The Government passed a bill giving leaseholders the benefit of the Acts of 1881, and prescribing a temporary reduction upon judicial rents already fixed. This last provision was open to many great and obvious objections, but was more or less justified by the fall in prices which had taken place since 1881.

The steady administration of the Crimes Act by Mr Balfour gradually quieted the country. Parnell had now gained the bulk of the Liberal party, including Lord Spencer (in spite of all that he had said and done) and Sir G. Trevelyan (in spite of his Hawick speech). In the circumstances the best chance for Home Rule was not to stir the land question. Mr Cecil Rhodes, who hoped to help imperial federation by breaking up the United Kingdom, gave Parnell £10,000 for the cause. In September 1887 a riot arising out of the "plan of campaign" took place at Mitchelstown. The police fired, and two lives were lost, Messrs Labouchere, M.P., and Brunner, M.P., being present at the time. The coroner's jury brought in a verdict against the police, but that was a matter of course, and the Government ignored it. A telegram sent by Gladstone a little later, ending with the words "remember Mitchelstown," created a good deal of feeling, but it did the Home Rulers no good. In October Mr Chamberlain visited Ulster, where he was received with enthusiasm, and delivered several stirring Unionist speeches. In November Lord Hartington and Mr Goschen were in Dublin, and addressed a great loyalist meeting there.

Parnell Commission.

In July 1888 an Act was passed appointing a commission, consisting of Lord Justice Hannen, Mr Justice Day, and Mr Justice A. L. Smith, to inquire into certain charges made by *The Times* against Parnell and his party. What caused most excitement was the publication by *The Times* on 15th May 1887 of a *facsimile* letter purporting to have been written by Parnell on 15th May 1882, nine days after the Phœnix Park murders. The writer of this letter suggested that his open condemnation of the murders had been a matter of expediency, and that Mr Burke deserved his fate. Parnell at once declared that this was a forgery, but he did nothing more at the time. Other alleged incriminating letters followed. The case of *O'Donnell* v. *Walter*, tried before the Lord Chief Justice of England in July 1888, brought matters to a head, and the special commission followed. The proceedings were necessarily of enormous length, and the commissioners did not report until 13th February 1890, but the question of the letters was decided just twelve months earlier, Richard Pigott, who shot himself at Madrid, having confessed to the forgeries. A few days later, on 8th March 1889, Parnell was entertained at dinner by the Eighty Club, Lords Spencer and Rosebery being present; and he was well received on English platforms when he chose to appear. Yet the special commission shed a flood of light on the agrarian and Nationalist movement in Ireland. Eight members of Parliament were pronounced by name to have conspired for the total political separation of the two islands. The whole party were proved to have disseminated newspapers tending to incite to sedition and the commission of crime, to have abstained from denouncing the system of intimidation, and to have compensated persons injured in committing crime.

New Tipperary.

The conduct of the agrarian war had in the meantime almost passed from Parnell's hands. The "plan of campaign" was not his work, still less its latest and most remarkable exploit. To punish Mr Smith-Barry for his exertions in favour of a brother landlord, his tenants in Tipperary were ordered to give up their holdings. A sum of £50,000 was collected to build "New Tipperary," and the fine shops and flourishing concerns in the town were deserted to avoid paying small ground-rents. The same course was pursued with the farmers, some of whom had large capitals invested. Mr William O'Brien presided at the inaugural dinner on 12th April, and some English M.P.'s were present, but his chief supporter throughout was Father Humphreys. Parnell was invited, but neither came nor answered. No shopkeeper nor farmer had any quarrel with his landlord. "Heretofore," a tenant wrote in *The Times* in the following December, "people were boycotted for taking farms, I am boycotted for not giving up mine, which I have held for twenty-five years. A neighbour of mine, an Englishman, is undergoing the same treatment, and we alone. We are the only Protestant tenants on the Cashel estate. The remainder of the tenants, about thirty, are clearing everything off their land, and say they will allow themselves to be evicted." In the end the attack on Mr Smith-Barry completely failed, and he took back his misguided tenants. But the town of Tipperary has not recovered its old prosperity.

Land purchase.

The principal Irish measure passed in 1891 was Mr Balfour's Purchase Bill, to extend and modify the operation of the Ashbourne Acts. Thirty millions were provided to convert tenants into proprietors, the instalments paid being again available, so that all the tenanted land in Ireland might ultimately be passed through if desired. The land itself in one shape or another forms the security, and guaranteed stock is issued which the holder may exchange for consols. The 40th clause of the Land Act of 1896 greatly stimulated the creation of occupying owners in the case of over-incumbered estates, but solvent landlords are not in a hurry to sell. The interests of the tenant are so carefully guarded that the prices obtainable are ruinous to the vendor unless he has other resources. The security of the Treasury is also so jealously scrutinized, that even the price which the tenant may be willing to pay is often disallowed. Thus the Land Commission really fixes the price of all property, and the last vestige of free contract is obliterated. Compulsory purchase has become a popular cry, especially in Ulster, and several members of Parliament are pledged to further it. It is certain, however, that owners cannot with any pretence of justice be forced to sell at ruinous prices, nor can tenants be forced to give more than they think fair. If the State, for purposes of its own, insists upon expropriating all landlords, it will have to find the difference, or to enter upon a course of undisguised confiscation. The Purchase Act was not the only one relied on by Mr Balfour. The Light Railways Act passed by him in 1890 has done much to open up some of the poorest parts of the west, and the temporary scarcity of that year was dealt with by relief works.

An action begun by Parnell against *The Times* was settled by the payment of a substantial sum and the withdrawal of the Pigott letters. The Nationalist leader seemed to stand higher than ever, but the writ in the divorce proceedings, brought by Captain O'Shea against his wife, with the Irish leader as co-respondent, was

hanging over him. To public astonishment, when the case came on for trial there was no defence, and on 17th November 1890 a decree *nisi* was granted. Parnell's subsequent marriage with the respondent before a registrar did him no good with his Roman Catholic supporters.

Parnell's downfall. The Irish bishops remained silent, while in England the "Nonconformist conscience" revolted. Three days after the verdict a great meeting was held in the Leinster Hall, Dublin, attended by 25 of the Irish parliamentary party. The result was an enthusiastic vote of confidence in Parnell, moved by Mr Justin M'Carthy and seconded by Mr T. M. Healy. Five days later he was unanimously re-elected chairman by his party in Parliament, but the meeting was scarcely over when Gladstone's famous letter to Mr Morley became public. The writer in effect demanded Parnell's resignation of the leadership as the condition upon which he could continue at the head of the Liberal party. He had to choose between the Nonconformist vote and the Irish leader, and he preferred the former. Next day the secession of the Irish members from their chief began. Long and acrimonious debates followed in committee-room 15, and on 6th December Parnell was left in the chair with only 26 supporters. The majority of 45 members—Anti-Parnellites, as they came to be called—went into another room, unanimously deposed him, and elected Mr Justin M'Carthy in his place. Parnell then began a campaign as hopeless as that of Napoleon after Leipzig. He seized the office of *United Ireland* in person. The Fenian element was with him, as he admitted, but the clergy were against him, and the odds were too great, especially against a Protestant politician. His candidate in a bye-election at Kilkenny was beaten by nearly two to one, and he himself was injured in the eyes by lime being thrown at him. Similar defeats followed at Sligo and Carlow. He went over to France to meet Messrs Dillon and O'Brien, who had not yet taken sides, but nothing was agreed to, and in the end both these former followers went against him. Every Saturday he went from London to Dublin and addressed some Sunday meeting in the country. The last was on 27th September. On 6th October 1891 he died at Brighton, from the effects of a chill following on overwork and excitement. His funeral at Glasnevin was attended by 200,000 people. At the general election of 1892, however, only 9 Parnellites—the section which under Mr John Redmond remained staunch to his memory—were returned to Parliament.

The "Parnellite split," as it was called, proved fatal to the cause of Home Rule, for the Nationalist party broke up into factions. No one of the sectional leaders commanded general confidence, and personal rivalries were of the bitterest kind. An important result of these quarrels was to stop the supply of American money, without which neither the Land League nor the Home Rule agitation could have been worked. The Unionist party had adopted a policy of local government for Ireland while opposing legislative independence, and a bill was introduced into the House of Commons by Mr Balfour in February 1892. The principle was affirmed by a great majority, but the measure could not then be proceeded with. At the general election in July the Gladstonians and Nationalists together obtained a majority of 40 over Conservatives and Liberal Unionists. Lord Salisbury resigned in August, and was succeeded by Gladstone, with Lord Houghton as lord-lieutenant and Mr John Morley as chief secretary. The Crimes Act, which had already been relaxed, was altogether suspended, and the proclamation declaring the National League illegal was revoked. The lord-lieutenant, on taking up his quarters in Dublin, refused a loyal address because of its Unionist tone; and in October the Government issued a commission, with Mr Justice Mathew as chairman, which had the restoration of the evicted tenants as its avowed object. Two of the commissioners very shortly resigned, and the whole inquiry became somewhat farcical. It was given in evidence that out of £234,431 collected under the plan of campaign only £125,000 had been given to evicted tenants. In February 1893, on the application of the sheriff of Kerry, an order from the Castle, refusing protection, was pronounced illegal in the Queen's Bench, and persons issuing it were declared liable to criminal prosecution. In the same month Gladstone introduced his second Home Rule Bill, which proposed to retain 80 Irish members in the Imperial Parliament instead of 103, but they were not to vote on any proceedings expressly confined to Great Britain. On 8th April 1886 he had told the House of Commons that it "passed the wit of man" to draw a practical distinction between imperial and non-imperial affairs. On 20th July 1888 he informed the same assembly that there was no difficulty in doing so. It had become evident, in the meantime, to numberless Englishmen that the exclusion of the Irish members would mean virtual separation. The plan now proposed met with no greater favour, for a good many English Home Rulers had been mainly actuated all along by the wish to get the Irish members out of their way. The financial provisions of the Bill were objected to by the Nationalists as tending to keep Ireland in bondage.

Home Rule Bill, 1893.

During the year 1892 a vast number of Unionist meetings were held throughout Ireland, the most remarkable being the great Ulster convention in Belfast, and that of the three other provinces in Dublin, on the 14th and 23rd of June. On 22nd April 1893, the day after the second reading of the Bill, the Albert Hall in London was filled by enthusiastic Unionist delegates from all parts of Ireland. Next day the visitors were entertained by Lord Salisbury at Hatfield, the duke of Devonshire, Mr Balfour, Mr Goschen, and Mr Chamberlain being present. Between the second reading and the third on 1st September the Government majority fell from 43 to 34. A great part of the Bill was closured by what was known as the device of the "gag" without discussion, although it occupied the House of Commons altogether eighty-two nights. It was thrown out by the Lords by 419 to 41, and the country undoubtedly acquiesced in their action. On 3rd March 1894 Gladstone resigned, and Lord Rosebery became prime minister. A bill to repeal the Crimes Act of 1887 was read a second time in the Commons by 60, but went no farther. A committee on the Irish Land Acts was closured at the end of July by the casting vote of the chairman, Mr Morley, and the minority refused to join in the report. The bill to restore the evicted tenants, which resulted from the Mathew Commission, was rejected in the Lords by 249 to 30. In March 1895 Mr Morley introduced a Land Bill, but the Government majority continued to dwindle. Another Crimes Act Repeal Bill passed the second reading in May by only 222 to 208. In July, however, the Government were defeated on the question of the supply of small-arms ammunition. A general election followed, which resulted in a Unionist majority of 150. The Liberal Unionists, whose extinction had once been so confidently foretold, had increased from 46 to 71, and the Parnellites, in spite of the most violent clerical opposition, from 9 to 12. Lord Cadogan became lord-lieutenant of Ireland, and Mr Gerald Balfour—who announced a policy of "killing Home Rule by kindness" —chief secretary.

In the session of 1896 a new Land Act was added to the statute-book. The general effect was to decide most disputed points in favour of the tenants, and to repeal the

exceptions made by former Acts in the landlord's favour. Dairy farms, to mention only a few of the most important points which had been hitherto excluded, were admitted within the scope of the Land Acts, and purely pastoral holdings of between £50 and £100 were for the first time included. A presumption of law in the tenant's favour was created as to improvements made since 1850. The 40th clause introduced the principle of compulsory sale to the tenants of estates in the hands of receivers. The tendency of this provision to lower the value of all property has been partly, but only partly, neutralized by the firmness of the land judge. The landlords of Ireland, who had made so many sacrifices and worked so hard to return Lord Salisbury to power, felt that the measure was hardly what they had a right to expect from a Unionist administration. In their opinion it unsettled the agricultural mind, and encouraged judicial tenants to go to law at the expiration of the first fifteen years' term instead of bargaining amicably with their landlords.

Land Act, 1896.

In the autumn of this year was published the report of the Royal Commission on the financial relations between England and Ireland. Mr Childers was the original chairman of this commission, which was appointed in 1894 with the object of determining the fiscal contribution of Ireland under Home Rule, and after his death The O'Conor Don presided. The report—or rather the collection of minority reports—gave some countenance to those who held that Ireland was overtaxed, and there was a strong agitation on the subject, in which some Irish Unionists joined without perceiving the danger of treating the two islands as "separate entities." No individual Irishman is taxed on a higher scale than any corresponding citizen of Great Britain. No tax, either on commodities or property, is higher in Ireland than it is in England. The alleged grievance has, however, been exploited to the utmost extent by the Nationalist party. In 1897 a Royal Commission, with Sir Edward Fry as chairman, was appointed to inquire into the operation of the Land Acts. Voluminous evidence was taken in different parts of Ireland, and the commissioners reported in the following year. The methods and procedure of the Land Commission were much criticized, and many recommendations were made, but no legislation followed. This inquiry proved, what few in Ireland doubted, that the prices paid for occupancy interest or tenant right increased as the landlord's rent was cut down.

Financial relations.

The session of 1898 was largely occupied with the discussion of a bill to establish county and district councils on the lines of the English Act of 1888. The fiscal jurisdiction of grand juries, which had lasted for more than two centuries and a half, was entirely swept away. Local government for Ireland had always been part of the Unionist programme, and the vote on the abortive bill of 1892 had committed Parliament to legislation. It may, nevertheless, be doubted whether enough attention was paid to the local peculiarities of Ireland, and whether English precedents were not too closely followed. In Ireland the poor-rate used to be divided between landlord and tenant, except on holdings valued at £4 and under, in which the landlord paid the whole. Councils elected by small farmers were evidently unfit to impose taxes so assessed. The poor-rate and the county cess, which latter was mostly paid by the tenants, were consolidated, and an agricultural grant of £730,000 was voted by Parliament in order to relieve both parties. The consolidated rate is now paid by the occupier, who will profit by economy and lose by extravagance. The towns gained nothing by the agricultural grant, but union rating was established for the first time. The net result of the county council elections in the spring of 1899 was to displace, except in some northern counties, nearly all the men who had hitherto done the local business. Nationalist pledges were exacted, and long service as a grand juror was an almost certain bar to election. The Irish gentry, long excluded, as landlords and Unionists, from political life, now felt to a great extent that they had no field for activity in local affairs. The new councils very generally passed resolutions of sympathy with the Boers in the South African war. The one most often adopted, though sometimes rejected as too mild, was that of the Limerick corporation, hoping "that it may end in another Majuba Hill." Efforts not wholly unsuccessful were made to hinder recruiting in Ireland, and every reverse or repulse of British arms was greeted with Nationalist applause.

Local Government Act, 1898.

The scheme for a Catholic University—of which Mr Arthur Balfour, speaking for himself and not for the Government, made himself a prominent champion—was much canvassed in 1899, but it came to nothing. It must always be very difficult to devise a scheme satisfactory both to Parliament and to the Roman Catholic hierarchy. It has not been forgotten that this question wrecked the Liberal party in 1874.

The chief Irish measure of 1899 was an Agricultural and Technical Instruction Act, which established a new department with the chief secretary at its head and an elaborate system of local committees. Considerable funds were made available, and Mr Horace Plunkett, who as an independent Conservative member had been active in promoting associations for the improvement of Irish methods in this direction, became the first vice-president, retaining his seat in Parliament under the Act. It remains to be seen what can be done in the way of technical instruction in a country where organized industries have hitherto been so few. Probably an attempt will be made to foster manual dexterity in the primary schools, where education has been too exclusively literary. In agriculture, and especially in cattle-breeding, improvement was formerly due mainly to the landlords, who have now been deprived by law of much of their power. The gap may be partly filled by the new department, but progress must be slow. Some experience has been gained not only through the voluntary associations promoted by Mr Plunkett, but also from the Congested Districts Board founded under the Land Purchase Act of 1891. This board has power within the districts affected by it to foster agriculture and fisheries, to enlarge holdings, and to buy and hold land. In March 1899 it had from first to last laid out a little more than half a million. The principal source of income was a charge of £41,250 a year upon the Irish Church surplus, but the establishment expenses were paid by Parliament.

Board of Agriculture.

At the opening of the session in January 1900 there was a formal reconciliation of the Dillonite, Healyite, and Redmondite or Parnellite factions. It was evident from the speeches made on the occasion that there was not much cordiality between the various leaders, but the outward solidarity of the party was calculated to bring in renewed subscriptions both at home and from America. It was publicly agreed that England's difficulty in South Africa was Ireland's opportunity, and that all should abstain from supporting an amendment to the address which admitted that the war would have to be fought out. Mr John Redmond was chosen chairman, and the alliance of Nationalists and Gladstonians was dissolved. The United Irish League, founded in Mayo in 1898 by Mr William O'Brien, had recently become a sort of rival to the parliamentary party, its avowed object

1900.

being to break up the great grass farms, and its methods resembling those of the old Land League.

The most striking event, however, in Ireland in the earlier part of 1900 was Queen Victoria's visit. Touched by the gallantry of the Irish regiments in South Africa, and moved to some extent, no doubt, by the presence of the duke of Connaught in Dublin as commander-in-chief, the Queen determined in April to make up for the loss of her usual spring holiday abroad by paying a visit to Ireland. The last time Her Majesty had been in Dublin was in 1861 with the Prince Consort. Since then, besides the visit of the prince and princess of Wales in 1885, Prince Albert Victor and Prince George of Wales had visited Ireland in 1887, and the duke and duchess of York in 1897; but the lack of any permanent royal residence and the long-continued absence of the Sovereign in person had aroused repeated comment. Directly the announcement of the Queen's intention was made the greatest public interest was taken in the project. Shortly before St Patrick's Day the Queen issued an order which intensified this interest, that Irish soldiers might in future wear a sprig of shamrock in their headgear on this national festival. For some years past the "wearing of the green" had been regarded by the army authorities as improper, and friction had consequently occurred, but the Queen's order put an end in a graceful manner to what had formerly been a plausible grievance. The result was that St Patrick's Day was celebrated in London and throughout the empire as it never had been before, and when the Queen went over to Dublin at the beginning of April she was received with the greatest enthusiasm.

The general election later in the year made no practical difference in the strength of parties, but Mr George Wyndham took Mr G. Balfour's place as chief secretary, without a seat in the Cabinet. Both before and after the election the United Irish League steadily advanced, fresh branches continually springing up.

The visit of Mr Redmond and others to America in 1901 was not believed to have brought in much money, and the activity of the League was more or less restrained by want of funds. Boycotting, however, became rife, especially in Sligo, and paid agents also promoted an agitation against grass farms in Tipperary, Clare, and other southern counties. In Roscommon there was a strike against rent, especially on the property of Lord De Freyne. This was due to the action of the Congested Districts Board in buying the Dillon estate and reducing all the rents without consulting the effect upon others. It was naturally argued that no one else's tenants could be expected to pay more. Some prosecutions were undertaken, but the Government was much criticized for not using the special provisions of the Crimes Act; and in April 1902 certain counties were "proclaimed" under it. In February 1902 Lord Rosebery definitely repudiated Home Rule, and steps to oppose his followers were at once taken among Irish voters in English constituencies.

AUTHORITIES.—*Annual Register*, 1879-1899.—Article on Parnell in *Dict. of National Biography*, with appendix of authorities.—R. BARRY O'BRIEN. *Life of Parnell*, 2nd ed., 1899.—H. O. ARNOLD FORSTER. *The Truth about the Land League*, 3rd ed., 1888.—*Reports of Bessborough Commission*, 1881 (Parl. Paper, C 2779); *of Richmond Commission*, 1881 (C 2778 and 2951); *of Cowper Commission*, 1887 (C 4969); *of Mathew Commission*, 1893 (C 6935).—*Boycotting in Co. Cork.* Cork, 1866.—ISAAC BUTT. *Irish Federalism*, 2nd ed., 1870.—W. E. GLADSTONE. *History of an Idea*, 1886 (with reply by J. E. WEBB, *The Queen's Enemies in America*, 1886).—A. V. DICEY. *England's Case against Home Rule*, 2nd ed., 1886.—Mrs LYNN LINTON. *About Ireland*, 1890.—*Report of Parnell Special Commission*, 1890.—*Report of Congested Districts Board*, 1899 (Parl. Paper, C 9375).—Publications of the Irish Unionist Alliance and the Liberal Unionist Association.

(R. BA.)

Ireland, Church of.—The ancient Church of Ireland (described in the Irish Church Act, 1869, by this, its historic title) has a long and chequered history, which it will be interesting to trace in outline. The beginnings of Christianity in Ireland are difficult to trace (see *Ency. Brit.* vol. v. p. 303), but there is no doubt that the first Christian missionary whose labours were crowned with any considerable success was Patrick (*fl. cir.* 450), who has always been reckoned the patron saint of the country. For six centuries the Church of which he was the founder occupied a remarkable position in Western Christendom. Ireland, in virtue at once of its geographical situation and of the spirit of its people, was less affected than other countries by the movements of European thought; and thus its development, social and religious, was largely independent of foreign influences, whether Roman or English. In full communion with the Latin Church, the Irish long preserved many peculiarities, such as their monastic system and the date at which Easter was kept, which distinguished them in discipline, though not conspicuously in doctrine, from the Christians of countries more immediately under papal control. In the 6th, 7th, and 8th centuries Ireland was famous as the home of sacred letters and as the nursery of zealous missionaries who carried the Gospel not only to Scotland, but to Burgundy and Switzerland, with the fervour of Celtic devotion (see *Ency. Brit.* vol. xiii. p. 248). The incessant incursions of the Danes, who were the scourge of the land for a period of nearly three hundred years, prevented the Church from redeeming the promise of her infancy; and at the date of the English conquest of Ireland (1172) she had lost much of her ancient zeal and of her independence. By this time she had come more into line with the rest of Europe, and the Synod of Cashel put the seal to a new policy by its acknowledgment of the papal jurisdiction and by its decrees assimilating the Church, in ritual and usages, to that of England. There was no thought of a breach of continuity (see *Ency. Brit.* vol. viii. p. 490), but the distinctive features of Celtic Christianity gradually disappeared from this time onwards. Thenceforth she was an appanage of the Church of England, the intervention of the stronger island being, however, as distasteful to the Irish in religious as in political affairs. English influence was strong only in the region round Dublin (known as the Pale); and beyond this district the Irish, though they had acquiesced in the discipline of the Church as directed from Rome, to which England was subject like the rest of Europe, were not disposed to view with favour any ecclesiastical reforms which had their origin in the sister country. Thus from the days of Henry VIII. the Reformation movement was hindered in Ireland by national prejudice, and it never succeeded in gaining the allegiance of the Irish people as a whole. The policy which directed its progress was blundering and stupid, and reflects little credit on the English statesmen who were responsible for it (see *Ency. Brit.* vol. xx. p. 337). The episcopal succession was, indeed, unbroken, and the continuity of the Church of Ireland with the ancient Celtic Church is a historical fact. Not only is she in possession of many ancient buildings which have been consecrated to Christian worship for many centuries, such as the cathedrals at Armagh and Dublin, but her bishops can claim descent in direct line from the successors of St Patrick. Nevertheless, she has not gained the people, and she is to this day the Church of a small section only of the population.

The Reformation period begins with the passing of the Irish Supremacy Act (1537). As in England, the changes in religion of successive sovereigns alternately checked and promoted the progress of the movement, although in

Ireland the mass of the people were less deeply affected by the religious controversies of the times than in Great Britain. At Mary's accession five bishops either abandoned, or were deprived of, their sees; but the Anglo-Irish who remained faithful to the Reformation were not subjected to persecution such as would have been their fate on the other side of the Channel. Again, under Elizabeth, while two bishops (Walsh of Meath and Leverous of Kildare) were deprived for open resistance to the new order of things, and while stern measures were taken to suppress treasonable plotting against the constitution, the uniform policy of the Government in ecclesiastical matters was one of toleration. James I. caused the Supremacy Act to be rigorously enforced, but on political rather than on religious grounds. It was in his reign that the first Convocation of the clergy was summoned in Ireland, of which assembly the most notable act was the adoption of the "Irish Articles" (1615). These had been drawn up by Ussher, and were more decidedly Calvinistic in tone than the Thirty-nine Articles, which were not adopted as standards in Ireland until 1634, when Strafford forced them on Convocation. During the Commonwealth period the bishoprics which became vacant were not filled; but on the accession of Charles II. the Church was strengthened by the translation of Bramhall from Derry to Armagh, and the consecration of eight other bishops, among whom was Jeremy Taylor. The short period during which the policy of James II. prevailed in Ireland was one of disaster to the Church; but under William and Mary she regained her former position. She had now been reformed for more than 100 years, but had made little progress; and the tyrannical provisions of the Penal Code introduced by the English Government made her more unpopular than ever. The clergy, finding their ministrations unacceptable to the great mass of the population, were tempted to indolence and non-residence; and although bright exceptions could be named, there was much that called for reform. To William King (1650–1729), Bishop of Derry and subsequently Archbishop of Dublin, it was mainly due that the work of the Church was reorganized, and the impulse which he gave it was felt all through the 18th century. His ecclesiastical influence was exerted in direct opposition to Primate Boulter and his school, who aimed at making the Established Church the instrument for the promotion of English political opinions rather than the spiritual home of the Irish people. In 1800 the Act of Union was passed by the Legislature; and thenceforward, until Disestablishment, there was but one "United Church of England and Ireland."

Continuous agitation for the removal of Roman Catholic disabilities brought about in 1833 the passing of the Church Temporalities Act, one of the most important provisions of which was the reduction of the number of Irish archbishoprics from four to two, and of bishoprics from eighteen to ten, the funds thus released being administered by commissioners. In 1838 the Tithe Rentcharge Act, which transferred the payment of tithes from the occupiers to the owners of land, was passed, and thus a substantial grievance was removed. It became increasingly plain, however, as years passed, that all such measures of relief were inadequate to allay the dissatisfaction felt by the majority of Irishmen because of the continued existence of the Established Church. Her position had been pledged to her by the Act of Union, and she was undoubtedly the historical representative of the ancient Church of the land; but such arguments proved unavailing in view of the visible fact that she had not gained the affections of the people. The census of 1861 showed that out of a total population of 5,798,967 only 693,357 belonged to the Established Church, 4,505,265 being Roman Catholics; and once this had been made clear, the passing of the Act of Disestablishment was only a question of time. Introduced by Mr Gladstone, and passed in 1869, it became law on 1st January 1871. (See ESTABLISHMENT.)

The Church was thus suddenly thrown on her own resources, and called on to reorganize her ecclesiastical system, as well as to make provision for the maintenance of her future clergy. A convention of the bishops, clergy, and laity was summoned in 1870, and its first act was to declare the adherence of the Church of Ireland to the ancient standards, and her determination to uphold the doctrine and discipline of the Catholic and Apostolic Church, while reaffirming her witness, as Protestant and Reformed, against the innovations of Rome. Under the constitution then agreed on, the supreme governing body of the Church is the General Synod, consisting of the bishops and of 208 clerical and 416 lay representatives of the several dioceses, whose local affairs are managed by subordinate Diocesan Synods. The bishops are elected as vacancies arise, and, with certain restrictions, by the Diocesan Synods, the Primate, whose see is Armagh, being chosen by the bishops out of their own number. The patronage of benefices is vested in boards of nomination, on which both the diocese and the parish are represented. The Diocesan Courts, consisting of the bishop, his chancellor, and two elected members, one clerical and the other lay, deal as courts of first instance with legal questions; but there is an appeal to the Court of the General Synod, composed of three bishops and four laymen who have held judicial office. During the years 1871 to 1878 the revision of the Prayer Book mainly occupied the attention of the General Synod; but although many far-reaching resolutions were proposed by the then predominant Evangelical party, few changes of moment were carried, and none which affected the Church's doctrinal position. A two-thirds majority of both the lay and clerical vote is necessary before any change can be made in the formularies, and an ultimate veto rests, on certain conditions, with the house of bishops.

The effects of Disestablishment have been partly good and partly evil. On the one hand, the Church has now all the benefits of autonomy and is free from the anomalies incidental to state control. Her laws are definite, and the authority of her judicial courts is recognized by all her members. The place given to the laity in her synods has quickened in them the sense of responsibility so essential to the Church's progress. And although there are few worldly inducements to men to take orders in Ireland, the clergy are, for the most part, the equals of their predecessors in social standing and in intellectual equipment, while the standard of clerical activity is higher than in pre-Disestablishment days. On the other hand, the vesting of patronage in large bodies like synods, or (as is the case in some districts) in nominators with little knowledge of the Church beyond the borders of their own parish, is not an ideal system, although it is working better as the dangers of parochialism and provinciality are becoming more generally recognized than in the early years of Disestablishment.

The finances are controlled by the Representative Church Body, to which the sum of £7,581,075 to provide annuities for the existing clergy (2043 in number), amounting to £596,913, was handed over by Parliament in 1870. So skilfully was this fund administered that on 31st December 1900, while only 200 annuitants were living, a small balance of £919,192 remained of the capital sum. In addition, the voluntary offerings of the clergy and the laity for the thirty-one years ending 31st December 1900 amounted to £5,494,586, the total moneys at the disposal of the Church amounting at that date to £8,220,073.

Out of the interest on this sum, augmented by the annual parochial assessments, which are administered by the central office, provision has to be made for two archbishops at £2500 per annum, eleven bishops, who receive about £1500 each, and 1534 parochial clergy. Of the clergy only 361 are curates, while 1173 are incumbents, the average annual income of a benefice being about £240, with (in most cases) a house. The large majority of the clergy receive their training in the Divinity School of Trinity College, Dublin. At the census of 1901 the members of the Church of Ireland numbered 579,385 out of a total population of 4,456,546.

AUTHORITIES.—MANT. *History of the Church of Ireland*, 2 vols. London, 1840.—*Essays on the Irish Church*, by various writers. Oxford, Parker, 1866.—STOKES. *Ireland and the Celtic Church.* London, 1888. *Ireland and the Anglo-Norman Church.* London, 1892. *Some Worthies of the Irish Church.* London, 1900.—OLDEN. *The Church of Ireland.* London, 1892.—BALL. *The Reformed Church of Ireland.* London, 1890.—*Reports of the Representative Church Body.* Dublin, 1872–1900. (J. H. BE.)

Ireland, John (1838–——), Roman Catholic Archbishop of St Paul, Minnesota, U.S.A., was born in Burnchurch, County Kilkenny, Ireland, 11th September 1838. When he was a boy his parents emigrated to America; but he received his theological education in France, and was ordained in St Paul, Minnesota, in 1861. He was chaplain of a Minnesota regiment during part of the Civil War, and afterwards was appointed rector of the cathedral at St Paul. In 1875 he became coadjutor-bishop, in 1884 bishop, and in 1888 archbishop of St Paul. In all his positions he has been active in religious, educational, and charity work; has organized many total abstinence societies; promoted the settlement of the north-west; and aided largely in the establishment of the Roman Catholic university at Washington. He has also been many years president of the state Historical Society of Minnesota, and is author of *The Church and Modern Society* (1896).

Irenaeus (THE SO-CALLED PFAFFIAN FRAGMENTS).—In 1715 a scholar of Tübingen, Christoph Matthäus Pfaff, published at The Hague what professed to be four fragments of the writings of St Irenaeus, which he said that he had discovered in MS. Catenae in the library at Turin (see Migne, *Patr. Graec.*, vii. 1248–1256). The subjects with which they deal are the true knowledge which is according to Christ, the oblation in the Eucharist, Christian freedom as regards fasts and festivals, and the second coming of Christ. If genuine, therefore, they are of no little importance, and on this account they have been frequently made use of and not a little discussed. Scipio Maffei impugned them during Pfaff's lifetime; and their genuineness has often been suspected since, partly on critical grounds, and partly because the alleged MS. Catenae has never been seen since Pfaff's day. On the other hand, they have been as strongly defended, and the general feeling seems to have been that if not genuine fragments of Irenaeus, they were at least in all probability of the 2nd century, the work of some writer like-minded with Irenaeus. Since 1900 the question may be said to have been set at rest entirely by Dr Adolf Harnack, who has proved almost to demonstration that they are forgeries by Pfaff himself. His reasons are shortly as follows: the Catenae are not to be found in the library, and have never been seen by anybody unless by Pfaff; the catalogues of the library show no signs of their existence; Pfaff's statements on the matter were not free from contradiction; the fragments show signs of being based on the Apostolical Constitutions (*q.v.*), and therefore must be later in date than they are; in grammar and style they do not coincide with those either of their alleged author or of their alleged date; they appear to depend upon the text of Halloix's edition of Irenaeus, and a false reading of his is incorporated; the New Testament is used according to the *Textus Receptus;* above all, they represent Pfaff's own theological position, so that the reason for the forgery is supplied. Altogether, Harnack's proof is as ingenious and convincing a piece of argument as could be wished for.

See AD. HARNACK, *Die Pfaff'schen Irenäus-Fragmente als Fälschungen Pfaffs nachgewiesen.* (Gebhardt and Harnack, *Texte und Untersuchungen*, neue Folge, vol. v. part 3, Leipzig, 1900.) (W. E. CO.)

Iriga, a town in the extreme south of the province of Ambos Camarines, Luzon, Philippine Islands, in the district known as La Rinconada on account of its inaccessibility. It has a temperate and very healthful climate. The soil in its vicinity is rich, producing rice, Indian corn, sugar, pepper, cacao, cotton, abacá, tobacco, and copra. The neighbouring forests furnish ebony, molave, tindalo, and other very valuable hardwoods. The language is Bicol. Population, 17,000.

Irkutsk, a government of Asiatic Russia, East Siberia, bounded on the W. by Tomsk and Yeniseisk, on the N. by Yakutsk, on the E. by Lake Baikal and Transbaikalia, and on the S. and S.W. by Mongolia (China). Its area is 287,061 square miles. The most populous region is a belt of plains, from 1200 to 2000 feet in altitude, stretching north-west to south-east between the Sayan mountains on the one side and the Baikal mountains on the other, narrowing as it approaches the town of Irkutsk. The highroad, now the Trans-Siberian Railway, follows this belt. The south-western part of the government is occupied by mountains of the Sayan system, whose exact orography is as yet not well known. From the high plateau of Mongolia (*q.v.*), fringed by the Sayan mountains, of which the culminating point is the snow-clad Munku-Sardyk (11,500 feet), a number of mountain ridges, from 7500 to 8500 feet high, strike off in a north-east direction. Going from south to north they are distinguished as the Tunka Alps, the Kitoi Alps (both snow-clad nearly all the year round), the Ida mountains, and the Kuitun mountains, which, however, are far from being the regular chains running between rivers which most maps show them to be. On the contrary, these highlands are a complex result of upheavals which took place at different geological epochs, and of denudation on a colossal scale. Gold in the north-west (Nizhneudinsk taiga) and graphite of the highest quality (Alibert's mine, 8000 feet) are found in these mountains. A beautiful, fertile valley, watered by the Irkut, spreads between the Tunka Alps and the Sayan, and another somewhat higher plain, but less wide, stretches along to Kitoi. A succession of high plains, from 2000 to 2500 feet in altitude, formed of horizontal beds of Devonian (or Upper Silurian) sandstone and limestone, spreads to the north of the railway along the Angara, the Nizhnyaya Tunguska (its tributary), and the upper Lena, as far as Kirensk. The Bratskaya Steppe is a prairie peopled by Buryats. A mountain region, usually described as the Baikal range, but consisting in reality of several ranges running north-eastwards, across Lake Baikal, and scooped out to form the depression occupied by the lake, is fringed on its north-western slope by horizontal beds of sandstone and limestone. Farther north-east the space between the Lena and the Vitim is filled by another mountain region belonging to the Olekma and Vitim system, composed of several parallel mountain ridges running north-eastwards (across the lower Vitim), and auriferous in the drainage area of

the Mama. The immense Lake Baikal separates Irkutsk from Transbaikalia. The chief rivers of the government are the Angara, which flows from this lake northwards, with numerous sharp windings, and receives from the left several large tributaries, as the Irkut, Kitoi, Byelaya, Oka, and Iya. The Lena is the main means of communication both with the gold mines on the lower Vitim and with the province of Yakutsk. The Nizhnyaya Tunguska flows northwards, to join the Angara in the far north, and the mountain streams tributary to the Vitim water the north-eastern part of the province. The Post-Tertiary formations are represented by glacial deposits in the highlands and loess on their borders. Jurassic deposits are met with in a zone running north-westwards from Lake Baikal to Nizhneudinsk. The remainder of this region is covered by vast series of Carboniferous, Devonian, and Silurian deposits—the first two but slightly disturbed over wide areas. All the highlands are built up of older, half crystalline Cambro-Silurian deposits, which attain a thickness of 2500 feet, and of crystalline slates and limestones of the Laurentian system, with granites, syenites, diorites, and diabases protruding from beneath them. Very extensive beds of basaltic lavas and other volcanic deposits are spread along the border ridge of the high plateau, about Munku-Sardyk, up the Irkut, and on the upper Oka, where cones of extinct volcanoes are found (Junbulak). Earthquakes are frequent in the neighbourhood of Lake Baikal and the surrounding region. Gold is extracted in the Nizhneudinsk district to the extent of about 10,000 oz. yearly; graphite is found on the Botogol or Alibert mountain (abandoned many years since) and on the Olkhon island of Lake Baikal. Brown coal (Jurassic) is found in many places, and coal on the Oka. The salt springs of Usoliye (45 miles west of Irkutsk), as also those on the Ilim and of Ust-Kut (on the Lena), yield annually about 7000 tons of salt. Fireclay, grindstone, marble and mica, lapis-lazuli, granites, and various half-precious stones occur on the Sludyanka (south-west corner of the Baikal). The climate is severe: the mean temperatures are at Irkutsk (1510 feet), being for the year 31° Fahr., for January –6°, for July 65°; at Shimki (valley of the Irkut, 2620 feet), for the year 24°, for January –17°, for July 63°. The average rainfall is 15 inches a year. Immense virgin forests cover all the highlands up to 6200 to 6600 feet. The population, which was 383,578 in 1879, was 506,517 in 1897, of whom 238,997 were women and 60,396 were urban; except about 120,000 Buryats and 1700 Tunguses, they are Russians. In 1890, of a registered population of 465,000, 223,812 were peasants, 34,659 common law and 619 political exiles, 5230 Cossacks, and 14,178 settled and 105,718 nomad natives, chiefly Buryats. The yearly increase of population is 1·4 per cent., to which immigration contributes about 14,000 every year. Schools are numerous at Irkutsk, but quite insufficient in the country, and only 12 per cent. of the children receive education. The soil is very fertile in certain parts of the territory, but meagre elsewhere, and less than a million acres are under crops. Grain has to be imported from West Siberia, and cattle from Transbaikalia. The live stock of the province numbers 292,110 horses, 380,340 horned cattle, and 356,400 sheep. Fisheries on Lake Baikal supply every year about 2,400,000 Baikal herring (*omul*). Industry is only beginning to be developed (iron works, glass works, and distilleries), and all manufactured goods are imported from Russia. (P. A. K.)

Irkutsk, capital of the above province, situated 40 miles west of Lake Baikal, 3378 miles from Moscow by rail, and is connected by rail with the Amur. Several valuable educational institutions have been established; since the great conflagration of 1879 large parts of the town have been built anew. Its commercial importance, in respect of the trade both with China and the interior, has been much increased by the railway. Population, 51,484.

IRON AND STEEL.

Summary.

In the last twenty years of the 19th century the world's production of pig iron more than doubled, and that of steel increased fivefold, while that of wrought iron became of secondary importance. The United States passed from the position of the second to that of by far the greatest producer of both pig iron and steel; its production of the former more than tripled, becoming 46 per cent. greater than that of Great Britain, and its production of steel increased to more than eight and one-half times that of 1880, becoming more than double that of Great Britain, some 70 per cent. greater than that of Germany and Luxemburg together, and 40 per cent. of the total for the whole world. In this period the basic open-hearth and basic Bessemer processes rose from mere beginnings to vast importance, each of them now producing in these, the three great iron-making countries, about as much steel as the whole world made in 1880. Of the total production of steel in these three countries, some 43 per cent. is made by the acid Bessemer process, 20 per cent. by the basic Bessemer, 16 per cent. by the acid open-hearth, 18 per cent. by the basic open-hearth—the process in which the greatest development is now to be expected—and only about 1 per cent. by the crucible and other minor processes. The production of wrought iron in the United States, which in 1880 was 70 per cent. greater than that of steel, is now only about one-sixth that of steel; and wrought iron has practically gone out of use for important objects like rails, and the beams, angles, and other chief parts of bridges and iron buildings, though it will probably long be used for special purposes for which great ease of welding or special ductility is needed. Delicate methods of research have revealed the nature and constitution of the several varieties of iron. This knowledge has contributed in no small degree to the important beginning which has been made in the use of rational methods of thermal treatment, in which a great extension is to be expected, and it has aided in the discovery and utilization of numerous "alloy" steels. For armour plate not only has steel completely displaced wrought iron, but alloy steel, which has been specially and differentially carburized, and has received a special heat-treatment, has come into general use. Much the same is true of many other important objects for which the highest quality is needed; thus all armour-piercing projectiles, and many important forgings for engines, especially marine engines, are made of the same materials. Throughout the manufacture of iron and steel those twenty years witnessed great simplification, extension of the use of mechanical appliances, and, especially in the manufacture of the relatively simple products, such as rails, wire, sheets, tubing, beams, &c., a concentration of the industry into enormous establishments, operating on so large a

scale as to warrant the use of powerful and costly labour-saving machinery and the employment of many highly trained specialists to investigate and watch with the utmost care even the slightest details. In the last ten years of the 19th century alone the cost of labour in many important processes was reduced by about one-half, without reducing wages. Processes for obtaining wrought iron and steel "direct" from the ore lost their immediate, though not wholly their prospective, importance, and at the present time nearly all the ore which is mined is converted into pig iron in the iron blast-furnace. Chiefly by daring, and by the use of more powerful blowing engines and hot-blast stoves, and of better arrangements for cooling and so protecting the lower part of the furnace, the production of the blast-furnace was increased, until the average production of a single Carnegie furnace in 1902, some 200,000 tons per annum, was greater than that of all the United States furnaces in 1830, and ten times that of 1820, and was one-fourth that of the whole world in 1800. By using the waste gases of the blast-furnace in gas engines their importance as sources of power has been greatly increased, so that establishments in which the rolling mills and other machinery adjoin the blast-furnaces, and therefore can be driven by such engines, will be given a new and often an irresistible advantage over their competitors. The use of great "mixers" to lessen the irregularities in the composition of the pig iron as it issues from the blast-furnace enables the Bessemer process to be applied directly to that iron, without allowing it to solidify and thus to dissipate its heat; and this same procedure is coming into use for the open-hearth and tentatively for the puddling process. The capacity of a single Bessemer converter has become as much as 20 tons, and that of the open-hearth furnace 100 tons, and owing to the car casting system and other improvements the production of a single pair of Bessemer converters reaches 50,000 tons per month—a rate forty-four times that of 1870, and more than thrice that of 1880. In some Bessemer works not only is the iron never allowed to cool between its entry into the blast-furnace in the state of ore and its delivery from the rolling mill in the form of rails or even of billets, but in this progress it undergoes no true heating by extraneous fuel, save in the blast-furnace itself, for the pig iron furnishes its own calorific power in the Bessemer converter, and the only other furnace treatment, that of "soaking," merely equalizes the heat of the ingot, and prevents its escape without adding to it.

I. Constitution, &c.

§ 1. *Nomenclature.*—The classification given in Table I. is now firmly established. Until about 1860 there were only three important classes of iron—wrought iron, steel, and cast iron. The essential characteristic of wrought iron was its nearly complete freedom from carbon; that of steel its moderate carbon-content (say between 0·30 and 2 per cent.), which, though great enough to confer the property of being rendered intensely hard by sudden cooling, yet was not so great as to make the metal brittle when cooled slowly; while that of cast iron was a carbon-content so high as to make the metal brittle whether cooled quickly or slowly. This classification was based on carbon-content, or on the properties which it gave. Wrought iron, and certain classes of steel which then were important, necessarily contained much slag or "cinder," because they were made by welding together pasty particles of metal in a bath of slag, without subsequent fusion. But the best class of steel, crucible steel, was freed from slag by fusion in crucibles; hence its name, "cast steel." Between 1860 and 1870 the Bessemer and open-hearth processes introduced a new class of iron, to-day called "mild" or "low-carbon steel," which lacked the essential property of steel, the hardening power, yet differed from the existing forms of wrought iron in freedom from cinder, and from cast iron in being very malleable. Logically it was wrought iron, the essence of which was, that it was (1) "iron" as distinguished from steel, and (2) malleable, *i.e.*, capable of being "wrought." This name did not please those interested in the new product, because existing wrought iron was a low-priced material. The only justifiable alternative would have been to assign a wholly new name to the wholly new product; but as steel was associated in the public mind with superiority, it appeared more profitable to appropriate its valuable name. This was done with the excuse that the new product resembled one class of steel—cast steel—in being free from slag; and, after a period of protest, all acquiesced in calling the new product "steel," which is now its firmly established name. The old varieties of wrought iron, steel, cast steel, and cast iron preserve their old names; the new class is called steel by main force. As a result, certain varieties, such as blister steel, are called "steel" solely because they have the hardening power, and others, such as low-carbon steel, solely because they are free from slag. But the former lack the essential quality—slaglessness—which makes the latter steel, and the latter lack the essential quality—the hardening power—which makes the former steel. "Steel" has come gradually to stand rather for excellence than for any specific quality.

Table I.—*General Classification of Iron and Steel.*

	Containing very little Carbon (say, less than 0·30 per cent.).	Containing an intermediate quantity of Carbon (say, between 0·30 and 2 per cent.).	Containing much Carbon (say, from 2 to 5 per cent.).
Slag-bearing or "Weld-metal" Series.	Wrought Iron. Puddled and bloomary, or charcoal-hearth iron belong here.	Weld Steel. Puddled and blister steel belong here.	
Slagless or "Ingot-metal" Series.	Low-Carbon or Mild Steel, sometimes called "ingot-iron." It may be either Bessemer, open-hearth, or crucible steel.	Half-Hard and High-Carbon Steels, sometimes called "ingot-steel." They may be either Bessemer, open-hearth, or crucible steel. Malleable cast iron also often belongs here.	Cast Iron. Normal cast iron, "washed" metal, and most "malleable cast iron" belong here.
		Alloy Steels. Nickel, manganese, tungsten, and chrome steels belong here.	Alloy Cast Irons.[1] Spiegeleisen, ferro-manganese, and silico-spiegel belong here.

[1] The term "Alloy Cast Irons" is not actually in frequent use, not because of any question as to its fitness or meaning, but because the need of such a generic term rarely arises in the industry.

These anomalies, however confusing to the general reader, in fact cause no appreciable trouble to important makers or users of iron and steel, beyond forming an occasional side-issue in litigation. If, however, we are to have a nomenclature comprehensible to the general public, we may adopt the following definitions, in which the essential distinction between steel and cast iron is that the former is malleable at least in some one range of temperature, malleableness being probably the only important specific property which to-day distinguishes all steels from all cast irons:—

Wrought Iron, slag-bearing, malleable iron, which does not harden materially when suddenly cooled.

Steel, iron which is malleable at least in some one range of temperature, and also is either (*a*) cast into an initially malleable mass; or (*b*) is capable of hardening by sudden cooling; or (*c*) is both so cast and so capable of hardening. (Tungsten steel and certain classes of manganese steel are malleable only when red-hot.)

Cast Iron, iron containing so much carbon or its equivalent as not to be malleable at any temperature.

Malleable Cast Iron, iron which has been cast in the condition of cast iron and made malleable by subsequent treatment without fusion.

Alloy Steels and *Cast Irons* are those which owe their properties chiefly to the presence of one or more elements other than carbon.

Ingot Iron, slagless steel with less than 0·30 per cent. of carbon.

Ingot Steel, slagless steel containing more than 0·30 per cent. of carbon.

Weld Iron, the same as wrought iron.

Weld Steel, slag-bearing varieties malleable at least at some one temperature, and containing more than 0·30 per cent. of carbon.

These definitions cover not all conceivable, but simply the present important classes of iron. Should others later become important, their nomenclature will then be determined solely by trade reasons.

§ 2. *Constitution.*—The great advance which has taken place in our knowledge of the constitution of steel and the other varieties of iron has shown that they resemble very closely the igneous and metamorphic rocks, *i.e.*, exactly those which, like the different varieties of iron, have formed from the cooling of molten or at least pasty masses. Just as a granite on close examination is seen to consist of an aggregation of crystalline fragments of mica, quartz, and felspar, each of which is a perfectly definite chemical compound, with definite crystalline form and definite physical properties in general, so the microscope shows us that a given piece of steel or iron usually consists of extremely minute crystalline particles of two or more substances, each of which is a definite entity, with definite chemical composition and definite physical properties. But besides the granitic type, certain varieties of iron seem to represent the obsidian type. In this, as in aqueous solutions, the ratios in which the different chemical substances, the silica, lime, &c., exist are not fixed or definite; they vary from case to case, not *per saltum* as between definite chemical compounds, but by infinitesimal gradations. The different substances present appear to be dissolved, as it were, in each other in a sort of solid solution which presents the indefiniteness of composition, the incapacity of being resolved by any magnification of the microscope, and the feeble chemical attraction between the different components, characteristic of a solution. The schistose structure of rock masses, their columnar or basaltic structure, arranged in columns perpendicular to the cooling surface, their "vugs" or cavities lined with specimens of free crystals, their segregation, &c., are reproduced in a most interesting way in metallic masses.

Of these different microscopic entities which constitute the different varieties of iron, only the following here need consideration:—

(1) *Ferrite*, the name assigned to the microscopic particles of nearly—perhaps perfectly—pure metallic iron. It is very soft and ductile.

(2) *Cementite*, a definite carbide of iron, Fe_3C, very brittle, harder than hardened steel, scratching glass and felspar, but not quartz ($H=6$), and present in proportions which in a general way increase with the proportion of carbon present. It is the substance to which chilled cast iron usually owes its hardness and brittleness.

(3) *Pearlite.* Slowly cooled steels in general consist essentially of a mixture of ferrite and cementite, in proportions corresponding to the carbon-content of the mass as a whole. But these two substances habitually interstratify as a "eutectic"[1] conglomerate called pearlite (Fig. 1) in the ratio of about seven parts of ferrite to one of cementite, hence containing about 0·90 per cent. of carbon. Steels containing either more or less carbon than 0·90 per cent., that is, an excess of cementite or ferrite over the eutectic ratio of 7 : 1, are a conglomerate of pearlite plus this excess (Fig. 2). They are called hyper-eutectic or hypo-eutectic according as this excess is cementite or ferrite, *i.e.*, according as their carbon-content is above or below the 0·90 per cent. which the eutectic itself contains. Their constitution is shown in Fig. 3, in which the ordinates of the line ABC represent the percentage of pearlite corresponding to each percentage of carbon, and the intercept ED or FG of any point D or F measures the percentage of the excess of ferrite or cementite for hypo- and hyper-eutectic steels respectively.

FIG. 1.—Pearlite.

(4) *Martensite*, the characteristic and chief constituent of hardened steel, is a hard, brittle mass, with a needle-like structure, consisting of iron containing carbon in proportions which vary from nothing up to about 2 per cent. As it has not yet been resolved by the microscope into different components, we regard it provisionally as a "solid solution," the ultimate constituents of which are iron and carbon; as to the nature of its proximate constituents we can as yet only speculate. When it contains 0·90 per cent. of carbon, and thus corresponds in ultimate composition to pearlite, it is called *hardenite*.

FIG. 2.—Pearlite with ferrite. (Sorby.) The polygons are pearlite; the network is ferrite.

(5) *Graphite*, a characteristic component of "grey cast iron," of which it usually forms from 2·50 to 3·50 per cent. It is nearly pure carbon, in very thin laminated plates or flakes, often curved. In grey cast iron these flakes form a nearly continuous skeleton; and as they readily split open when a piece of this iron is broken, rupture passes through them, with the result that, even though the graphite may form only some 3 per cent. of the mass by weight (say 10 per cent. by volume), practically nothing but graphite is seen in the fracture. Hence the weakness and the dark grey fracture of "grey cast iron," and hence, by brushing this fracture with a wire brush and so detaching these loosely adherent flakes of graphite, the colour can be changed nearly to the very light grey of pure iron.

(6) *Slag*, the characteristic component of wrought iron, in which it is usually present to the extent of 0·20 to 2·00 per cent., is essentially a silicate of iron, and is present in wrought iron simply because this product is made by welding together pasty granules of iron in a bath of such slag, without ever melting the resultant mass or otherwise giving the envelopes of slag thus imprisoned a chance to escape completely.

(7) *Austenite, troostite, sorbite*, and other constituents have also been described.

(8) Fig. 4 shows how the occurrence of these constituents varies both with the temperature and with the proportion of carbon present. The Roman letters indicate the constituents normal and stable in each of the many fields into which it is divided. Before considering this diagram we must recognize the further complication in the constitution of iron, due to its having at least three distinct allotropic modifications, α, β, and γ, each corresponding to a distinct range of temperature.

(9) α iron is the weak, ductile, magnetic variety, stable below A_2, Fig. 4, characteristic of wrought iron and of low-carbon steel.

[1] A "Eutectic" is the last-freezing part of an alloy and corresponds to what the mother-liquor of a saline solution would become if such a solution, after the excess of saline matter was crystallized out, were finally completely frozen. It is the mother-liquor or "Bittern" frozen. Its striking characteristics are: (1) that for given metals alloyed together its composition is fixed, and does not vary with the proportions in which those metals are present, the "excess-metal" freezing before the eutectic; (2) that though thus constant, its composition is not in simple atomic proportions; (3) that its freezing-point is constant; and (4) that it consists of interstratified layers of the metals which compose it. (See ALLOYS and FUSION.)

FIG. 3.—Diagram of the constitution of the iron carbon compounds. (Sauveur.)

N.B.—The "carbon-content" of this diagram refers only to the carbon actually combined with the iron, and excludes that which is present as graphite. This may be regarded as a foreign body. For instance, a grey cast iron containing 3·50 per cent. of carbon, of which 3 per cent. is graphite and only 0·50 per cent. combined, may be looked upon as in effect a hypo-eutectic steel, approximately rail steel, containing 0·50 per cent. of carbon (H in the figure), but contaminated with 3·00 per cent. of graphite as a foreign body.

(10) β iron is the non-magnetic variety, stable between A_2 and A_3, probably very hard and brittle, and probably characteristic of certain self-hardening steels, such as manganese steel containing 7 per cent. of manganese, and of normal or "carbon" steel when hardened by sudden cooling.

(11) γ iron is the non-magnetic variety, stable above A_3, characteristic of nickel and 12 per cent. manganese steels, and probably relatively hard, but ductile.

In Fig. 4, AB and BD represent the freezing-point of iron for different proportions of carbon, and the lines below these, aBc, GOS, SE, MO, and PSP′ represent spontaneous retardations which occur during the undisturbed further slow cooling, showing that at these several lines heat is evolved within the metal, and hence that some molecular rearrangement occurs. Each of the tripartite groups of lines, (1) AB, BD, aBc, and (2) GOS, SE, PSP′, is of the family of curves of the solidification of those solutions which in freezing break up to form a mechanical mixture of (*a*) a eutectic, and (*b*) the component of that eutectic which is in excess over the eutectic ratio. The natural inference that these two groups here represent analogous occurrences is thus far well supported by the evidence.

To illustrate the meaning of the diagram let us follow by means of the ordinate QUW the undisturbed slow cooling from the molten state of a hyper-eutectic steel containing 1·00 per cent. of carbon. When the gradually falling temperature reaches 1460° C., (Q) the mass as a whole freezes gradually, forming martensite, apparently simply a solidified solution of carbon in γ iron, which, though solid, preserves the essential characteristics of a solution. The heat evolved during solidification retards the fall of temperature; after this the rate of cooling remains regular until T (850°) on the line STE (A_{r3}) is reached, when a second retardation occurs, due to the heat liberated by the passage within the pasty mass of part of the iron and carbon from a state of mere solution to that of definite combination in the ratio Fe_3C, forming microscopic particles of cementite, while the remainder of the iron and carbon continue dissolved in each other as martensite. This formation of cementite continues as the temperature falls, till at about 690° C., (U, called $A_{r3\text{-}1}$) so much of the carbon (in this case about 0·10 per cent.) and of the iron has united in the ratio of cementite, that the composition of the remaining solid-solution or "mother-metal" of martensite has reached that of hardenite; *i.e.*, it now contains 0·90 per cent. of carbon. As the temperature now falls past 690°, this hardenite mother-metal in turn splits up, after the fashion of eutectics, into alternate layers of ferrite and cementite grouped together as pearlite, so that the mass as a whole now becomes a mixture of pearlite with cementite. The iron thus liberated, as the ferrite of this pearlite, changes simultaneously to α ferrite. The passage of this large quantity of carbon and iron, 0·90 per cent. of the former and 12·6 of the latter, from a state of mere solution as hardenite to one of definite chemical union as cementite, together with the passage of the iron itself from the γ to the α state, evolves so much heat as actually to heat the mass up so that it brightens in a striking manner. This phenomenon is called the "recalescence." The change from martensite to ferrite and cementite is accompanied by the loss of the hardening power, as will be explained shortly.

To take a second case, molten hypo-eutectic steel of 0·20 per cent. of carbon on freezing at K passes to the state of martensite, γ iron with this 0·20 per cent. of carbon dissolved in it. Its further cooling undergoes three spontaneous retardations, one at K′ (A_{r3}), at about 820° C., at which part of the iron isolates itself in separate crystals within the solid solution as ferrite, and in crystallizing passes from the γ to the β state, that is, free iron of the β allotropic modification. At the second retardation, K″ (A_{r2}), which occurs at about 770° C., this β ferrite changes to the normal and magnetic α state, so that the metal becomes magnetic. Moreover, the crystallization of ferrite within the martensite, which began at A_{r3}, continues until 690° or A_{r1} is reached, by which time so much iron has separated out that the remaining mother-metal has reached the composition of hardenite, *i.e.*, it now contains 0·90 per cent. of carbon. Again, as the temperature in turn falls past A_{r1}, this hardenite mother-metal splits up into cementite and ferrite grouped together as pearlite, with simultaneous change of this ferrite to the α state, and with the resulting recalescence. All these phenomena are parallel with those of 1·00 per cent. carbon steel at this same critical point A_{r1}. As such steel cools slowly past A_{r3}, A_{r2}, and A_{r1}, it loses its hardening power progressively. In short, from A_{r3} to A_{r1}, the excess

substance, ferrite or cementite, in hypo- and hyper-eutectic steels respectively, progressively crystallizes out within the martensite mother-metal, which thus progressively approaches the composition of hardenite, reaching it at A_{r1}, and there splitting up into ferrite and cementite interstratified as pearlite. Further, any ferrite liberated at A_{r3} changes there from γ to β, and any present at A_{r2} changes from β to α. Between O and S, A_{r3} and A_{r2} occur together, as do A_{r2} and A_{r1} between S and P′, and A_{r3}, A_{r2}, and A_{r1} at S itself; so that these critical points in these special cases are called $A_{r3\text{-}2}$, $A_{r2\text{-}1}$, and $A_{r3\text{-}2\text{-}1}$ respectively. The corresponding critical points which occur during rise of temperature, with the reverse transformations, are called A_{c1}, A_{c2}, A_{c3}, &c., A (Chernoff) being their generic name, r referring to falling temperature (refroidissant), and c to rising temperature (chauffant, Osmond).

To take a third case, that of hyper-eutectic steel containing

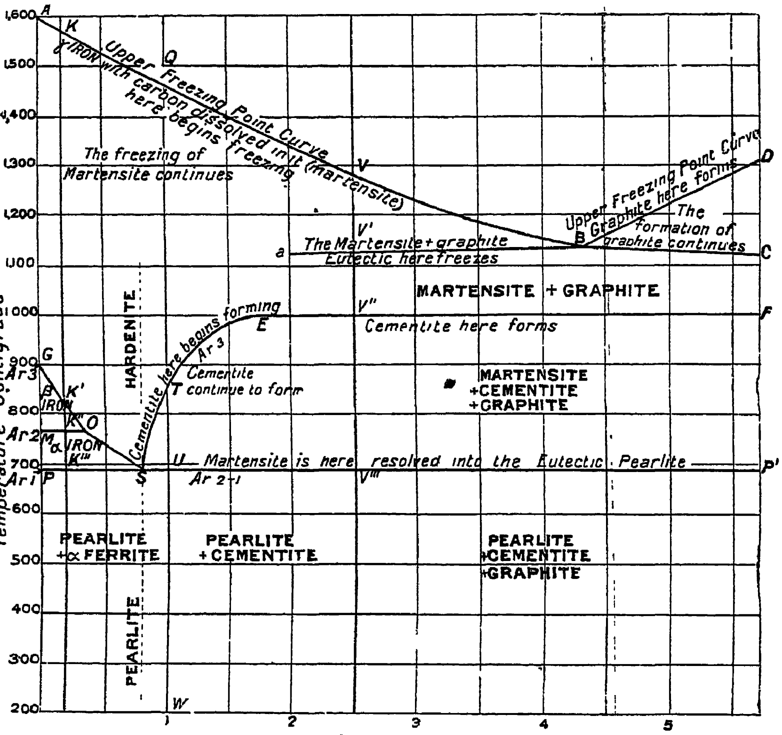


FIG. 4.—The constitution of iron and steel. (After Roberts-Austen, with modifications by Bakhuis Roozeboom.) The Roman letters indicate the constituents normal and stable in each of the many fields into which the diagram is divided. The transformations which in cooling occur at the horizontal and oblique boundary lines of these fields are indicated in italics.

2·50 per cent. of carbon, and thus approaching the limits of cast iron: since some 2 per cent. of carbon suffices to saturate solid γ iron, the martensite, which progressively freezes out as the temperature sinks below V, tends to reject, and thus to leave in the still molten matrix of entangled mother-metal, all carbon in excess of this quantity. This progressive separation of martensite, with consequent enrichment of the mother-metal in carbon, continues with further fall of temperature until, when 1125° C. (V′ on aBc) has been reached, the carbon-content of the mother-metal has reached 4·30 per cent., which is that of the martensite plus graphite eutectic. As the temperature now sinks past aBc this mother-metal in turn freezes as a whole, splitting up into the eutectic conglomerate of martensite plus graphite, and, as in the other cases, the heat thus liberated retards the cooling. When the temperature falls to 1000°, part of the graphite already formed unites with part of the iron of the martensite to form cementite; so that between V″ and V‴ the mass is a conglomerate of martensite, cementite, and graphite. On reaching A_{r1} at V‴ this martensite (now become hardenite) as usual splits up into pearlite, and the mass now becomes a conglomerate of pearlite, cementite, and graphite, and remains so after cooling is complete.

As we pass to cases with higher and higher carbon-content, the martensite which begins freezing on cooling past the line AB forms a smaller and smaller proportion of the whole, and the martensite-graphite eutectic which forms at the second freezing-point aB increases in amount until, when the carbon-content reaches 4·30 per cent., there is but a single freezing-point, and the whole mass when solid is made up of this eutectic. If there be more than 4·30 per cent. of carbon, then not martensite but graphite solidifies between BD and Bc, but, as before, the martensite-graphite eutectic freezes at the lower freezing-point Bc. But in either case the changes occur at EF and PSP′ which have been described for hyper-eutectic steel of 2·50 per cent. of carbon.

Just as the presence of carbon shifts the positions of the freezing-point and of the various critical points, so does that of other elements, notably silicon, phosphorus, manganese, chromium, nickel, and tungsten. Nickel and manganese lower these critical points, so that, with 25 per cent. of nickel or with 13 per cent. of manganese, A_{r3} lies below the common temperature of 20° C. These steels then normally consist of γ iron, modified by the large amount of nickel or manganese with which it is alloyed. They naturally are non-magnetic, or very feebly magnetic. But the critical points of such nickel steel, though thus depressed, are not destroyed; and if it be cooled in liquid air below its A_{r2}, it passes to the α state and becomes magnetic.

§ 3. *Thermal Treatment.*—The hardening, tempering, and annealing of steel, the chilling and annealing of cast iron, and the annealing of malleable cast iron, are readily explained by the facts just set forth. Sudden cooling hardens and embrittles steel and cast iron because it retains the high temperature martensite state, by denying the time needed for these successive transformations which, in slow cooling, finally yield a mixture of pearlite either with ferrite, or with cementite alone, or with cementite and graphite; in the cold these transformations cannot take place, thanks to molecular rigidity or other cause. The suddenly cooled metal is hard and brittle, because the cold martensite which it contains is hard and brittle. The degree of hardening which steel undergoes increases with its carbon-content, either (1) because the hardness of martensite increases with its own carbon-content; or (2) because during sudden cooling the presence of carbon, like a brake, impedes the change from martensite to pearlite with ferrite or cementite, thus leading to a more complete retention of the martensite, or of the intermediate β state of the ferrite; or (3) for both reasons.

But these transformations, though restrained by the sudden cooling, still tend to occur; if we reheat hardened steel to say 250° C. (482° F.) as in tempering, we so far relax this restraint that part of the martensite, thus forcibly retained, changes to pearlite with ferrite or cementite. We undo the effect of the sudden cooling, to a degree which increases with the temperature of reheating or "tempering," and with the degree of molecular freedom which it gives. If the reheating be carried still farther, to a dull red heat, the restraint is wholly relaxed, so that the change from martensite to pearlite and cementite becomes complete; the metal is as soft and ductile as if the cooling had been slow instead of sudden; it is annealed.

"Chilling" cast iron, *i.e.*, hastening its cooling by casting it in a cold mould, restrains the separation of graphite by hurrying the metal through the range between ABD and EF in which graphite tends to form, and retains in its stead the supersaturated martensite which the metal forms on sudden solidification, more or less split up into pearlite and cementite on passing $A_{r2\text{-}1}$. The annealing of such iron may occur in either of two degrees—a small one, as in making common chilled cast iron objects, such as railway car wheels, or a great one, as in making malleable cast iron. In the former case, the objects are heated only to the neighbourhood of A_{r1}, so that the martensite may resolve itself into pearlite and cementite. The joint effect of such chilling and such annealing is to make the metal much harder than if slowly cooled, because for each 1 per cent. of graphite which the chilling

suppresses, the annealing substitutes 15[1] per cent. of the glass-hard cementite.

In making "malleable cast iron" the reheating is carried to a temperature near or perhaps above EF, so that the graphite-forming tendency, suppressed by the initial relatively rapid cooling—a suppression favoured by the special composition of the cast iron used—asserts itself. Since graphite and iron combine to form cementite when the temperature sinks past 1000°, reheating the metal above 1000° should cause cementite to split up into martensite plus graphite. Graphite now forms slowly within the mass; but whereas the graphite which separates when common cast iron objects cool slowly from the melting-point forms large flakes which weaken and embrittle the metal by breaking up its continuity, that which now separates forms a fine powder, naturally much less injurious. For this heating the castings are packed in a mass of iron oxide, which at this temperature gradually removes the fine or "temper" graphite by oxidizing that in the outer crust to carbonic oxide, whereon the carbon farther in begins diffusing outwards by "molecular migration," to be itself oxidized on reaching the crust. This removal of graphite doubtless further stimulates the formation of graphite, by relieving the mechanical and perhaps the osmotic pressure. Thus, first, for the brittle glass-hard cementite and martensite there is gradually substituted the relatively harmless temper graphite; and, second, even this is in large part removed by surface oxidation.

Each of these ancient processes thus consists essentially in so manipulating the temperature that, out of the several possible constituents, the metal shall actually consist of a special set in special proportions. But in addition there is another very important principle underlying many of our thermal processes, viz., that the state of aggregation of certain of these constituents, and through it the properties of the metal, as a whole, are profoundly affected by temperature manipulations. Thus, prior exposure to a temperature materially above A_{c1} coarsens the structure of most steel, in the sense of giving it when cold a coarse fracture, and enlarging the grains of pearlite, &c., found in the slowly-cooled metal. This coarsening and the brittleness which accompanies it increase with the temperature to which the metal has been exposed. Steel which after a slow cooling from about 722° C. will bend 166° before breaking, will, after slow cooling from about 1050° C., bend only 18° before breaking. This injury fortunately can be cured either by *reheating* the steel to A_{c1}, when it "refines," *i.e.*, returns spontaneously to its fine-grained ductile state (*cooling* past A_1 does not have this effect); or by breaking up the coarse grains by *mechanical distortion*, *e.g.*, by forging or rolling. For instance, if steel has been coarsened by heating to 1400° C., and if, when it has cooled to a lower temperature, say 850° C., we forge it, its grain-size and ductility when cold will be approximately those which it would have had if heated only to 850°. Hence steel which has been heated very highly, whether for welding, or for greatly softening it so that it can be rolled to the desired shape with but little expenditure of power, ought later to be refined, either by reheating it from below A_{r1} to A_{r1}, or by rolling it after it has cooled to a relatively low temperature, *i.e.*, by having a low "finishing temperature." Steel castings initially have the extremely coarse structure due to cooling without mechanical distortion from their very high temperature of solidification; they are "annealed," *i.e.*, this coarseness and the consequent brittleness are removed, by reheating them to the critical range, which also relieves the internal stresses due to the different rates at which different layers cool, and hence contract, during and after solidification. For steel containing less than some 0·13 per cent. of carbon, the embrittling temperature is in a different range, near 700° C., and such steel refines at temperatures above 900° C.

When we consider the great number of different regions in Fig. 4, each with its own set of constituents, and remember that by different rates of cooling from different temperatures we can retain in the cold metal these different sets of constituents in widely varying proportions; and when we further reflect that not only the proportion of each constituent present but also its state of aggregation can be controlled by thermal treatment, we see how vast a field is here opened, how great a variety of different properties can be induced in any individual piece of steel, how enormous the variety of properties thus attainable in the different varieties collectively, especially since for each percentage of carbon an incalculable number of varieties of steel may be made by alloying it with different proportions of such elements as nickel, chromium, &c. As yet there has been only the roughest survey of certain limited areas in this great field, the further exploration of which will enormously increase the usefulness of this wonderful metal.

[1] Fifteen per cent., if we add together both the "excess" cementite and that contained in the eutectic pearlite, which result finally from the carbon which has been prevented from separating as graphite.

§ 4. *Alloy steels* have come into extensive use for important special purposes, and a very great increase of their use is to be expected. The chief ones are nickel steel, manganese steel, chrome steel, and tungsten steel. The general order of merit of a given variety or specimen of iron or steel may be measured by the degree to which it combines strength and hardness with ductility. These two classes of properties tend to exclude each other, for, as a general rule, whatever tends to make iron and steel hard and strong tends to make it correspondingly brittle, and hence liable to break treacherously, especially under shock. Manganese steel and nickel steel form an important exception to this rule, in being at once very strong and hard and extremely ductile. *Nickel steel*, which usually contains from 3 to 3·50 per cent. of nickel and about 0·25 per cent. of carbon, combines very great tensile strength and hardness, and a very high limit of elasticity, with great ductility. Its combination of ductility with strength and hardness has given it very extended use for the armour of war-vessels. For instance, following Krupp's formula, the side and barbette armour of war-vessels is now generally if not universally made of nickel steel containing about 3·25 per cent. of nickel, 0·25 per cent. of carbon, and 1·50 per cent. of chromium, deeply carburized on its impact face. Here the merit of nickel steel is not so much that it resists perforation, as that it does not crack even when deeply penetrated by a projectile. The combination of ductility, which lessens the tendency to break when overstrained or distorted, with a very high limit of elasticity, gives it great value for shafting, the merit of which is measured by its endurance of the repeated stresses to which its rotation exposes it whenever its alignment is not mathematically straight. The alignment of marine shafting, changing with every passing wave, is an extreme example. Such an intermittently applied stress is far more destructive to iron than a continuous one, and even if it be only half that of the limit of elasticity, its indefinite repetition eventually causes rupture. In a direct competitive test the presence of 3·25 per cent. of nickel increased nearly sixfold the number of rotations which a steel shaft would endure before breaking.

As actually made, *manganese steel* contains about 12 per cent. of manganese and 1·50 per cent. of carbon. Although the presence of 1·50 per cent. of manganese makes steel brittle, and although a further addition at first increases this brittleness, so that steel containing between 4 and 5·5 per cent. can be pulverized under the hammer, yet a still further increase gives very great ductility, accompanied by great hardness—a combination of properties which was not possessed by any other known substance when this remarkable alloy, known as Hadfield's manganese steel, was discovered. Its ductility, to which it owes its value, is profoundly affected by the rate of cooling. Sudden cooling makes the metal extremely ductile, and slow cooling makes it brittle; its behaviour in this respect is thus the opposite of that of carbon steel. Its great hardness, however, is not materially affected by the rate of cooling. It is used extensively for objects which require both hardness and ductility, such as rock-crushing machinery, railway crossings, mine-car wheels, and safes. The burglar's blow-pipe locally "draws the temper," *i.e.*, softens a spot on a hardened carbon steel or chrome steel safe by simply heating it, so that as soon as it has again cooled he can drill through it and introduce his charge of dynamite. But neither this nor any other known procedure softens manganese steel. This very fact that it is unalterably

hard has, however, limited its use, because of the great difficulty of cutting it to shape, which has in general to be done with emery wheels instead of the usual iron-cutting tools. Another defect is its relatively low elastic limit.

Chrome steel, which usually contains about 2 per cent. of chromium and 0·80 to 2 per cent. of carbon, owes its value to combining, when in the "hardened" or suddenly cooled state, intense hardness with a high elastic limit, so that it is neither deformed permanently nor cracked by extremely violent shocks. For this reason it is the material generally if not always used for armour-piercing projectiles. It is much used also for certain rock-crushing machinery (the shoes and dies of stamp-mills), and for safes. These are made of alternate layers of chrome steel and soft wrought iron, hardened by sudden cooling. The hardness of the hardened chrome steel resists the burglar's drill, and the ductility of the wrought iron the blows of his sledge.

Tungsten steel, which usually contains from 5 to 10 per cent. of tungsten and from 1 to 2 per cent. of carbon, is used for magnets, because of its great retentivity, and for lathes and similar metal-cutting tools which are to cut off a very thick slice at each cut. The great friction, due to the thickness of the cut, heats the tool to a temperature at which the temper of common or "carbon" steel is drawn. The merit of tungsten steel is that, like manganese steel, it retains its extreme hardness even after it has been heated to 400° C. (752° F.). Under these conditions the Taylor and White variety retains its cutting power even when the friction is so great that the chips of metal cut are so hot as to glow visibly, and even the edge of the tool itself grows red-hot.

§ 5. *Deep Carburizing; Harvey and Krupp Processes.*—Much of the heavy side armour of war-vessels is made of nickel steel initially containing so little carbon that it cannot be hardened, *i.e.*, it remains very ductile even after sudden cooling. The impact face of these plates is given the intense hardness needed by being converted into high-carbon steel, and then hardened by sudden cooling. Harvey carburized the impact face to a depth of about an inch by heating the plate for about a week to about 1200° C. (2192° F.), with that face strongly pressed against a bed of charcoal. The Krupp process, a newer one, carburizes the impact face by exposing it at a high temperature to illuminating gas. This is decomposed by the heat, and deposits on the face of the plate a layer of fine carbon, which is absorbed by the steel as in the cementation process. The impact face thus carburized is cooled suddenly from a red heat, *e.g.*, by spraying it with iced brine. An intensely hard impact surface results, the hardness decreasing gradually from this face inwards. Thanks to the glass-hardness of the face, the projectile is arrested so abruptly that it is shattered, and its energy is delivered piecemeal by its fragments; but as the face is integrally united with the unhardened, ductile, and slightly yielding interior and back, the plate, even if it be bent backwards somewhat by the blow, neither cracks nor flakes.

II. Extraction of Iron from its Ores.

§ 6. The *blast-furnace process* has been so much cheapened by the great increase in its rate of production, and by the introduction of mechanical appliances for handling the raw materials and the iron and slag, that it is now the sole important process of extracting iron from its ores. Practically all the iron ore mined passes through the blast-furnace, if we except the relatively small quantity used in the puddling and the open-hearth processes, each of which may recover a fraction of the iron of the ore used in it. The blast-furnace has a very great advantage over the direct processes of extracting wrought iron or steel from

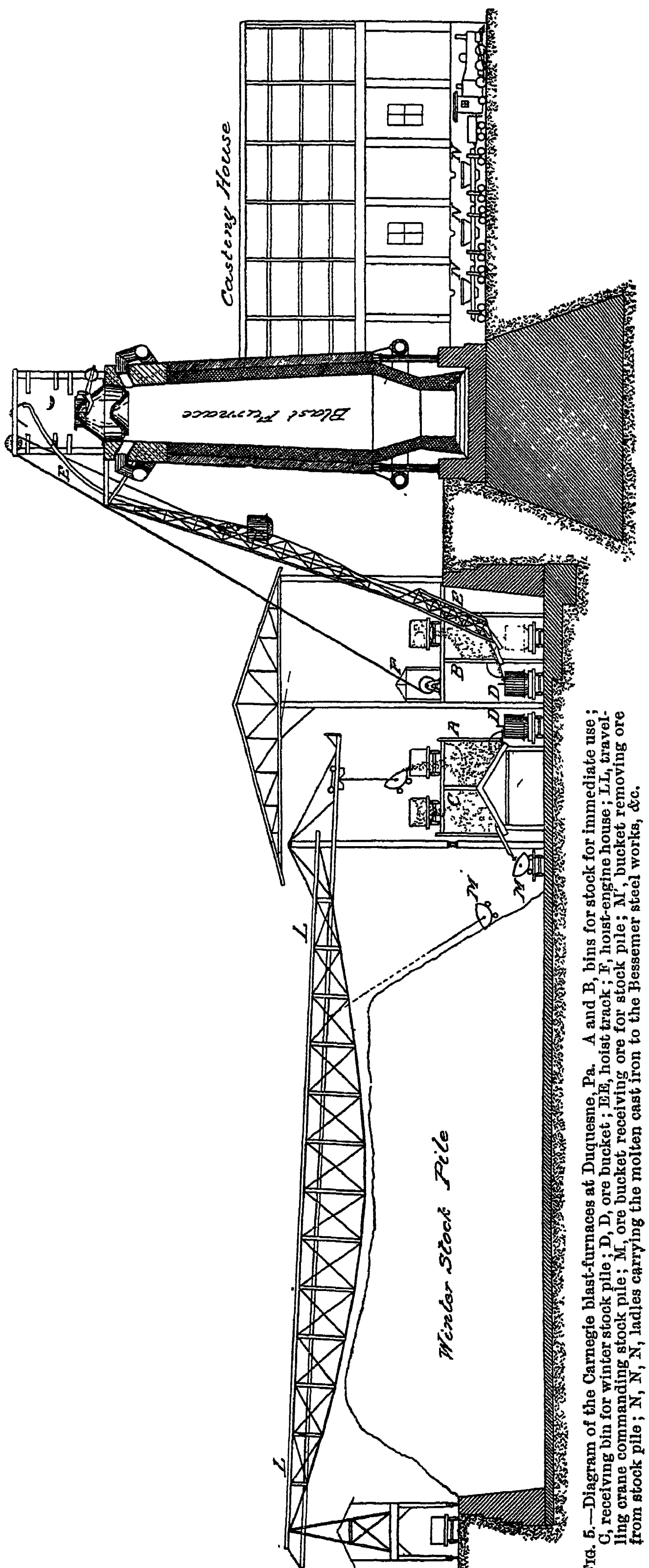


Fig. 5.—Diagram of the Carnegie blast-furnaces at Duquesne, Pa. A and B, bins for stock for immediate use; C, receiving bin for winter stock pile; D, D, ore bucket; EE, hoist track; F, hoist-engine house; LL, travelling crane commanding stock pile; M, ore bucket receiving ore for stock pile; M', bucket removing ore from stock pile; N, N, N, ladles carrying the molten cast iron to the Bessemer steel works, &c.

the ore, in recovering nearly the whole of the iron present, and in delivering both its products, the metal and the slag, in a molten state, in which they can be handled far

more cheaply than if solid or pasty. It is not easy to see how either of these things can be accomplished by any direct process. The advantages of the blast-furnace are so great, that not only have the direct processes practically

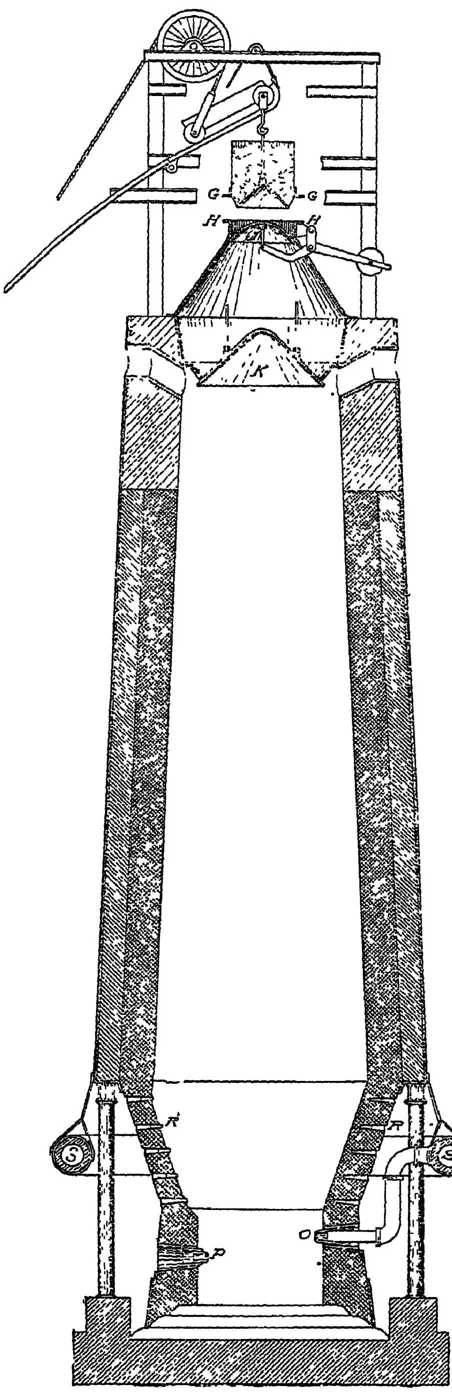


FIG. 6.—Section of one of the Duquesne blast-furnaces. GG, flanges on the ore bucket; HH, fixed flanges on the top of the furnace; J, counter-weighted false bell; K, main bell; O, tuyere; P, cinder notch; R, R', water-cooled boxes; S, blast pipe.

ceased to exist, but we can hardly see in what way they are to be revived, unless it be through some modification of the blast-furnace process itself, which shall bring the composition of its product nearer to that of steel, *i.e.*, shall give it less carbon and silicon than are present in cast iron as now made. The stumbling-block in the way of developing such a modification is the removal of sulphur. The processes for converting cast iron into steel can now remove phosphorus easily, but the removal of sulphur in them is so difficult that it has to be accomplished for the most part in the blast-furnace itself. In the latter there have been remarkable economies in the mechanical arrangements for handling the ore, flux, and fuel, and the cast iron and slag; a great improvement in the protection of the inner walls of the furnace by better water-cooling; and a remarkable increase in the output, chiefly due to the use of extremely powerful blowing engines and blast-heating stoves. But the latest great advance, the use in gas engines of the waste gases escaping from the top of the furnace, is perhaps the most striking and important of all.

A. *The Handling of Raw Materials.*—That any of the raw materials should be shovelled by hand is a thing

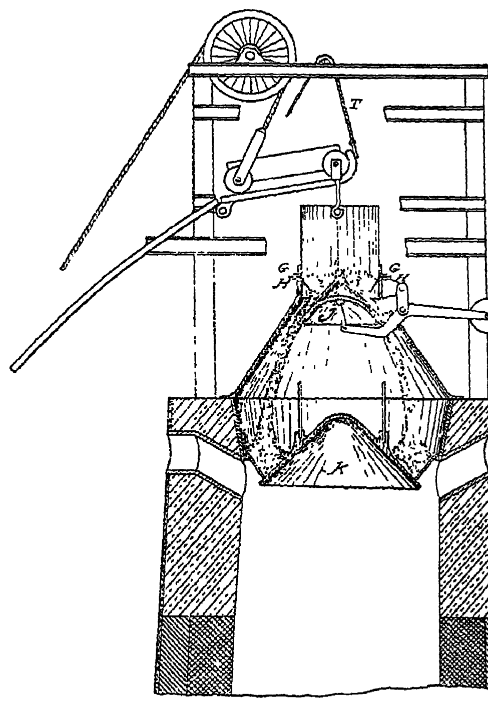


FIG. 7.—Diagram showing the transfer of the ore from the bucket to the main charging bell. Lettering as in Fig. 6.

no longer even to be considered in designing new works, at least in the United States. The arrangement at the Carnegie Company's Duquesne works (Fig. 5) may serve as an example of modern methods of handling.

The standard-gauge cars which bring the ore and coke to Duquesne pass over one of three very long rows of bins, A, B, and C (Fig. 5), of which A and B receive the materials (ore, coke, and limestone) for immediate use, while C receives those to be stored for winter use. From A and B the materials are drawn as they are needed into large buckets D standing on cars, which carry them to the foot of the hoist track EE, up which they are hoisted to the top of the furnace. Arrived here, the material is introduced into the furnace without allowing any of the furnace gas to escape by an ingenious piece of mechanism. The hoist-engineer in the house F at the foot of the furnace, when informed by means of an indicator that the bucket has arrived at the top, lowers it so that its flanges GG (Fig. 6) rest on the corresponding fixed flanges HH, as shown in Fig. 7. The further descent of the bucket being thus arrested, the special cable T is now slackened, so that the conical bottom of the bucket drops down, pressing down by its weight the counter-weighted false cover J of the furnace, so that the contents of the bucket slide down into the space between this false cover and the true charging bell, K. The special cable T is now tightened again, and lifts the bottom of the bucket so as both to close it and to close the space between J and K, by allowing J to rise back to its initial place. The bucket then descends along the hoist-track to make way for the next succeeding one, and K is lowered, dropping the charge into the furnace. Thus some 1700

tons of materials are charged daily into each of these furnaces without being shovelled at all, running by gravity from bin to bucket and from bucket to furnace, and being hoisted and charged into the furnace by a single engineer below, without any assistance or supervision at the furnace-top.

The winter stock of materials is drawn from the left-hand row of bins, and distributed over immense stock piles by means of the great crane LL (Fig. 5), which transfers it as it is needed to the row A of bins, whence it is carried to the furnace, as already explained.

B. *Handling the Molten Cast Iron.*—A great saving of labour was effected by the introduction of "pig-breaking" machines. A whole row or litter of pigs, with its sow (see *Ency. Brit.*, vol. xiii. p. 306, Fig. 24), was lifted from its moulds by a travelling crane, and placed on rollers which progressively fed it forward, one pig at a time, under a hydraulic press with three plungers, of which one broke off the sow between a given pig and its neighbour, and two others broke the pig itself into three pieces, which slid down into a car beneath. The iron is handled still more cheaply by the Uehling type of casting machine (Fig. 8), which consists essentially of a series of thin moulds, BB, carried by endless chains past the lip of a great ladle A. This pours into them the molten cast iron which it has just received direct from the blast-furnace. As the string of moulds, each thus containing a pig, moves slowly forward, the pigs solidify and cool, the more quickly because in transit they are sprayed with water, or even submerged in water in the tank EE. Arrived at the farther sheave C, the now cool pigs are dumped into a railway car. Besides a very great saving of labour, which, however, is partly counterbalanced by the cost of repairs, these machines have the great merit of making the management independent of a very trouble-some set of labourers, the hand pig-breakers, who were not only absolutely indispensable for every cast and every day, because the pig iron must be removed promptly to make way for the next succeeding cast of iron, but very difficult to replace because of the great physical endurance required.

C. *Preservation of the Furnace Walls.*—The combined fluxing and abrading action of the descending charge tends to wear away the lining of the furnace where it is hottest, which of course is near its lower end, thus changing its shape materially, lessening its efficiency, and in particular increasing its consumption of fuel. The walls therefore are now made thin, and are thoroughly cooled by water, which circulates through pipes or boxes bedded in them. Mr James Gayley's method of cooling, shown at the right-hand side of Fig. 6, is to set in the brickwork walls several horizontal rows of flat water-cooled bronze boxes, RR′, extending nearly to the interior of the furnace, and tapered so that they can readily be withdrawn and replaced in case they burn through. The brickwork may wear back to the front edges of these boxes, or even, as is shown at R′, a little farther. But in the latter case their edges still determine the effective profile of the furnace walls, since the depressions at the back of these edges become filled with carbon and scoria-ceous matter when the furnace is in normal working. Each of these rows, of which five are shown in Fig. 6, consists of a great number of short segmental boxes.

D. *Blast-furnace Gas Engines.*—The gases which escape from the top of the blast-furnace are necessarily very rich in carbonic oxide, of which they usually contain between 20 and 26 per cent., and they are thus a very valuable fuel. They have hitherto been used chiefly for heating the blast, and for raising steam not only for generating that blast, but also more lately for the rolling-mill and other engines of the establishment. But it has now been shown that these gases can be used directly in gas engines, in which they generate about four times as

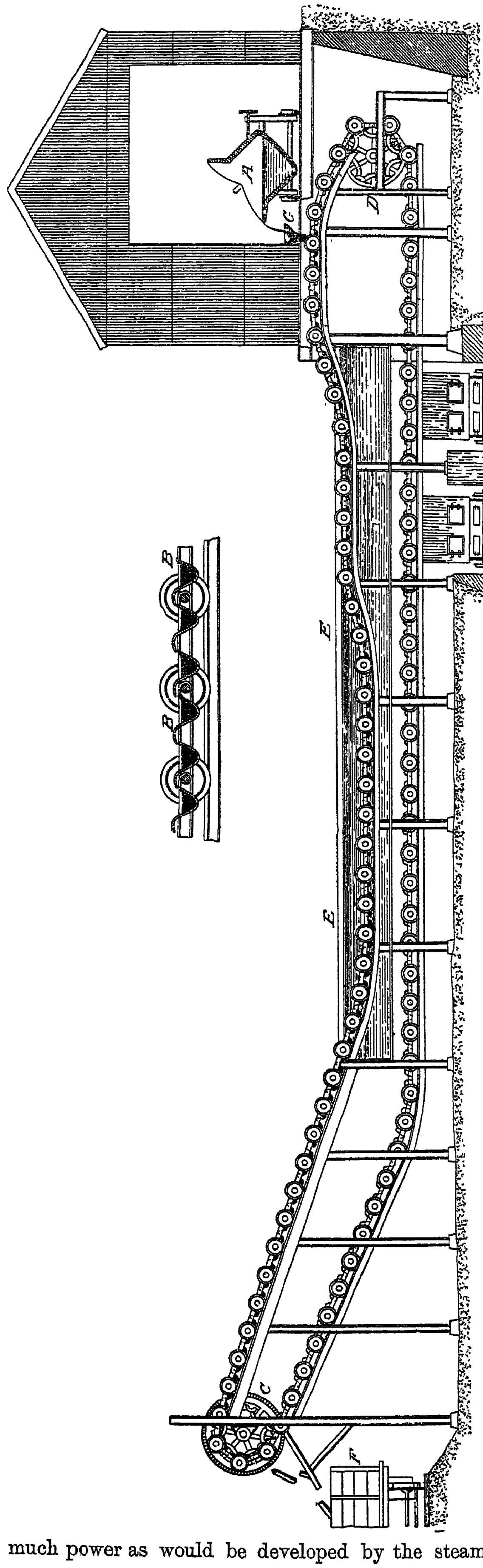


FIG. 8.—Diagram of pig-casting machine. A, ladle bringing the cast iron from the blast-furnace; BB, the moulds; C, D, sheaves carrying the endless chain of moulds; E, E, tank in which the moulds are submerged; F, car into which the cooled pigs are dropped; G, distributing funnel

much power as would be developed by the steam raised

by burning them under boilers. It has been calculated that the gas from a pair of old-fashioned blast-furnaces, making 1600 tons of iron per week, would in this way yield some 16,000 horse-power in excess of their own requirements. At that rate a pair of the great American furnaces would have some 70,000 horse-power to spare. Although the quantity may really be much less than this, because the higher efficiency of these furnaces leaves less residual calorific power in the waste gases, it is clear that their importance as sources of power is very great. This use of the gas engine is likely to have far-reaching results. In order to utilize this power, the converting, *i.e.*, steel-making, mill and the rolling-mills must adjoin the blast-furnace. The numerous converting mills which treat pig iron made at a distance will now have the crushing burden of providing in other ways the power which their rivals get from the blast-furnace, in addition to the severe disadvantage under which they already suffer, of wasting the initial heat of the molten cast iron as it runs from the blast-furnace.

E. *Hot-Blast Stoves.*—The cast iron or "pipe" stoves, in which the blast was heated by passing through a long series of cast iron pipes, around and outside which the waste gases of the blast-furnace itself were burnt, are fast going out of use, chiefly because they are destroyed quickly if an attempt is made to heat the blast above 1000° F. (538° C.). In their place the regenerative stoves of the Whitwell and Cowper (Fig. 9) types are chiefly used. With these the regular temperature of the blast at some works is about 1400° F. (760° C.), and the usual blast temperature lies between 900° and 1200° F. (480° and 650° C.).

Like the Siemens furnace, they have two distinct phases—one "on gas," during which part of the waste gas of the blast-furnace is burnt within the stove, highly heating the great surface of brickwork which for that purpose is provided within it; the other, "on wind," during which the blast is heated by passing it back over these very surfaces which have thus been heated. They are heat-filters or heat-traps for impounding the heat developed by the combustion of the furnace gas, and later returning it to the blast. Each blast-furnace is now provided with three or even four of these stoves, which collectively may be nearly thrice as large as the furnace itself. At any given time one of these is "on wind" and the others "on gas." The Whitwell stove (*Ency. Brit.*, vol. xiii. p. 304, Fig. 19) has been simplified by greatly lengthening it and reducing the number of its vertical partitions from nine to three, so that the blast, and also the gas, has only three instead of nine reversals of direction, and the blowing engines have just so much less frictional resistance to overcome. The necessary heating surface is given by three high partitions instead of by nine short ones. The Cowper stove (Fig. 9) differs from the Whitwell (1) in having not a series of flat smooth walls, but a great number of narrow vertical flues, for the alternate absorption and emission of the heat, with the consequence that, for given outside dimensions, it offers about one-half more heating surface than the Whitwell stove; and (2) in that the gas and the blast pass only once up and once down through it, instead of twice up and twice down as in the modern Whitwell stoves. As regards frictional resistance, this smaller number of reversals of direction compensates in a measure for the smaller size of its flues. The large combustion chamber B permits thorough combustion of the gas.

F. *The Increase in the Rate of Production* per furnace has been extraordinary. In 1863 a daily production of 50 tons per furnace, and in 1880 one of 115 tons, was unusually large; but in 1898 one of the

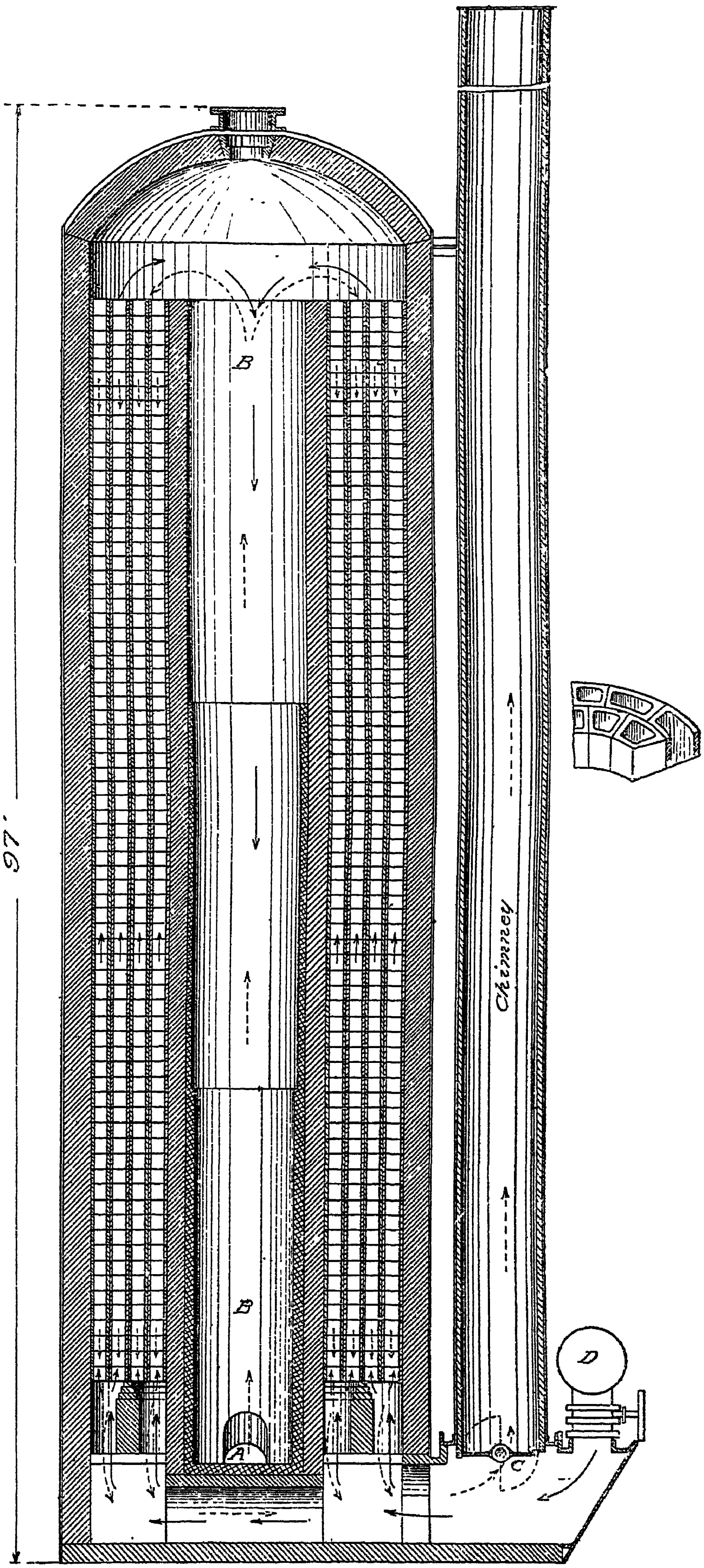


Fig. 9.—Diagram of Cowper hot-blast stove at Duquesne. (After J. Kennedy.) A, entrance for blast-furnace gas; B, B, combustion chamber; C, chimney valve; D, cold blast main. Broken arrows show the path of the gas and air while the stove is "on gas," and solid arrows that of the blast while it is "on wind."

Duquesne furnaces made 711 tons in a day, and the four furnaces there were making regularly between 2200 and 2300 tons daily, a rate as great as that of the whole world in 1800, and half as great as that of all the United States furnaces collectively in 1870. The rate of output of a single one of these furnaces is much greater than that of all the United States furnaces in 1830, about ten times that of 1820, and nearly four times that of the 153 furnaces in the United States in 1810. These Carnegie furnaces of course are exceptional ones, and the common rate of production, especially in case of European furnaces, is much less. For instance, the average daily production in the eighty-five existing and projected furnaces of Lorraine and Luxemburg is estimated at only 127 tons, and the greatest estimated daily production for any of those now building is only 200 tons. Indeed, it is questioned whether the rapid driving at Duquesne, with its rich Lake Superior ores, would be economical if applied to the lean Minette ores of Luxemburg and Lorraine. The remarkable increase since 1880 has been brought about, not chiefly by the use of larger furnaces, although the hearth or crucible is made somewhat wider than formerly, but by providing very powerful engines and hot-blast stoves; and it has almost forced the adoption of simple mechanical arrangements for handling rapidly both the raw materials and the products of the furnace. Between 1880 and 1899 the importance of anthracite as a fuel for iron smelting decreased greatly and that of charcoal very greatly; thus of the total United States product of pig iron, the percentage made with anthracite decreased in this period from 42 to 12, and that made with charcoal from 13 to 2 (see Table VI.).

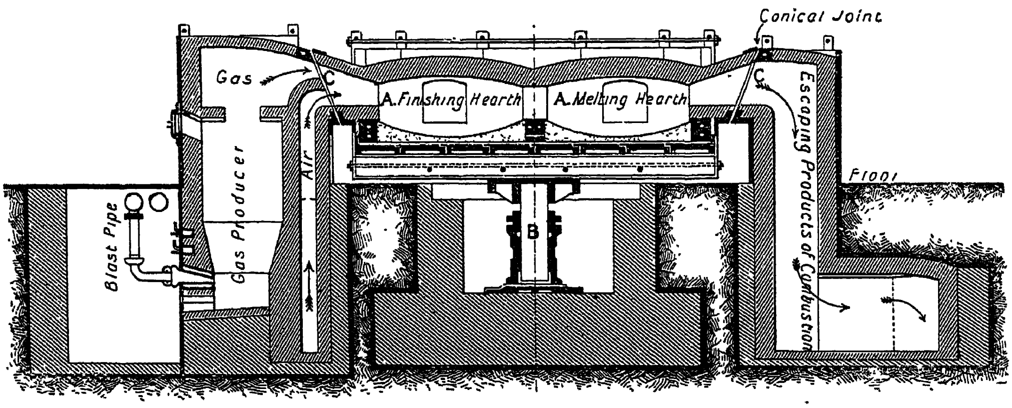


FIG. 10.—Diagrammatic section of the Pietzka puddling furnace.

III. CONVERSION INTO WROUGHT IRON AND STEEL.

§ 7. *Manufacture of Wrought Iron.*—That wrought iron, which in 1880 seemed about to be completely displaced by mild steel, remains in very extensive use is due chiefly (1) to the conservatism, often reasonable, of certain consumers, (2) to the great ease with which it welds, and (3) to the great purity which can readily be given to it. Thus wrought iron horse-shoes, bars, &c., are made in great quantities for country smiths and others who have had no opportunity to learn the slightly different treatment which mild steel needs. Welded steam, gas, and water pipes also are still often made of wrought iron instead of steel, because here thoroughness of welding is of the first importance, and because if steel for pipes is made sufficiently free from carbon to weld readily, special care is needed to prevent cavities called "blow-holes" (see § 12), due to the escape of gas from the steel when the ingots into which it is initially cast are solidifying. These blow-holes are liable either to aggravate the effects of rusting by causing local pitting, or to injure the soundness of the thread which is cut at the end of each length of pipe. As a material for making the better classes of tool steel by remelting by the crucible process, wrought iron is preferred to mild steel, both because it can be made freer than mild steel from certain elements, especially manganese, which are here undesirable, and because the crucible steel made from it is, in the opinion of the best judges, better than that made from mild steel even if of like composition, though why this is so has not been convincingly explained. For the former of these reasons, too, and perhaps also because of its very defect of being laminated by the presence of cinder, wrought iron is more ductile than mild steel under certain special conditions of use, such as those of rivets and horse-shoe nails, many of which are made of it.

While the yearly production of wrought iron in the United States more than doubled between 1870 and 1890, yet since the latter year it has shrunk very much, probably nearly to that of 1870; and between 1870 and 1900 the proportion which the production of wrought iron bears to that of steel diminished very greatly. Of the combined annual production of wrought iron and steel in the United States, that of wrought iron formed 95 per cent. in 1870, 63 per cent. in 1880, 37 per cent. in 1890, and probably not far from 15 per cent. in 1899. The corresponding numbers for Great Britain are 34 per cent. for 1890, and 19 per cent. for 1899, in which year the average number of British puddling furnaces in operation is reported as 1149 out of a total of 1320 in existence. Thus in nineteen years the position of wrought iron changed from that of the chief product to one of secondary importance.

The *Puddling Process* still supplies nearly all the wrought iron made. The numerous mechanical puddling furnaces which in 1880 or thereabouts were offered so prominently as means of lessening the very severe labour of the puddler have for the most part disappeared, even the Danks furnace being now almost forgotten, and puddling is now usually done by hand in the old-fashioned furnaces and in the same way as formerly. The novelties in puddling which here need notice are (1) the Pietzka furnace, (2) a tentative increase in the size of charges treated, and (3) the use of "direct metal," *i.e.*, molten cast iron direct from the blast-furnace.

A much lower temperature is needed during the early part of the puddling process, in which the initial charge of cast iron, a relatively fusible substance, is melted down, than towards the end, when the resultant relatively infusible wrought iron must be very highly heated so that its particles may be welded firmly together, and the cinder be so fluid that the greater part of it may readily be squeezed out of the puddled ball. The *Pietzka furnace* (Fig. 10) is designed to meet this condition, by having two separate "hearths" or working chambers, A, A, in the right-hand or cooler of which a new charge is melted down and puddling is begun, while in the left-hand hearth, which

is hotter because nearer the fire, another charge is finishing. As soon as this latter charge has been drawn from the furnace and the necessary repairs have been made, the two hearths are made to change places, being lifted by means of the hydraulic plunger B, and rotated 180° about this plunger as an axis. This brings to the hot end of the furnace the charge of which the treatment has been begun at the cooler end. To permit this rotation the joints C, between the rotating parts of the furnace and the fixed parts, may be made conical. In effect the heat, which in a common puddling furnace would escape directly from the working chamber into the chimney and thus be lost, is here used in the right-hand or cooler hearth for the early part of the process itself. Beyond this, the heat in the escaping products of combustion may be further recovered by the Siemens regenerative or by the recuperative system. Thus arranged, the Pietzka furnace effects a great saving of fuel.

In common practice the cast iron as it runs from the blast-furnace is allowed to solidify and cool completely in the form of pigs, which are then graded by their fracture, and remelted in the puddling furnace itself. At Hourpes, in order to save the expense of this remelting, the molten cast iron as it comes from the blast-furnace is poured directly into the puddling furnace, in large charges of about 2200 pounds, which are thus about four times as large as those of common puddling furnaces. These large charges are puddled by two gangs of four men each, and a great saving in fuel and labour is effected.

Attractive as are these advances in puddling, they have not been widely adopted, for two chief reasons: First, owners of puddling works have been reluctant to spend money freely in plant for a process of which the future is so uncertain, and this unwillingness has been the more natural because these very men are in large part the more conservative fraction, which has resisted the temptation to abandon puddling and adopt the steel-making processes. Second, in puddling iron which is to be used as a raw material for making very fine steel by the crucible process, quality is the thing of first importance. Now in the series of operations, the blast-furnace, puddling, and crucible processes, through which the iron passes from the state of ore to that of crucible tool steel, it is so difficult to detect just which are the conditions essential to excellence in the final product that, once a given procedure has been found to yield excellent steel, every one of its details is adhered to by the more cautious ironmasters, often with surprising conservatism. Buyers of certain excellent classes of Swedish iron have been said even to object to the substitution of electricity for water-power as a means of driving the machinery of the forge. In case of direct puddling and the use of larger charges this conservatism is reasonable, for the established custom of allowing the cast iron to solidify gives a better opportunity of examining its fracture, and thus of rejecting unsuitable iron, than is afforded in direct puddling. So, too, when several puddlers are jointly responsible for the thoroughness of their work, as happens in puddling large charges, they will not exercise such care (nor indeed will a given degree of care be so effective) as when responsibility for each charge rests on one man.

§ 8. In the *Siemens-Martin Process*, now more often called the *open-hearth process*, the advances have been more important than those in any other branch of steel making. The chief of them are: (1) the wide use of a basic lining and basic slag, so that the process removes phosphorus from the iron; (2) a great increase in the size of furnaces, from 10 to 50 and even 100 tons capacity; (3) the use of tilting furnaces; and (4) special modes of procedure.

In 1880 the radical defect of the open-hearth process, like that of the Bessemer process, was that it did not remove phosphorus, of which nearly all pig irons contain more than is desirable, and most of them more than is permissible, in steel. The essence of both these processes is the removal, by oxidation, of the impurities—carbon, silicon, manganese, &c.—which the molten cast iron contains. Phosphorus also may be oxidized by means of iron oxide, forming phosphoric acid, which separates from the molten metal and combines with the slag floating upon it. Phosphoric acid, however, is here so unstable that it tends strongly to be again deoxidized, as fast as it is formed, by the carbon and silicon of the molten iron beneath, or even by the molten iron itself, and, when so deoxidized, it immediately re-unites with that iron, so that in effect dephosphorization is wholly prevented. This strong tendency to instantaneous and complete "rephosphorization" must be counteracted if the removal of phosphorus is to be effective, and to make that possible the slag must be made strongly retentive of phosphoric acid. This is its condition only when it contains an excess of powerful bases, such as lime and iron oxide, for these, so long as they are in excess, form with the phosphoric acid salts so stable as to resist the deoxidizing action of the molten metal beneath. Silica, or silicic acid, here plays the part of an acid so powerful that, if there be more than some 20 per cent. of it in the slag, it enfeebles the hold of these bases on the phosphoric acid, with the result that much of this substance is reduced to phosphorus, and consequently re-absorbed by the molten metal. To exclude silica the furnace walls, which under other conditions are usually made of sand or clay, are here made either of a neutral substance, chromite (FeO, Cr_2O_3), or of a basic and yet infusible one, such as magnesia or the mixture of magnesia and lime which results from calcining dolomite $(Ca, Mg)CO_3$. This, when mixed with some 10 per cent. of dehydrated coal tar, is coked by the heat of the furnace into a hard ringing mass, which is much more resistant than a silicious lining, so that the basic process is actually easier to conduct than the older or "acid" process with its acid, *i.e.*, silicious, walls and slag. The basic variety has reached great importance in Germany, and in America 70 per cent. of the total of open-hearth steel is made by it, though in Great Britain the proportion is only 10 per cent.

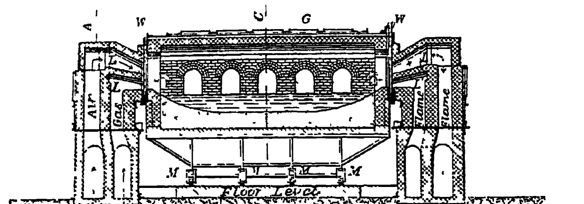
Furnaces, each treating a charge of 50 tons — five times the weight common in 1880 — have proved so economical that one of 75 tons has been built; and this has proved so completely successful that one of 100 tons capacity is building. No special difficulties have arisen in the use of these enormous furnaces. The gas and the air each enter the furnace through a single port, yielding a flame so great and long as to fill the whole melting chamber.

Many of these large furnaces are tilted at the end of each charge, as shown by the arrows in Fig. 13, so as to pour the molten steel into the casting-ladle and the molten slag into its receptacle; thus the troublesome operation of pouring is brought under much better control. This and the other incidental advantages of tilting are much more important in the basic than in the acid process, but even in the former case it is not generally conceded that the tilting system has yet been so perfected as to make its advantages considerably outweigh its greater cost for installation and repairs.

Figs. 11 to 14 are intended to explain not only the tilting furnace, but the general principle of the Siemens furnace. The charge of metal is melted and brought to the desired composition and temperature in the working chamber or body of the furnace, G, a long quasi-cylindrical vessel of brickwork, heated by burning within it preheated gas with preheated air. This working chamber is the furnace proper, in which the whole of the open-hearth process is carried out, and the function of all the rest of the apparatus, apart from the tilting mechanism, is simply to preheat the air and gas, and to lead them to the furnace proper and thence to the chimney. How this is done may be understood more easily if Figs. 11 and 12 are regarded for a moment as forming a single diagrammatic figure instead of sections in different planes. The unbroken arrows show the direction of the incoming gas and air, the broken ones the direction of the escaping products of their combustion. The air and gas, the latter coming from the gas producers or other source, arrive through H and J respectively, and their path thence is determined by the position of the reversing

valves K and K′. In the position shown in solid lines, these valves deflect the air and gas into the left-hand pair of "regenerators," large chambers filled with fire-bricks so piled as to leave abundant free passage for the gases. These, however, are exposed

FIG. 11.—Section on EF through furnace and port ends.



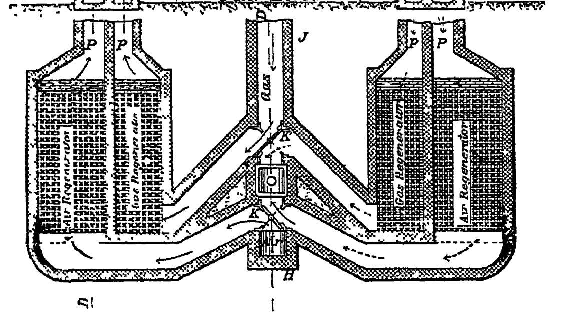


FIG. 12.—Plan through regenerators, flues, and reversing valves.

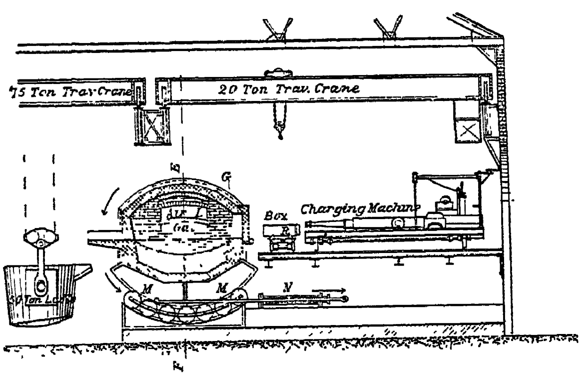


FIG. 13.—Section on CD through body of furnace.

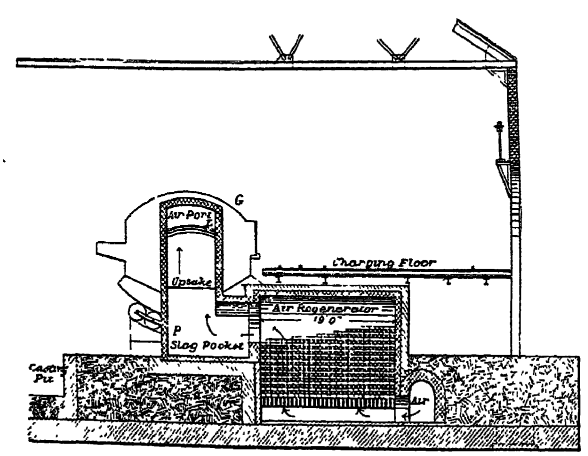


FIG. 14.—Section on AB through uptake, slag pocket, and regenerator.

Figs. 11 to 14.—Diagrammatic sections of tilting and Siemens furnaces: G, furnace body; H, air supply; J, gas supply; K, air reversing valve; K′, gas reversing valve; L, air port; L′, gas port; M, rollers on which the furnace tilts; N, hydraulic cylinder for tilting the furnace; O, flue leading to chimney; P, slag pockets; R, charging boxes; W, water-cooled joints between furnace proper, G, and ports L, L′.

to an enormous extent of brickwork surface, which we will assume for the moment has been highly preheated, so that they are heated by contact with it to a light yellow heat, say 1100° C. (2012° F.). Ascending thence as two separate streams through the uptakes (Fig. 14), they first mix at the moment of entering the working chamber through the ports L and L′ (Fig. 11). As they are so hot at starting, their combustion of course yields a very much higher temperature than if they had been cold before burning, and they form an enormous flame, which fills the great working chamber. The products of combustion are sucked by the pull of the chimney through the farther or right-hand end of this chamber, out through the exit ports, as shown by the dotted arrows, down through the right-hand pair of regenerators, heating to perhaps 1300° C. the upper part of loosely-piled masses of brickwork within them, and thence past the valves K and K′ to the chimney-flue O. During this phase the incoming gas and air have been withdrawing heat from the left-hand regenerators, which have thus been cooling down, while the escaping products of combustion have been depositing heat in the right-hand pair of regenerators, which have thus been heating up. After some thirty minutes this condition of things is reversed by turning the valves K and K′ 90° into the positions shown in dotted lines, when they deflect the incoming gas and air into the right-hand regenerators, so that they may absorb in passing the heat which has just been stored there; thence they pass up through the right-hand uptakes and ports into the working chamber, where as before they mix, burn, and heat the charge. Thence they are sucked out by the chimney-draught through the left-hand ports, down through the uptakes and regenerators, here again meeting and heating the loose mass of "regenerator" brickwork, and finally escape by the chimney-flue O. After another thirty minutes the current is again reversed to its initial direction, and so on. These regenerators are the essence of the Siemens or "regenerative furnace"; they are heat-traps, catching and storing by their enormous surface of brickwork the heat of the escaping products of combustion, and in the following phase restoring the heat to the entering air and gas. At any given moment one pair of regenerators is storing heat, while the other is restoring it.

The tilting working chamber is connected with the stationary ports L and L′ by means of the loose water-cooled joint W in Campbell's system, which is here shown. The furnace, resting on the rollers M, is tilted by the hydraulic cylinder N. The slag-pockets P (Fig. 14), below the uptakes, are provided to catch the dust carried out of the furnace proper by the escaping products of combustion, lest it enter and choke the regenerators. Wellman's tilting furnace rolls on a fixed rack instead of on rollers, and by his charging system a charge of as much as fifty tons is quickly introduced. The metal is packed by unskilled labourers in iron boxes, R (Fig. 13), standing on cars in the stock-yard. A locomotive carries a train of these cars to the track running beside a long line of open-hearth furnaces. Here the charging machine lifts one box at a time from its car, pushes it through the momentarily opened furnace door, and empties the metal upon the hearth of the furnace by inverting the box, which it then replaces on its car.

New Varieties of the Open-Hearth Process.—Cast iron differs from steel essentially in containing more carbon and silicon, and often more phosphorus; and the open-hearth process converts molten cast iron into molten steel either (1) by diluting its carbon and silicon by additions of scrap, steel, or wrought iron (*pig and scrap process*); or (2) by oxidizing its carbon and silicon, jointly by means of the oxidizing flame of the Siemens furnace, and of iron oxide added in the form of ore or scale (*pig and ore process*); or (3) by both means jointly. Because ore is usually much cheaper than scrap iron, the pig and ore process would usually be the cheaper, were it not that it must be conducted very slowly, lest the frothing due to the escape of the carbonic oxide gas, which results from the oxidation of the carbon of the metal, cause the charge to overflow. Rapid decarburization is permissible in the Bessemer process, which lasts only as many minutes as the open-hearth process lasts hours, because the Bessemer converter is very deep. Further, the cold iron ore of the pig and ore process can be introduced only very slowly, lest it chill the molten metal, both directly and because its reaction on the carbon absorbs heat; this local cooling, indeed, is what aggravates the frothing. A cold lump of ore chills the slag immediately around it, just where its oxygen reacting on the carbon of the metal generates carbonic oxide; the slag becomes cool, viscous, and froths easily just where gas is formed.

Bertrand and Thiel oxidize the carbon of molten cast iron by running it into a bath of molten iron which has first been

oxygenated, *i.e.*, charged with oxygen and superheated in an open-hearth furnace. The two metallic masses coalesce, and the reaction between the oxygen of one and the carbon of the other is therefore extremely rapid because it occurs throughout their depth, whereas in common procedure oxidation occurs only at the upper surface of the bath of cast iron at its contact with the overlying slag. Moreover, since local cooling, with its consequent viscosity and tendency to froth, are avoided, the frothing is not excessive in spite of the rapidity of the reaction. The oxygenated metal is prepared by melting cast iron diluted with as much scrap steel as is available, and oxidizing it with the flame and with iron ore as it lies in a thin molten layer on the hearth of a large open-hearth furnace; the thinness of the layer hastens the oxidation, and the large size of the furnace permits considerable frothing. But the oxygenated metal might be prepared easily in a Bessemer converter.

To enlarge the scale of operations makes strongly for economy in the open-hearth process as in other high temperature ones. (See below.) Yet the use of an open-hearth furnace of very great capacity, say of 75 or of 100 tons per charge, has the disadvantage that such very large lots of steel, delivered at relatively long intervals, are less readily managed in the subsequent operations of soaking and rolling down to the final shape, than smaller lots delivered at shorter intervals. To meet this difficulty Mr B. Talbot carries on the process as a quasi-continuous instead of an intermittent one, operating on 75- or 100-ton lots of cast iron in such a way as to draw off his steel in 20-ton lots at relatively short intervals, charging a fresh 20-ton lot of cast iron to replace each lot of steel thus drawn off. Besides minor advantages, this plan has the merit of avoiding an ineffective period which occurs in common open-hearth procedure just after the charge of cast iron has been melted down. At this time the slag is temporarily rich in iron oxide and silica, resulting from the oxidation of the iron and of its silicon as the charge slowly melts and trickles down. Such a slag not only corrodes the furnace lining, but also impedes dephosphorization, because it is irretentive of phosphorus. Further, the relatively low temperature impedes decarburization. Clearly, no such period can exist in the continuous process.

At a relatively low temperature, say 1300° C., the phosphorus of cast iron oxidizes and is removed much faster than its carbon, while at a higher temperature, say 1500° C., carbon oxidizes in preference to phosphorus. It is well to remove this latter element early, so that when the carbon shall have fallen to the proportion which the steel is to contain, the steel shall already be free from phosphorus, and so ready to cast. In common open-hearth procedure, although the temperature is low early in the process, viz., at the end of the melting down, dephosphorization is then impeded by the temporary acidity of the slag, as just explained. At the Carnegie works Mr Monell gets the two dephosphorizing conditions, low temperature and basicity of slag, early in the process, by pouring his molten but relatively cool cast iron upon a layer of preheated lime and iron oxide in the open-hearth furnace. Phosphorus is quickly removed. The ebullition from the formation of carbonic oxide puffs up the resultant phosphoric slag enough to make most of it run out of the furnace, thus both removing the phosphorus permanently from danger of being later deoxidized and returned to the steel, and partly freeing the bath of metal from the heat-insulating blanket of slag. Yet frothing is not excessive, because the slag is not, as in common practice, locally chilled and made viscous by cold lumps of ore.

None of these new modifications has been long enough in use to permit a definite estimate of its merit. In the procedures followed by Bertrand and Thiel and by Monell, the attack of the iron oxide on the basic lining of the furnace may perhaps be a source of trouble.

§ 9. *The Bessemer Process.*—The chief advances in the Bessemer process have been the use (1) of molten cast iron direct from the blast-furnace, or "direct metal"; (2) of "mixers" in which the cast iron from several blast-furnaces is mixed together, so as to equalize its composition; (3) of "car casting," or casting the molten steel in moulds standing on a train of cars. In addition to these, which are advances not in the nature but in the administration of the process, (4) the basic Bessemer or Thomas[1] process has come into extensive use (*Ency. Brit.*, vol. xiii. p. 345).

[1] Such terms as the "Bessemer-Mushet" process, the "Kelley-Bessemer" process, and the "Snelus-Thomas-Gilchrist" process are no longer in use. The Bessemer process is called after Bessemer alone, while in French and German the basic Bessemer process is called the Thomas process. While several men usually so contribute to the introduction of a process as to seem at first to have been essential to it, yet there is generally one great central figure to whom the world is chiefly indebted for its own adoption of the invention.

A. *Direct Metal and the Mixer.*—Until lately the cast iron for the Bessemer process has nearly always been allowed to solidify in pigs, which were next broken up by manual labour and remelted at great cost. It has long been seen that there should be a great saving if this remelting could be avoided and "direct metal," *i.e.*, the molten cast iron direct from the blast-furnace, be treated in the Bessemer process. The obstacle is that, owing to unavoidable irregularities in the blast-furnace process, the silicon- and sulphur-content of the cast iron vary to a degree and with an abruptness which the Bessemer process can hardly tolerate. Sulphur, which is not removed in the acid Bessemer process, injures the steel so greatly that it must be held below a limit, fixed in each case by the uses to which the steel is to be put. Further, the point at which the process should be arrested is recognized by the appearance of the flame which issues from the converter's mouth, and variations in the silicon-content of the cast iron treated alter this appearance, so that the indications of the flame become confusing, and control over the process is lost. Moreover, the quality of the resultant steel depends closely on the temperature of the process, and this in turn depends upon the proportion of silicon, the combustion of which is the chief source of the heat developed. Hence the importance of having the silicon-content constant. This difficulty was avoided at the Carnegie "Edgar Thomson" works by Captain W. R. Jones's invention of the "Mixer," which is simply a great reservoir into which successive lots of molten cast iron from all the blast-furnaces available are poured, forming a great molten mass of some two hundred or more tons. This is kept molten by a small flame playing above it, and successive lots of the cast iron thus mixed are drawn off, as they are needed, for conversion into steel by the Bessemer process. This device not only makes the cast iron much more uniform, but also removes much of its sulphur by a curious slow reaction. Many metals have the power of dissolving their own oxides and sulphides, but not those of other metals. Thus iron dissolves its own sulphide freely, but not that of either calcium or manganese. Consequently, when we deoxidize calcium in the iron blast-furnace, it greedily absorbs the sulphur which has dissolved in the iron as iron sulphide, and the sulphide of calcium thus formed separates from the iron. In like manner, if the molten iron in the mixer contains manganese, this metal unites with the sulphur present, and the manganese sulphide, insoluble in the iron, slowly rises to the surface, and there reaching the air, its sulphur oxidizes to sulphurous acid, which escapes. The use of the mixer, and through it that of direct metal, has now become general.

There still remains some irregularity in the silicon-content of the cast iron, and consequently in the temperature developed in the process, but this is met by throwing into the converter, during the process itself, a variable quantity of cold scrap steel (the crop-ends of rails and other waste pieces), and also by introducing a variable quantity of steam into the air which is blown through the molten iron. This is decomposed, with great absorption of heat and consequent lowering of the temperature, affording a most convenient way of regulating the temperature. If, on the other hand, the temperature threatens to be too low, it may be raised by so inclining the converter that the layer of metal through which the blast from certain of the tuyeres passes shall be so thin that here the blast shall oxidize much iron, which thus becomes a source of heat, though an expensive one.

B. The *Car casting* system deserves description chiefly because it shows how, when the scale of operations is as enormous as it is in the Bessemer process, even a slight simplification and a slight heat-saving may be of great economic importance.

Whatever be the form into which the steel is to be rolled, it must in general first be poured from the Bessemer converter in

which it is made into a large clay-lined ladle, and thence cast in vertical pyramidal ingots. To bring them to a temperature suitable for rolling, these ingots must be set in heating or soaking furnaces (§ 13), and this should be done as soon as possible after they are cast, both to lessen the loss of their initial heat, and to make way for the next succeeding lot of ingots, a matter of great importance, because the charges of steel follow each other at such very brief intervals. A pair of working converters has made 4958 charges of 10 tons each, or a total of 50,547 tons, in one month, or at an average rate of a charge every seven minutes and twenty-four seconds throughout every working day. It is this extraordinary rapidity that makes the process so economical and determines the way in which its details must be carried out. Moreover, since the mould acts as a covering to retard the loss of heat, it should not be removed from the ingot until just before the latter is to be placed in its soaking furnace. These conditions are fulfilled by the car casting system of Mr F. W. Wood, of Sparrows Point, Md., in which the moulds, while receiving the steel, stand on a train of cars, which are immediately run to the side of the soaking furnace. Here, as soon as the ingots have so far solidified that they can be lifted without breaking, their moulds are removed and set on an adjoining train of cars, and the ingots are charged directly into the soaking furnace. The mould-train now carries its empty moulds to a cooling yard, and, as soon as they are cool enough to be used again, carries them back to the neighbourhood of the converters to receive a new lot of steel. In this system there is for each ingot and each mould only one handling, in which it is moved as a separate unit, the mould from one train to the other, the ingot from its train into the furnace. In the other movements, all the moulds and ingots of a given charge of steel are grouped as a train, which is moved as a unit by a locomotive. The difficulty in the way of this system was that, in pouring the steel from ladle to mould, more or less of it occasionally spatters, and these spatterings, since the solidified steel is extremely tenacious, if they strike the rails or the running gear of the cars, obstruct and foul them, preventing the movement of the train. But this cannot be tolerated, because the economy of the process requires extreme promptness in each of its steps. On account of this difficulty the moulds formerly stood not on cars, but directly on the floor of a casting pit while receiving the molten steel. When the ingots had so far solidified that they could be handled, the moulds were removed and set on the floor to cool, the ingots were set on a car and carried to the soaking furnace, and the moulds were then replaced in the casting pit. Here each mould and each ingot was handled as a separate unit twice, instead of only once as in the car casting system; the ingots radiated away great quantities of heat in passing naked from the converting mill to the soaking furnaces, and the heat which they and the moulds radiated while in the converting mill was not only wasted, but made this mill, open-doored as it was, so intolerably hot, that the cost of labour there was materially increased. Mr Wood met this difficulty by the simple device of so shaping the cars that they completely protect both their own running gear and the track from all possible spattering, a device which, simple as it is, has materially lessened the cost of the steel and greatly increased the production. The following table shows how great has been this increase :—

TABLE II.

Year.	Maximum Production of Ingots by a Pair of American Converters, in gross Tons per Week.
1870	254
1880	3,433
1889	8,549
1899, for a month the average weekly production was	11,233

Thus in less than thirty years the rate of production per pair of vessels has increased forty-four-fold. The production of European Bessemer works is very much less than that of American. Indeed, the whole German production of acid Bessemer steel in 1899 was at a rate but slightly greater than that here given for one pair of American converters; and three pairs, if this rate were continued, would produce almost exactly as much steel as all the sixty-five active British Bessemer converters, acid and basic together, produced in 1899.

C. *Range in Size of Converters.*—In the Bessemer process, and indeed in most high-temperature processes, to operate on a large scale has, in addition to the usual economies which it offers in other industries, a special one, arising from the fact that from a large hot furnace or hot mass in general a very much smaller proportion of its heat dissipates through radiation and like causes than from a smaller body, just as a thin red-hot wire cools in the air much faster than a thick bar equally hot. Hence the progressive increase which has occurred in the size of converters, until now some of them can treat a 20-ton charge, is not surprising. But, on the other hand, when only a relatively small quantity of a special kind of steel is needed, very much smaller charges, in some cases weighing even less than half a ton, have been treated with technical success.

This has been particularly true in the manufacture of steel castings, *i.e.*, objects usually of more or less intricate shape, which are cast initially in the form in which they are to be used, instead of being forged or rolled to that form from steel cast originally in ingots. For making castings, especially those which are so thin and intricate that, in order that the molten steel may remain molten long enough to run into the thin parts of the mould, it must be heated initially very far above its melting-point, the Bessemer process has a very great advantage in that it can develop a much higher temperature than is attainable in either of its competitors, the crucible and the open-hearth processes. Indeed, no limit has yet been found to the temperature which can be reached, if matters be so arranged that not only the carbon and silicon of the pig iron, but also a considerable part of the metallic iron which is the iron itself, be oxidized by the blast; or if, as in the Walrand-Legenisel modification, after the combustion of the initial carbon and silicon of the pig iron has already raised the charge to a very high temperature, a still further rise of temperature is brought about by adding more silicon in the form of ferro-silicon, and oxidizing it by further blowing. But in the crucible and the open-hearth processes the temperature attainable is limited by the danger of melting the furnace itself, both because some essential parts of it, which, unfortunately, are of a destructible shape, are placed most unfavourably in that they are surrounded by the heat on all sides, and because the furnace is necessarily hotter than the steel made within it. But no part of the Bessemer converter is of a shape easily affected by the heat, no part of it has heat on more than one side, and the converter itself is necessarily cooler than the metal within it, since the heat is generated within the metal itself by the combustion of its silicon and other calorific elements. In it the steel heats the converter, whereas in the open-hearth and crucible processes the furnace heats the steel.

D. *The Basic Bessemer Process.*—The field of this process is greatly restricted by the fact that there are few ores which yield pig iron suited to it. For though there is usually neither excessive difficulty nor prohibitory expense in complying with the conditions that this iron should contain not more than 1 per cent. of silicon or 0·12 per cent. of sulphur, and preferably not less than 1·80 per cent. of manganese, yet the 1·80 per cent. of phosphorus which it imperatively needs can be supplied by but few ores. Of these the chief is the lean but very cheap "Minette" ore of the enormous deposits of Luxemburg and Lorraine, though Sweden also has deposits of phosphoric iron ore from which much is to be expected. Eighty-six per cent. of the German and Luxemburg Bessemer steel of 1899, and 28 per cent. of the British, were made by the basic process, which is important also in Belgium and Bohemia. But in the United States few phosphoric ores are so much cheaper than the non-phosphoric or "Bessemer" ores as to permit the basic process, in itself the more expensive, to compete with the original or "acid" Bessemer process. It is carried out at only one American establishment, and even there only intermittently. The *rôle* of the 1·80 per cent. of phosphorus of the pig iron is to generate, in being oxidized to phosphoric acid by the air blown through the metal, the very high temperature, about 1600° C. (2912° F.), which the process needs because of the high melting-point of its product, Bessemer steel. Silicon cannot be used here as a chief source of heat, as it is in the "acid" Bessemer process, because the resultant silica would both corrode the basic walls of the converter, and cause "rephosphorization," as explained in § 8, unless counteracted by great additions of lime, which would not only occupy precious room, but in themselves consume most of the heat generated by the oxidation of the silicon. Further, if the

silicon be much in excess of 1 per cent., it causes such frothing as to throw much of the metal out of the mouth even of these roomy converters. Manganese to the extent of 1·80 per cent. is desired as a means of preventing the resultant steel from being redshort, *i.e.*, brittle at a red or forging heat. The pig iron should be as nearly free as possible from sulphur, because the removal of any large quantity of this injurious element in the process itself is both difficult and expensive. The basic lining of the converters, made of calcined dolomite mixed with 10 per cent. of dehydrated coal tar, is expensive, and lasts but relatively few charges—in few works more than 200, and in some only 100—while the silicious lining of the acid converter lasts thousands of charges. Hence, for the basic process, spare converters must be provided, so that there may always be some of them re-lining, either while standing in the same place as when in commission, or, as in Holley's arrangement, in a separate repair house, to which these gigantic vessels are removed bodily. The slag of the process usually contains about 18 per cent. of phosphoric acid, and on this account it is so valuable a fertilizer as to be a most important bye-product. Its percentage composition is approximately as follows :—

Phosphoric Acid.	Silica.	Lime.	Magnesia.	Ferrous Oxide.
16 to 19	6 to 9	50	3	13

In order that the phosphoric acid may be the more fully liberated by the humic acid, &c., of the earth, a little silicious sand is mixed with the still molten slag after it has been poured off from the molten steel. The slag is used in agriculture with no further preparation, save very fine grinding.

§ 10. *Darby's Recarburizing Process.* — In the basic Bessemer process most of the phosphorus is not removed until after the carbon, probably because the lime, which is charged in solid lumps, melts and enters the slag so slowly that not until late in the operation does the slag become so basic as to be retentive of phosphoric acid. Hence in making steel rich in carbon it is not possible, as in the acid Bessemer process, to end the operation as soon as the carbon in the metal has fallen to the point sought, but it is necessary to remove practically all of the carbon, then the phosphorus, and then "recarburize," *i.e.*, add whatever carbon the steel is to contain. On account of certain objections to adding this carbon in the form of cast iron, Darby adds gas-carbon, coke, or other carbonaceous matter, which is absorbed greedily by the molten steel. This process, which in careful hands yields regular results, is much used in connexion with the basic open-hearth process, though indeed it can be used with either the acid or basic variety of the Bessemer and of the open-hearth process.

§ 11. *Comparison of Processes.*—The puddling process, often preceded by the removal of silicon in the "refinery" process, is still widely used for making wrought iron for certain normal purposes which need great ease in welding; for purposes requiring special forms of extreme ductility which are not so confidently expected in steel; for miscellaneous purposes by many users, some ignorant, some very conservative; and for remelting in the crucible process. All the best cutlery and tool steel is made by the crucible process, and indeed all for which any considerable excellence is claimed is supposed to be, though often incorrectly. But the great mass of steel is made by the Bessemer and the open-hearth processes. Open-hearth steel is generally considered better than Bessemer, and the acid variety of each of these two processes is thought to yield a better product than the basic variety. Probably this is not necessarily true, but the acid variety lends itself more readily to excellence than the basic. A very large proportion of ores cannot be made to yield cast iron either free enough from phosphorus for the acid Bessemer or the acid open-hearth process, neither of which removes that most injurious element, or rich enough in phosphorus for the basic Bessemer process, which must rely on that element as its source of heat. But cast iron for the basic open-hearth process can be made from almost any ore, since its requirements, comparative freedom from silicon and sulphur, depend on the management of the blast-furnace rather than on the composition of the ore, whereas the phosphorus-content of the cast iron depends solely on that of the ore, since nearly all the phosphorus of the ore necessarily passes into the cast iron. Thus the basic open-hearth process is the only one which can make steel from cast iron containing more than 0·10 per cent. but less than 1·80 per cent. of phosphorus. In cost of conversion the acid Bessemer process is the cheapest, the basic Bessemer next, and the basic open-hearth next, though the difference is not very great. The crucible process, however, is far more expensive than any of the others. Rail steel is almost always made by either the acid or the basic Bessemer process. Between 1880 and 1899 the yearly production of open-hearth steel advanced in the United States from 9 to 39 per cent. of that of Bessemer steel, and in Great Britain from 24 to 166 per cent. In the three great iron-making countries taken collectively, Great Britain, the United States, and Germany and Luxemburg, between 1880 and 1899 the production of acid open-hearth steel increased sevenfold, that of all open-hearth steel sixteenfold, that of the acid Bessemer process more than tripled, the total production of the Bessemer converter increased fourfold, the total production of steel fivefold, and the basic open-hearth and the basic Bessemer process, which were merely beginning to be used in 1880, in 1899 each produced about as much steel as the whole world produced by all processes in 1880. In these countries in 1899, 43 per cent. of the total steel production was made by the acid Bessemer process, 20 per cent. by the basic Bessemer, 16½ per cent. by the acid open-hearth, 18½ per cent. by the basic open-hearth, and a little over 1 per cent. by the crucible and other processes.

IV. MECHANICAL TREATMENT.

§ 12. *Defects in Steel Ingots.*—These are of three chief classes—pipes, blowholes, and segregation. When molten steel is cast in an ingot in a cold cast iron mould, its outer crust solidifies and cools so far as to be rigid and incompressible, at a time, T, when much of the interior is still molten. In the further cooling the molten interior, because it is at this moment, T, so much hotter than the exterior, has a greater range of temperature to pass through before becoming completely cold; and for this reason the interior will undergo more contraction than the exterior. But since the interior just filled the exterior at the moment T, it will not be large enough to fill it completely after it has undergone this excess of contraction. In particular, the interior undergoes much of this excess of contraction between the time T and the time T′ when the last of the interior itself solidifies. Consequently at T′ the solidifying interior no longer suffices to fill the outer crust; and on this account a deep pear-shaped contraction cavity or *pipe* is formed, as shown at C in Fig. 15.

Since this pipe is due to the difference in the rates of contraction of interior and exterior, it may be lessened by retarding the cooling of the mass as a whole, and it may be prevented from stretching down deep by retarding the solidification of the upper part of the ingot, as, for instance, by preheating the top of the mould, or by

covering the ingot with a great mass of burning fuel or of molten slag. This keeps the upper part of the mass molten, so that it continues to flow down and feed the pipe during the early part of its formation in the lower and quicker-cooling part of the ingot. In making castings of steel, this same difficulty arises; and much of the steel-founder's skill consists either in preventing these pipes, or in so placing them that they shall not occur in the finished casting, or at least not in a harmful position. In making armour-plates from steel ingots, as much as 40 per cent. of the metal may be rejected as unsound from this cause. An ingot should always stand upright while solidifying, so that the unsound region due to the pipe may readily be cut off, leaving the rest of the ingot solid. If the ingot lay on its side while solidifying, the pipe would occur as shown in Fig. 16, and nearly the whole length of the ingot would be rendered unsound.

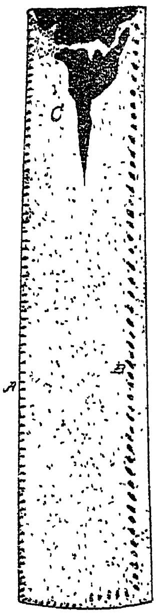


FIG 15.—Diagram showing how a pipe is formed. A, superficial blowholes; B, deep-seated blowholes; C, pipe.

Iron, like water and many other substances, has a higher solvent power for gases, such as hydrogen and nitrogen, when molten, *i.e.*, liquid, than when frozen, *i.e.*, solid. Hence in the act of solidifying it expels any excess of gas which it has dissolved while liquid, and this gas becomes entangled in the freezing mass, causing gas bubbles or *blowholes*, as at A and B in Fig. 15. Since the volume of the pipe represents the excess of the contraction of the interior between T and T′, any space within the ingot-crust occupied by blowholes must diminish by just so much the volume of the pipe, so that the more and larger the blowholes are, the smaller will the pipe be. The interior surface of a blowhole which lies near the outer crust of the ingot, as at A, is liable to become oxidized by the diffusion of the atmospheric oxygen, in which case it can hardly be completely welded later, since welding implies actual contact of metal with metal; it thus forms a permanent flaw. But deep-seated blowholes like those at B are relatively harmless, because the subsequent operation of forging or rolling usually obliterates them by welding their sides firmly together.

Blowholes may be lessened or even wholly prevented by adding to the molten metal shortly before it solidifies either silicon or aluminium, or both; even as little as 0·002 per cent. of aluminium is usually sufficient. These additions seem to act in part by deoxidizing the minute quantity of iron oxide and carbonic oxide present, in part by increasing the solvent power of the metal for gas, so that even after freezing it can retain in solution the gas which it had dissolved when molten. But, since preventing blowholes increases the volume of the pipe, it is often better to allow them to form, but to control their position, so that they shall be deep-seated. This is done chiefly by casting the steel at a relatively low temperature, and by limiting the quantity of manganese and silicon which it contains. Brinell finds that, for certain normal conditions, if the sum of the percentage of manganese plus 5·2 times that of the silicon equal 1·66, there will be no blowholes; if this sum be less, blowholes will occur, and will be injuriously near the surface unless this sum be reduced to 0·28. He thus finds that this sum should be either as great as 1·66, so that blowholes shall be absent; or as low as 0·28, so that they shall be harmlessly deep-seated. These numbers must be varied with the variations in other conditions, such as casting temperature, rapidity of solidification, &c.

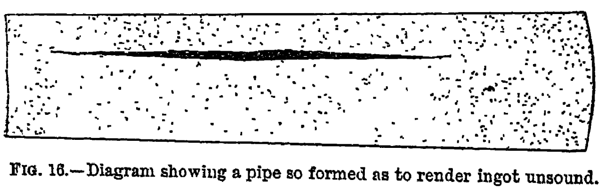


FIG. 16.—Diagram showing a pipe so formed as to render ingot unsound.

The solidification of a large ingot of steel takes place gradually from without inwards, and each layer in solidifying tends to expel into the still molten interior the impurities which it contains, especially the carbon, phosphorus, and sulphur, which by this process are in part concentrated or *segregated* in the last-freezing part of the ingot. This is in general around the lower part of the pipe, so that here is a second motive for rejecting the piped part of the ingot. While segregation injures the metal here, often fatally, by giving it an indeterminate excess of phosphorus and sulphur, it clearly purifies the remainder of the ingot, and on this account it ought, under certain conditions, to be promoted rather than restrained. The following is an extreme case:—

	Carbon	Silicon.	Manganese.	Phosphorus.	Sulphur.
Composition of the initial metal per cent.	0·24	0·336	0·97	0·089	0·074
Composition of the segregation . .	1·27	0·41	1·08	0·753	0·418

§ 13. *Heating Furnaces.*—The introduction of the "soaking" or Gjers pit and the development of the continuous or Eckman type of furnace have been of great importance. When the outer crust of a large ingot in which a lot of molten steel has been cast has so far

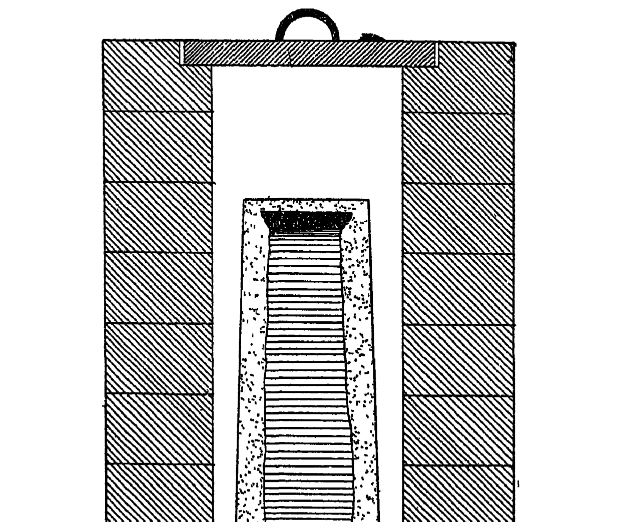


FIG. 17.—Section of Gjers soaking pit.

cooled that it can be moved without breaking, the temperature of the interior is still far above that suitable for rolling or hammering—so far above it that the surplus heat of the interior would more than suffice to reheat the now cool crust to the rolling temperature, if we could only arrest or even greatly retard the further escape of heat from that crust. Bringing such an ingot, then, to the rolling temperature is not really an operation of heating, since its average temperature is already above the rolling temperature, but one of equalizing the temperature, by allowing

the internal excess of heat to "soak" through the mass. Gjers did this by setting the partly-solidified ingot in a well-closed "pit" of brickwork, preheated by the excess heat of previous lots of ingots. The arrangement, shown in Fig. 17, has three advantages—(1) that the temperature is adjusted with absolutely no consumption of fuel; (2) that the waste of iron due to the oxidation of the outer crust of the ingot is very slight, since the little atmospheric oxygen initially in the pit is not renewed, whereas in a common heating furnace the flame brings a constant fresh supply of oxygen; and (3) that the ingot remains upright during solidification, so that its pipe is concentrated at one end and is thus removable. (See § 12.) In this form the system is rather inflexible, for if the supply of ingots be delayed the pits grow unduly cool, so that the next ensuing lot of ingots either is not heated hot enough or is delayed too long in soaking. This defect is usually remedied by heating the pits by the Siemens regenerative system (see § 8); the greater flexibility thus gained outweighs the cost of the fuel used and the increased loss of iron by oxidation by the Siemens gas flame.

The Gjers system is not applicable to small ingots or "billets,"[1] because they lack the inner surplus heat of large ingots; indeed, they are now allowed to cool completely. To heat these on the intermittent plan for further rolling, *i.e.*, to charge a lot of them as a whole in a heating furnace, bring them as a whole to rolling

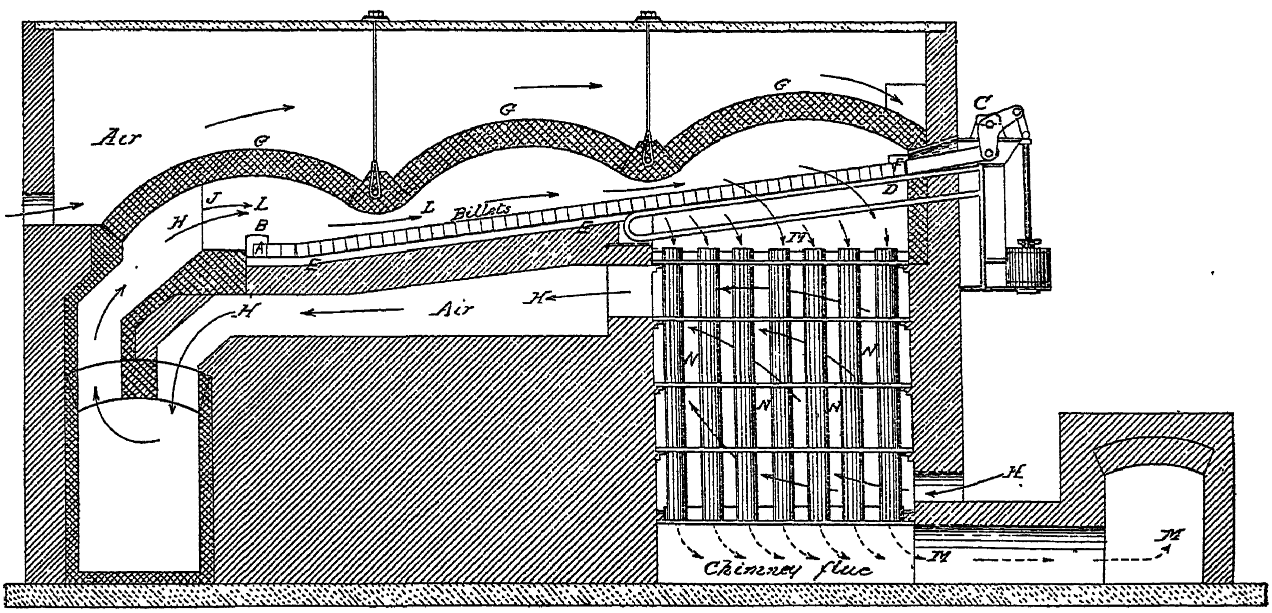


Fig. 18.—Diagram of C. H. Morgan's continuous heating furnace for 2-inch billets 30 feet long.

A, hottest billet ready for rolling; B, exit door; C, pusher, for forcing billets forward; D, water-cooled pipe on which billets are pushed forward; E, magnesite bricks on which the hot billets slide forward; F, the billet last entered; G, the suspended roof; H, the incoming air preheated by G and by the pipes N; J, the incoming gas; L, the flame; M, the escaping products of combustion; N, pipes through which the products of combustion pass.

temperature, and then withdraw them as a whole for rolling, is very wasteful of heat, because it is only in the first part of the heating that the outside of the ingots is cool enough to abstract thoroughly the heat from the flame; during all the latter part of the heating, when the temperature of the ingot has approached that of the flame, only an ever smaller and smaller part of the heat of that flame can be absorbed by the ingots. Hence in the intermittent system most of the heat generated within the furnace escapes from it with the products of combustion. The continuous heating system (Fig. 18) recovers this heat by bringing the flame into contact with successively cooler and cooler billets, A–F, and finally with quite cold ones, of consequently great heat-absorbing capacity.

As soon as a hot billet A is withdrawn by pushing it endwise out of the exit door B, the whole row is pushed forward by a set of mechanical pushers C, the billets sliding on the raised water-cooled pipes D, and, in the hotter part of the furnace, on the magnesite bricks E, on which iron slides easily when red-hot. A new cold billet is then charged at the upper end of the hearth, and the cycle begins by pushing out through B a second billet, and so forth. To lessen the loss in shape of "crop ends," and for general economy, these billets are in some cases 30 feet long, as in the furnace shown in Fig. 18. It is to make it wide enough to receive such long billets that its roof is suspended, as here shown, by two sets of iron tie-rods. As the foremost end of the billet emerges from the furnace it enters the first of a series of roll-trains, and passes immediately thence to others, so that before half of the billet has emerged from the furnace its front end has already been reduced by rolling to its final shape, that of merchant-bars, which are relatively thin, round, or square rods, in lengths of 300 feet.

In the intermittent system the waste heat can, it is true, be utilized either for raising steam (but inefficiently and inconveniently, because of the intermittency), or by a regenerative method like the Siemens; but this would probably recover less heat than the continuous system, first, because it transfers the heat from flame to metal indirectly instead of directly; and, second, because the brickwork of the Siemens system is probably a poorer heat-catcher than the iron billets of the continuous system, its disadvantages of low conductivity and low specific heat probably outweighing its advantages of roughness and porosity.

§ 14. *The Continuous Rolling-Mill.*—The use of the continuous or Bedson type of rolling-mill has been much extended, so that it receives billets as large as 4 by $5\frac{3}{4}$ inches, and rolls sheets, skelp, merchant-bars, cotton-ties, and other important products. In this system several roll-trains stand one behind another in column, so that the forward end of a given steel billet which is under treatment passes immediately from one pair of rolls into the next, and so on, and emerges from the last reduced to a diameter of say three-quarters of an inch, before the rear end of the same billet has entered the first pair of rolls, or indeed has emerged from the furnace in which it has been heated for rolling. By practically eliminating

[1] Billets are bars from 2 to 6 inches square, an intermediate product into which large ingots are rolled, to be further rolled into wire rods, sheets, small round and square rods, &c.

the loss of time between the successive reductions, large billets can be rolled at one operation into small rods of great length, so that the proportion of metal wasted in the form of crop ends is greatly reduced. Once the rod is so very thin as to be flexible, further reduction may be made by the Belgian system, in which the successive roll-trains stand in line instead of in column, and the front end of the rod as it emerges from one pair of rolls is turned 180° in a loop by hand or mechanism, and so returned to undergo another pass in the same train. By a combination of these two systems, as developed by C. H. Morgan and W. Garrett respectively, billets 3 inches square are rolled at one operation into bars three-quarters of an inch in diameter and about 230 feet long.

§ 15. *Hammers and Hydraulic Presses.*—The demand for very large forgings, especially for armour-plate and ordnance, has led to the erection of enormous steam-hammers. The falling parts of the largest of these, that at Bethlehem, Pa., weigh 125 tons. But even so great a hammer is an ineffective tool for making large forgings, chiefly because the effect of its blow is concentrated on the outside of the forging, and does not penetrate well towards the interior; indeed, the days of large hammers seem to be over. The use of this particular one has been abandoned for that of an enormous hydraulic press which exerts a pressure of 14,000 tons. It is moved by water under a pressure of 7000 pounds per square inch, supplied by pumps of 16,000 horse-power. For forging shafting and other objects not readily made in rolling-mills, because their cross-section is not uniform, the hydraulic press seems to be firmly established as by far the most efficient tool. But though the great 14,000-ton Bethlehem press is used with great success for forging armour-plate also, the rolling-mill certainly has special merits for such a purpose, and with it all of Krupp's armour-plate is now made. The rolls of this great armour-plate mill are 4 feet in diameter and 12 feet long, and can receive an ingot 4 feet thick.

V. Statistics.

§ 16. *Cost of Manufacture.*—There has been a remarkable reduction in the cost of iron and steel manufacture, a few examples of which, taken from American practice, are given in Table III. Here we find a reduction of some 35 per cent. in total cost and an even greater reduction in the cost of labour, reaching in one case even 54 per cent. in a period of from seven to ten years. The reduction in the cost of labour has been brought about by improvements in administration and by mechanical appliances, and not by reduction of wages. According to Mr Carnegie, in one of the largest American steel works the average wages in 1900 for all persons paid by the day, including labourers, mechanics, and boys, were more than $4 (say 16s. 6d.) a day for the 311 working days. How economical the methods of mining, transportation, and manufacture have become is shown by the fact that steel billets have been sold at $13·96 (£2, 17s. 8d.) per ton, and in very large quantities at $15 (£3, 2s.) per ton, in the latter case, according to Mr Carnegie, without further loss than that represented by interest, although the cost of each ton includes that of mining 2 tons of ore and carrying them 1000 miles, mining and coking 1·3 tons of coal and carrying its coke 50 miles, and quarrying one-third of a ton of limestone and carrying it 140 miles, besides the cost of smelting the ore, converting the resultant cast iron into steel, and rolling that steel into rails.

Table III.—*Reduction in Cost of Iron Manufacture in America—C. Kirchoff.*

Place Represented.	Operation Represented.	Period Covered.		Cost, Profit, and Production at End of Period in Percentage of that at Beginning of Period.						
		From	To	Cost. Ore.	Fuel.	Labour.	Total.	Total excluding Raw Material.	Profit per Ton.	Production per Furnace, &c., per day.
A large Southern Establishment	Manufacture of Pig Iron	1889	1898	79	64·1	51·9	63·4	...	47·9	167·7
North-eastern District	" "	1890	1898	103·7	97	61·1	65·8	...	33·9	163·3
Pittsburg District	" "	1887	1897	...	...	46	...	44	...	...
Eastern District	Manufacture of Bessemer Steel Ingots	1891	1898	...	...	75	64·39	...	..	107
Pittsburg	" "	1887	1897	...	...	...	...	52	...	...
Not stated	Rolling Wire Rods	1888	1898	...	...	...	63·6	...	...	325

Table IV.—*Reduction in Price of Certain Products.*

Date.	Average Price in Pennsylvania.				
	Wrought Iron.		Iron Rails.	Steel Rails.	No. 1 Foundry Pig Iron.
1800, Jan.	$100	Best Hammered	...	...	...
1815, Feb.	155	Best Hammered	...	...	...
1824, Nov.	80	Best Hammered	...	...	...
1837, Apr.	115	Best Hammered	...	...	...
1850, Aug.	59·54	Rolled	$47·88	...	$20·88
1865 "	106·38	Rolled	98·62	(1868) $158·50	46·12
1870 "	78·96	Rolled	72·25	106·75	33·25
1880 "	...	Rolled	49·25	67·50	28·50
1890 "	45·92	Rolled	...	31·75	18·40
1898 "	...	Rolled	...	17·62	11·66

Table IV. shows the reduction in prices. The price of wrought iron in Philadelphia reached $155 (£32, 0s. 8d.) in 1815, and, after declining to $80 (£16, 10s. 8d.), again reached $115 (£23, 15s. 4d.) in 1837. Bessemer steel rails sold at $174 in the depreciated currency of 1868 (equivalent to about £25, 17s. 4d. in gold), and at $17 (£3, 10s. 3d.) in 1898.

VI. Increase in Production.

§ 17. In 1810 the United States made about 7 per cent., and in 1830, 1850, and 1860 not far from 10 per cent. of the world's production of pig iron, though, indeed, in 1820 their production was only about one-third as great as in 1810. But after the close of the Civil War the production increased by leaps and bounds, till in 1899 it was sixteen times as great as in 1865; and the percentage which it formed of the world's production rose to some 14 per cent. in 1870, 21 per cent. in 1880, and 34 per cent. in 1899. Between 1880 and 1899, though the British production increased only 20 per cent., that of the United States more than tripled, that of Germany and Luxemburg nearly tripled, and that of the world more than doubled. The corresponding changes in case of steel are even more striking. The United States production in 1899 was nearly 800 times that of 1865; and the proportion of the world's steel which it formed rose from 3 per cent. in 1865 to 10 per cent. in 1870, 30 per cent. in 1880, 36 per cent. in 1890, and 40 per cent. in 1899. Between 1880 and 1899 the production of Great Britain

has increased to nearly four times, and that of the United States to eight and a half times, their respective productions in 1880. As has been already indicated, of the combined wrought iron and steel of the United States, steel formed 2 per cent. in 1865, 37 per cent. in 1880, but about 85 per cent. in 1899. The age of iron has in these nineteen years given place to the age of steel.

The *per capita* consumption of iron in Great Britain, excluding exports, has been calculated as 144 pounds in 1855 and 250 pounds in 1890, that of the United States as 117 pounds for 1855, 300 pounds for 1890, and some 378 pounds for 1899, or more than thrice that of 1855. Among the chief causes of this increase in the consumption of iron by the human race we may recognize, in addition to the general advance in wealth and civilization, the increasing diversion of mankind from agricultural to manufacturing, *i.e.*, machinery-using, occupations — and nearly all machinery is necessarily made of iron; the displacement of wood by iron for ship and bridge building; the great extension of the use of iron beams, columns, and other pieces in constructing buildings of various kinds; the growth of steam and electric railways; and the introduction of iron fencing. The increased importance of Germany and Luxemburg may be referred in large part to the invention of the basic Bessemer and open-hearth processes by Thomas, who by them gave an inestimable value to the phosphoric ores of these countries. That of the United States is due in part to the growth of its population; to the introduction of labour-saving machinery in iron manufacture; to the grand scale on which this manufacture is carried on; and to the discovery of the cheap and rich ores of the Mesabi region of Lake Superior. But, given all these, the thousand miles which separate the ore fields of Lake Superior from the cheap coal of Pennsylvania would have handicapped the American iron industry most seriously but for the remarkable cheapening of transportation which has occurred. As this in turn has been due to the very men who have developed the iron industry, it can hardly be questioned that, on further analysis, this development must in considerable part be referred to racial qualities. The same is true of the German iron development. We may note with interest that the three great iron producers so closely related by blood—Great Britain, the United States, and Germany and Luxemburg—made in 1889 79 per cent. of the world's pig iron and 81 per cent. of its steel; and that the four great processes by which nearly all steel and wrought iron are made—the puddling, crucible, and both the acid and basic varieties of the Bessemer and open-hearth processes, as well as the steam-hammer and grooved rolls for rolling iron and steel—were invented by Britons, though in the case of the open-hearth process Great Britain must share with France the credit of the invention. (H. M. H.)

Tables V., VI., VII., and VIII., are compiled mainly from figures given in Mr J. M. Swank's Reports (American Iron and Steel Association). Other authorities are indicated as follows: [a], *The Mineral Industry*, 1892; [b], *Idem*, 1899; [d], *Journal Iron and Steel Institute*, 1881, ii.

TABLE V.—*Production of Pig Iron (in thousands of long tons).*

Year.	United States.	Great Britain.	Germany and Luxemburg.	The World.
1800	...	...	...	825
1810	54	..	...	...
1830	165	677	...	1,825
1850	565	...	...	4,750
1865	832	4,825	972	9,250
1870	1,665	5,964	1,369	11,900
1880	3,835	7,749	2,685	17,950
1890	9,203	7,904	4,583	27,157
1899	13,621[b]	9,302[b]	7,900[b]	39,752[b]

TABLE VI.—*Production of Pig Iron in the United States (in thousands of long tons).*

Year.	Anthracite.	Charcoal.	Coke and Bituminous.	Total.
1880	1,614	480	1,741	3,835
1885	1,299	357	2,389	4,045
1890	2,186	628	6,388	9,202
1895	1,271	225	7,950	9,446
1899	1,600[b]	285[b]	11,736[b]	13,621[b]

"Anthracite" here includes iron made with anthracite and coke mixed, and "Bituminous" includes iron made with coke, with raw bituminous coal, or with both.

TABLE VII.—*Production of Wrought Iron, also that of Bloomary Iron (in thousands of long tons).*

	1870.		1880.		1890.		1899.	
	United States.	Great Britain.	United States.	Great Britain.	United States.	Great Britain.	United States.	Great Britain.
Wrought Iron	1153[c]	...	2803[c]	...	2518	1894[c]	...	1202[b]
Bloomary Iron direct from the ore	...	...	34	..	8	...	3	...

[c] Hammered products are excluded.

TABLE VIII.—*Production of Steel (in thousands of long tons).*

	1870.			1880.				1890.				1899.				
	United States.	Great Britain.	The World.	United States.	Great Britain.	Germany and Luxemburg.	The World.	United States.	Great Britain.	Germany and Luxemburg.	The World.		United States.	Great Britain.	Germany and Luxemburg.	The World.
Bessemer	37	215		1,074	1,044	608[d]		3,689	2,015			Acid	7,586	1,308[b]	613[b]	
												Basic		517[b]	3,909[b]	
Open-hearth	1	(for 1873) 78		101	251	87[d]		513	1,564			Acid	867	2,736[b]	1,667[b]	
												Basic	2,080	295[b]		
Crucible and Miscellaneous	31	...		72	80	33[d]		75	100				106	145	...	
Total	69	292[a]	692[a]	1,247	1,375	728	4,205[a]	4,277	3,679	2,127	11,902[a]		10,639	5,001		26,685[b]

TABLE IX.—*Tonnage (gross register) of Iron and Steel Vessels built under Survey of Lloyd's Registry, in thousands of tons.*[1]

	1877.	1880.	1885.	1890.	1895.
Wrought Iron	443	460	304	42	8
Steel	0	35	163	958	863

[1] J. Riley.

VII. IRON ORES.

§ 18. *Distribution.*—Iron ores are widely distributed, and found associated with rocks of various geological ages in most of the explored regions of the earth. But their practical exploitation is not as universal as their occurrence, although explorers report, even in remote portions, crude appliances for smelting ores and producing iron

therefrom. The number of regions in which iron ore mines are developed and iron ore is produced on any considerable scale is limited, and the different countries may be divided into three general classes :—

(1) Those which mine sufficient iron ore practically to supply their domestic demand, and export none, or but small amounts, such as the United States, Russia, Austria-Hungary, China, Mexico, &c.

(2) Those which produce and consume domestic ores, but are obliged to draw largely from other countries in order to obtain sufficient raw material of the required character for the iron manufactured. This class includes Great Britain, Germany, France, and Belgium.

(3) Those which have excellent iron ore resources, easily exploited, but utilize only a small proportion and export large amounts of ore. Spain, Sweden, Algeria, Cuba, Italy, and Greece are in this category.

A fourth class will include those countries which neither use nor export any considerable amount of iron ores, *e.g.*, Australia, the South American States, &c. Considered simply as iron ore producers, the United States ranks first, followed by the German empire, British empire, Spain, France, Russia, Austria-Hungary, Sweden, &c.

§ 19. *Composition.*—Iron ores vary greatly in chemical composition and physical characteristics, but may be segregated into four general classes :—

A. *Magnetites*, in which three atoms of iron united with four atoms of oxygen form the magnetic oxide, yielding 72·4 per cent. of iron. These ores are usually hard and dense, and are seldom found unassociated with phosphorus, sulphur, or titanium, while earthy impurities often reduce their commercial yield still further. Magnetites have, however, been won in large quantities which produced 70 per cent. of iron. Some of the leaner ores are enriched by crushing them and separating the ore grains from the gangue by electro-magnetic methods or by jigs. Sulphur is eliminated by roasting.

B. *Red Hematites*, in which two atoms of iron are combined with three atoms of oxygen to form ferric oxide, yielding 70 per cent. of iron. Many of these have an excess of earthy impurities, while some approach chemical perfection as to iron contents, and a number are quite low in phosphorus. Sulphur and titanium are seldom present in notable proportions. They include fossil, slate, dyestone, and flax-seed ores.

C. *Brown Hematites* are of the same chemical composition as red hematites, but the ferric oxide is hydrated, so that the practical limit of yield may be taken at 60 per cent. of iron. In these there is apt to be a considerable amount of phosphorus and often manganese, but seldom sulphur. Some are merely carbonate ores changed by weathering. Bog ores are brown hematites deposited in the beds of extinct or existing lakes. Limonite, goethite, &c., also fall under this head.

D. *Carbonates* are found associated with the Coal Measures, and are combinations of ferrous oxide and carbonic acid in such proportions as to yield when pure to 48·2 per cent. of iron. By roasting, as by protracted weathering, the carbonic acid is driven off, and yields of iron are obtained approximating to those from brown hematite. Carbonates are locally known as clay ironstone, spathic iron ore, black band ore.

A majority of the ores used yield 50 per cent. or more of iron, although where the supply is favoured by local conditions some containing only about 40 per cent. are smelted. The tendency is to use ores naturally rich in iron or to beneficiate lean ores. The expansion of the Bessemer steel industry has required a general subdivision of all ores into Bessemer and non-Bessemer grades, based on the phosphorus contents. Nominally a Bessemer ore may carry one part of phosphorus to each 1000 parts of iron, but commercially the proportion is nearer one to 1300. The practical yield of metal from iron ores as used may be considered as — Magnetites, 45 to 65 per cent.; red hematites, 40 to 60 per cent.; brown hematites, 40 to 55 per cent.; carbonates (roasted), 40 to 55 per cent.

§ 20. *Production.*—The total iron ore production of the world in 1899 is estimated at 81,000,000 gross tons, and for purposes of comparison, figures showing the output of the principal countries in 1880, 1890, and 1899 are given in the following table :—

Production of Iron Ore in the Principal Countries of the World.

Countries.	1880.	1890.	1899.
Great Britain	18,026,049	13,780,767	14,461,330
United States	7,120,362	16,036,043	24,683,173
Germany and Luxemburg	7,238,640	11,406,132	17,970,679
France	2,874,263	3,471,718	5,067,500
Spain	3,565,338	6,546,495	9,234,302
Russia	1,023,883	1,767,313	4,871,461[a]
Austria-Hungary	1,142,606	2,153,789	3,400,585[a]
Sweden	775,344	941,241	2,435,200
Belgium	253,499	186,546	217,370[a]
Algeria	164,146	474,632	473,569[a]
Cuba	None.	362,068	368,758

[a] Figures are for year 1898.

The tons used in this table are the gross avoirdupois (2240 ℔) and metric (2204 ℔).

Great Britain.—Sir Lowthian Bell classifies British iron ores as follows :—

1. Altered carbonates (a variety of brown ores), got by open work from the Lias and Oolitic formations in Lincolnshire, Northamptonshire, Leicestershire, &c.
2. Carbonate (clay ironstone), got by mining in the Lias, as in Cleveland.
3. Carbonate (clay ironstone), got from the Coal Measures as it occurs in Scotland, Staffordshire, &c.
4. Red hematite, largely wrought in Lancashire and Cumberland.
5. Brown hematites, such as the ores of Antrim in Ireland and the Forest of Dean, neither of these being now of much importance.
6. Sundries, consisting of different varieties, but all in unimportant quantities.

In the principal iron ore region in England (the Cleveland district) there are two well-known seams of ironstone, the "upper" and "lower" beds. The first is silicious and irregular in quality, and the lower bed may be regarded as the only general source of supply. From this district is obtained nearly one-half the iron ore mined in England, the production for 1899 being estimated as 5,612,742 tons. The ore carries about 33 per cent. of iron on the average. British ores are supplemented by liberal additions of foreign ores, obtained principally from Spain, Sweden, Greece, Algeria, Elba, India, &c. In the year 1899 the imports of foreign ore and manganiferous iron ores into Great Britain was 7,054,578 long tons, of which 6,186,022 tons were contributed by Spain, the greater portion being from the Bilbao district. The probable exhaustion of the rich and easily-mined Bilbao ores has directed attention to other large deposits in the southern section of Spain, which could be drawn upon if needed, while Sweden can supply quantities of magnetic ore. Great Britain's maximum production of iron ore in 1882 was 18,031,957 long tons, while in 1899 but 14,461,330 tons were mined.

United States.—In 1899 the United States, the largest pig-iron-producing country in the world, most of it being smelted from native ores, contributed 24,684,173 tons of iron ores. Of this amount 81 per cent. was of the red hematite variety, 11·23 per cent. brown hematite, 7 per cent. magnetite, and 1·3 per cent. carbonate ores. The iron ore output of 1900 is estimated at 25,500,000 tons. Over 70 per cent. of the domestic iron ores (17,802,955 tons) in 1899 came from the Lake Superior region, situated in the states of Michigan, Minnesota, and Wisconsin. In the Lake Superior basin there are enormous deposits of iron ore. Those upon the south and west are in the United States, and have been liberally exploited. The Canadian deposits in the north have but lately been developed. The American deposits occur in five districts or ranges — Marquette range, in the state of Michigan; Gogebic range and Menominee range, in Michigan

and Wisconsin; and Vermilion and Mesabi ranges in Minnesota. Mesabi the youngest and Marquette the oldest ranges are the largest producers. Many of the deposits are wrought upon an enormous scale, ten mines in the Lake Superior region producing from 500,000 to over 1,000,000 tons in 1899. In the eastern portion of the United States, New York and New Jersey supply magnetites, Massachusetts and Connecticut brown hematites. Pennsylvania produces about one million tons annually, most of which is magnetite from the Cornwall ore hills. In the south, Virginia, Georgia, Alabama, Tennessee, and Texas supply hematites. Hematites also and some magnetites are won in the Rocky Mountains region, from the states of Wyoming, Colorado, Utah, and New Mexico Territory. Some of this iron ore and also that obtained in California is used as a flux for silver smelting. Carbonate ores are mined in Pennsylvania, New York, Ohio, and Maryland.

Germany.—Iron ores are liberally distributed throughout the German empire, but the largest deposits are in the Grand Duchy of Luxemburg and German Lorraine, where Oolitic ores, locally known as minette, are found, in a length of rather less than 40 miles and a width of about 8 miles; the beds also extend into Belgium and France. More than one-half of the output of the German empire comes from this minette district of Lorraine and Luxemburg. The average analyses of the ores show that they contain from 28 to occasionally 48 per cent. of iron, with phosphorus ranging from 0·5 to 2 per cent. The ore district of Siegerland ranks next in importance. Most of the ores are spathic, although in some cases red hematites occur. The district contributes about one-tenth of the total for the empire. In Hesse-Nassau red hematites are associated in some instances with brown ores, and manganiferous iron ores form an important supply for the Westphalia furnaces. Probably five-sixths of the German product consists of brown hematite ores in various forms. Germany exports minette ores chiefly to France and Belgium, and imports a considerable amount of foreign ores, the greater portion coming from Sweden. The maximum German product of iron ore, 17,989,665 metric tons, was in 1899.

France.—The iron ore deposits of France, though numerous, are scattered, and except in the eastern portion of the country there are none capable of feeding any considerable number of blast-furnaces. The maximum production was 5,067,500 metric tons in 1899. Since the loss of Alsace-Lorraine a considerable amount of iron ore has been imported into France from the region which was annexed to Germany, while Algeria, Spain, and Italy also contribute.

Russia.—Iron manufacture in Russia, since 1700, has been confined mostly to the Ural region, the ore being smelted with charcoal. Of late years blast-furnaces have been built in Southern Russia to smelt the rich ores found there with mineral fuel, and the advance has been rapid. The ore deposits are chiefly of the magnetic, specular, and red hematite variety; but in Olnetz and Finland lake and bog ores are won, while in Southern Poland brown hematites are found. Practically all the iron ore mined is smelted in the blast-furnaces of the country. The greatest production of iron ore was in 1898, when 4,871,461 tons were reported as being mined.

Spain.—Distributed throughout Spain are large deposits of iron ores, but owing to the lack of good mineral fuel the pig iron industry has not attained importance, and most of the ore won is exported. The greatest yield has been from the Biscayan provinces in the north, but there are valuable deposits extending along the south-eastern coast, commencing with those at Porman, continuing at moderate distances from the coast through the provinces of Murcia, Almeria, and Malaga, and finally trending north-west to the district of Seville, farther inland. The ores of Biscaya are, near the surface, hydrated peroxides, rich in iron and fairly free from phosphorus and sulphur. At greater depths the mass of the unchanged deposit below the gossan or oxidized outcrop is found to be spathic iron ore, containing a larger proportion of sulphur than the zone above. The mines most extensively worked are in the vicinity of Bilbao, and form three groups, known as the Somorrostro, Galdames, and Ollargon. From this district the bulk of the iron ore imported into Great Britain is obtained. Spain in 1899 produced 9,234,302 tons of iron ore.

Sweden.—This country, famous for its iron industry, is almost entirely dependent on magnetic ores, although some hematite or specular ores, and a small amount of lake or bog ore, is mined. The Swedish ores vary from 30 to 70 per cent. of iron, averaging about 50 per cent., and generally (except in the north) contain very little phosphorus. The principal iron ore deposits extend across the country from the Dannemora region, north of Stockholm, towards the Norwegian border, and cover a length of 180 miles. Southwards the region continues to the middle part of the province of Östergötland, and northwards to the northern boundary of Dalecarlia, thus covering 5800 square miles. In the vicinity of the Arctic Circle, in Swedish Finland, are the large deposits of Gellivara, Kirunavara, and Luossavara, connected by a railway 129 miles long with the harbour of Lulea, at the north end of the Baltic Sea. The quality of these ores is variable, but they are usually rich in iron. Although Bessemer ores occur in considerable quantity, the greater part are high in phosphorus. The percentage of sulphur, however, is small. Most of these rich ores are exported, chiefly to Germany, Great Britain, and Austria. Owing to the annual increase of this export trade, and to obtain a harbour open all the year, a railway has been constructed to Victoria Haven (Narvik) in Norway. The advance in the production of iron ore since the opening of the Gellivara deposits in 1892 has been rapid, the maximum for Sweden being 2,435,200 tons in 1899, of which over one-half was exported.

Belgium.—Only about one-tenth of the iron ores smelted in the Belgian blast-furnaces comes from native mines. These are Oolitic iron ores, minette ore, bog ore from Campine, and manganiferous iron ore from Liége. The chief domestic supply comes from the Luxemburg and Lorraine Oolitic limonite ores, carrying 30 to 35 per cent. of iron. The foreign imports are chiefly from Germany, France, Spain, Sweden, Algeria, &c. The amount of native ore produced approximates 200,000 tons per annum; about $2\frac{1}{2}$ million tons of iron ore are annually imported, and 300,000 tons exported.

Other Countries.—Algeria has important deposits of iron ore, chiefly magnetite, red and brown hematite, and siderite. The mines at present worked are in the department of Constantine, and produce annually about half a million tons of iron ore, all of which is exported. The iron ores of Greece are carbonates, hematites, and magnetites, most of which contain manganese. A considerable quantity of ore is mined, all of which is exported. In Italy about 250,000 tons of red hematite and specular, with some magnetic iron ore, is mined and exported, mostly from the island of Elba. Owing to the lack of fuel, the pig iron industry of Italy is of minor importance. In the south-eastern portion of Cuba are rich deposits of red hematite ores, operated by American companies, producing, in 1899, 368,758 tons of ore. Since 1884, when shipments commenced, Cuba produced to 1899 inclusive 4,000,000 tons of iron ore, nearly all of which was sent to the United States. Canada has numerous deposits of iron ore, and is developing an important iron industry. On Lake Superior red hematite is worked, in Nova Scotia red and brown hematites are won, in Ontario red hematites and magnetites occur, while in Quebec bog ores are obtained. In British Columbia are deposits of magnetite. Newfoundland has an extensive deposit of red hematite ore, carrying about 50 per cent. of iron, which is easily won by quarrying. Asia, Africa, South America, and Australia have iron ore deposits, but only India, China, and Mexico can be considered as manufacturing iron in appreciable amounts. (J. Bi*.)

Iron Mountain, capital of Dickinson county, Michigan, U.S.A., on the Menominee river, in the north-western part of the state, at an altitude of 1142 feet. Its site is level and its plan regular. It is at the intersection of branches of the Chicago and North-Western, and the Chicago, Milwaukee, and St Paul railways. It is in an iron-mining and lumber region. Population (1890), 8599; (1900), 9242, of whom 4376 were foreign-born.

Ironton, capital of Lawrence county, Ohio, U.S.A., on the north bank of the Ohio, in the southern part of the state, at an altitude of 540 feet. It has three railways—the Cincinnati, Hamilton, and Dayton, the Ironton, and the Norfolk and Western, which, with the navigation of the river, give it a large trade in iron and coal, which are the leading products of the surrounding region. It contains blast-furnaces, rolling-mills, and foundries, and has extensive manufactures of iron goods. It contained in 1900 112 manufacturing establishments, which had a total capital of $3,321,219, and employed an average number of 1758 wage-earners. The total value of the products was $5,715,112. Population (1880), 8857; (1890), 10,939; (1900), 11,868, of whom 714 were foreign-born and 924 were negroes.

Ironwood, a city of Gogebic county, Michigan, U.S.A., in the Gogebic iron range, in the extreme north-western part of the state, at an altitude of 1506 feet. It is on the Chicago and North-Western and the Wisconsin Central railways, and is devoted almost entirely to iron-mining. Population (1890), 7745; (1900), 9705, of whom 4615 were foreign-born.

IRRIGATION.

I. General.

THE subject of irrigation is discussed generally in the earlier volumes of the Encyclopædia (9th edition, vol. xiii.), and the treatment of water-meadows in England is there described minutely and accurately. Little is said, however, of the great systems of irrigation prevailing in tropical and sub-tropical countries, which differ from the irrigation practised in England as much as the cultivation of an American prairie differs from that of a dainty English flower-garden. It is of this irrigation on a large scale that it is now proposed to treat. It is to be found in Europe only in the rich plains of Northern Italy, and in some of the provinces of Spain. In Spain it can be traced directly to the Moorish Conquest, and almost everywhere throughout Asia or Africa where the Moslem has raised his green flag is to be found some knowledge of irrigation. But the art was known long before the days of Mahommed, and it is certain that there could have been no population in the Nile valley until the habit was established of sowing grain on the muddy surface of the land from which the flood water was slowly retreating, and in due time of reaping the crops.

Primitive methods.

The simplest form of irrigation is when the water is raised from a river or lake, or from a well situated in a field. The sculptures and paintings of ancient Egypt bear no trace of anything approaching scientific irrigation, but they often show the peasant bailing the water up from the Nile. By means of this simple plan of raising water and pouring it over the fields thousands of acres are watered every year in India, and the system has many advantages in the eyes of the peasant. Though there is great waste of labour, he can apply his labour when he likes; no permission is required from a Government official; no one has to be bribed. The simplest and earliest form of water-raising machinery is the pole with a bucket suspended from one end of a crossbeam and a counterpoise at the other. In India this is known as the *denkli* or *paecottah*; in Egypt it is called the *shadúf*. All along the Nile banks from morning to night may be seen brown-skinned peasants working these *shadúfs*, tier above tier, so as to raise the water 15 or 16 feet on to their lands. With a *shadúf* it is only possible to keep about 4 acres watered, so that a great number of hands are required to irrigate a large surface. Another method largely used is the shallow basket or bucket suspended to strings between two men, who thus bail up the water. A step higher than these is the rude water-wheel, with earthen pots on an endless chain running round it, worked by one or two bullocks. This is used everywhere in Egypt, where it is known as the *sakya*. In Northern India it is termed the *harat*, or Persian wheel. With one such water-wheel a pair of oxen can raise water any height up to 18 feet, and keep from 5 to 12 acres irrigated throughout an Egyptian summer. A very familiar means in India of raising water from wells in places where the spring level is as much sometimes as 100 feet below the surface of the field is the *churras*, or large leather bag, suspended to a rope passing over a pulley, and raised by a pair of bullocks which go up and down a slope as long as the depth of the well. All these primitive contrivances are still in full use throughout India. Egypt has of late years been more in touch with Western civilization, and the prosperous farmer prefers to employ a centrifugal pump driven by a fixed or portable steam engine. There are now about 400 of the former and 2000 of the latter at work on the Nile and the canals of Lower Egypt.

Irrigation on a really large scale, however, requires that the water shall flow over the surface of the land by gravitation, without being artificially raised. This may be effected either by canals drawn from a river, and flowing on a slope less than that of the country, so as ultimately to obtain a command over it, or by reservoirs formed by throwing masonry or earthen embankments across valleys, and there storing up the rainfall. The water is discharged from a sluice at the bottom of the embankment, and flows over the adjoining land at the foot of the valley. Canal irrigation is very much the more important of the two, but before describing it a little will be said about what can be done by reservoirs.

Irrigation reservoirs.

Among the valleys of a rolling country it is often easy to find a site for a good reservoir, and if the rainfall comes down in heavy showers, it may not be difficult to catch and store it. The points to be aimed at are to find (1) a valley with a large catchment basin and hard rocky sides, off which the rain water will quickly flow; (2) a narrow neck across which a dam may easily be thrown, with firm sides into which it can be built; (3) a good site for a waste-weir and channel down which to pass flood water; and (4) either good and easily quarried stone for building a masonry dam, or beds of clay for constructing the solid puddle core which should form the centre of an earthen embankment. Of course all these requirements are useless if there is not also suitable land to irrigate down-stream of the dam.

Spain.

Reservoirs are familiar everywhere for the water-supply of towns, but as the volume necessary, even for a large town, does not go far in irrigating land, many sites which would do admirably for the former would not contain water sufficient to be worth applying to the latter purpose. In the Mediterranean provinces of Spain there are some very remarkable irrigation dams. The great masonry dam of Alicante on the river Monegre, which dates from 1579, is situated in a narrow gorge, so that while 140 feet high, it is only 190 feet long at the crest. The reservoir is said to contain 130 million cubic feet of water, and to serve for the irrigation of 9000 acres, but unless it refills several times a year, it is hardly possible that so much land can be watered in any one season. The Elche reservoir, in the same province, has a similar dam 55 feet high. In neither case is there a waste-weir, the surplus water being allowed to pour over the crest of the dam. South of Elche is the province of Murcia, watered by the river Segura, on which there is a dam 25 feet high, said to be 800 years old, and to serve for the irrigation of 25,000 acres. The Lorca dam in the same neighbourhood irrigates 27,000 acres. In the jungles of Ceylon are to be found remains of gigantic irrigation dams, and on the neighbouring mainland of Southern India, throughout the provinces of Madras and Mysore, the country is covered with irrigation reservoirs, or, as they are locally termed, tanks. These vary from village ponds to lakes 14 or 15 miles long. Most of them are of old native construction, but they have been greatly improved and enlarged since, say, 1850. The casual traveller in Southern India constantly remarks the ruins of old dams, and the impression is conveyed that at one time, before British rule prevailed, the irrigation of the country was much more perfect than it is

India.

now. That idea, however, is mistaken. An irrigation reservoir, like a human being, has a certain life. Quicker or slower, the water that fills it will wash in sand and mud, and year by year this process will go on till ultimately the whole reservoir is filled up. The embankment is raised, and raised again, but at last it is better to abandon it and make a new tank elsewhere, for it would never pay to dig out the silt by manual labour. It may safely be said that at no time in history were there more tanks in operation than at present. The ruins which are seen are the ruins of long centuries of tanks that once flourished and became silted up. But they did not all flourish at once. In the countries now being considered, the test of an irrigation work is how it serves in a season of drought and famine. It is evident that if there is a long cessation of rain, there can be none to fill the reservoirs. In September 1877 there were very few in all Southern India that were not dry. But even so, they helped to shorten the famine period; they stored up the rain after it had ceased to fall, and they caught up and husbanded the first drops when it began again.

Irrigation canals. Irrigation effected by river-fed canals naturally depends on the regimen of the rivers. Some rivers vary much in their discharge at different seasons. In some cases this variation is comparatively little. Sometimes the flood season recurs regularly at the same time of the year; sometimes it is uncertain. In some rivers the water is generally pure; in others it is highly charged with fertilizing alluvium, or, it may be, with barren silt. In rainless countries, such as Egypt or Sind, there can be no cultivation without irrigation. Elsewhere the rainfall may be sufficient for ordinary crops, but not for the more valuable kinds. In ordinary years in Southern India the maize and the millet, which form so large a portion of the peasants' food, can be raised without irrigation, but it is required for the more valuable rice or sugar-cane. Elsewhere in India the rainfall is usually sufficient for all the cultivation of the district, but about every eleven years comes a season of drought, during which canal water is so precious as to make it worth while to construct costly canals merely to serve as a protection against famine. When a river partakes of the nature of a torrent, dwindling to a paltry stream at one season and swelling into an enormous flood at another, it is impossible to construct a system of irrigation canals without very costly engineering works, sluices, dams, waste-weirs, &c., so as to give the engineer entire control of the water. Such may be seen on the canals of Cuttack, derived from the Mahanadi, a river of which the discharge does not exceed 400 cubic feet per second in the dry season, and rises to 1,600,000 cubic feet per second in the rainy season. Very differently situated are the great canals of Lombardy, drawn from the Ticino and Adda rivers, flowing from the Maggiore and Como lakes. The severest drought never exhausts these reservoirs, and the heaviest rain can never convert these rivers into the resistless floods which they would be but for the moderating influence of the great lakes. The Ticino and Adda do not rise in floods more than 6 or 7 feet above their ordinary level, or fall in droughts more than 4 or 5 feet below it, and their water is at all seasons very free from silt or mud. Irrigation cannot be practised in more favourable circumstances than these. The great lakes of Central Africa, Victoria and Albert Nyanzas, and the vast swamp tract of the Sudan, do for the Nile on a gigantic scale what Lakes Maggiore and Como do for the rivers Ticino and Adda. But for these great reservoirs the Nile would decrease in summer to quite an insignificant stream. India possesses no great lakes from which to draw rivers and canals, but through the plains of Northern India flow rivers which are fed from the glaciers of the Himalaya; and the Ganges, the Indus, and their tributaries are thus prevented from diminishing very much in volume. The greater the heat, the more rapidly melts the ice, and the larger the quantity of water available for irrigation. The canal system of Northern India is the most perfect the world has yet seen, and contains works of hydraulic engineering which can be equalled in no other country. In the deltas of Southern India irrigation is only practised during the monsoon season. The Godaveri, Kistna, and Kaveri all take their rise on the Western Ghats, a region where the rainfall is never known to fail in the monsoon season. Across the apex of the deltas are built great weirs (that of the Godaveri being $2\frac{1}{2}$ miles long),

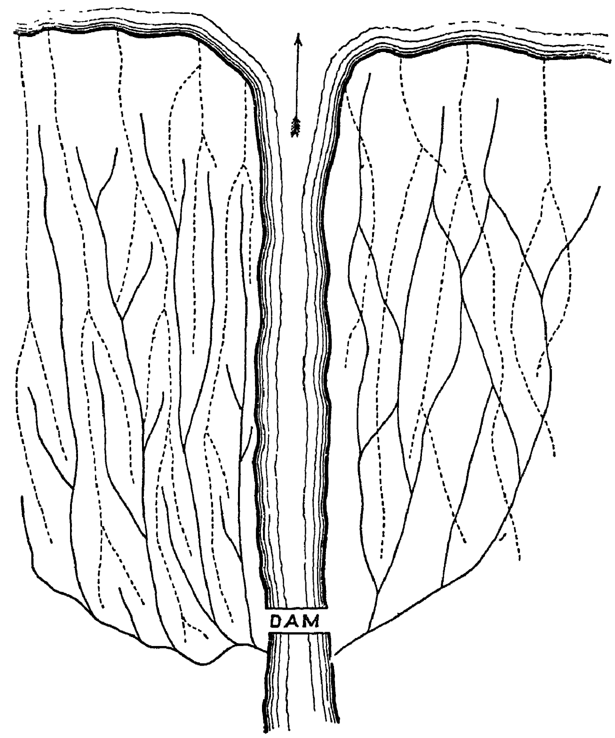


FIG. 1.—Diagram showing irrigation properly combined with drainage (*to left*), and laid out regardless of drainage required later (*to right*).

at the ends and centre of which is a system of sluices feeding a network of canals. For this monsoon irrigation there is always abundance of water, and so long as the canals and sluices are kept in repair, there is little trouble in distributing it over the fields. Similar in character was the ancient irrigation of Egypt, practised merely during the Nile flood—a system which is still the only one that prevails throughout the greater part of Upper Egypt. A detailed description of it will be found below.

Distribution of the water. Where irrigation is carried on throughout the whole year, even when the supply of the river is at its lowest, the distribution of the water becomes a very delicate operation. It is generally considered sufficient in such cases if during any one crop one-third of the area that can be commanded is actually supplied with water. This encourages a rotation of crops and enables the precious liquid to be carried over

a larger area than could be done otherwise. It becomes then the duty of the engineer in charge to use every effort to get its full value out of every cubic foot of water. Some crops of course require water much oftener than others, and much depends on the temperature at the time of irrigation. During the winter months in Northern India magnificent wheat crops can be produced that have been watered only twice or thrice. But to keep sugar-cane, or indigo, or cotton alive in summer before the monsoon sets in in India or the Nile rises in Egypt the field should be watered every ten days or fortnight, while rice requires a constant supply of water passing over it.

Drainage.

Experience in these sub-tropical countries shows the absolute necessity of having, for successful irrigation, also a system of thorough drainage. It was some time before this was discovered in India, and the result has been the deterioration of much good land. In Egypt, prior to the British occupation in 1883, no attempt had been made to take the water off the land. The first impression of a great alluvial plain is that it is absolutely flat, with no drainage at all. Closer examination, however, shows that if the prevailing slopes are not more than a few inches in the mile, yet they do exist, and scientific irrigation requires that the canals should be taken along the crests and drains along the hollows. In the preceding diagram (Fig. 1) is shown to the right of the river a system of canals branching out and afterwards rejoining one another, so as to allow of no means for the water that passes off the field to escape into the sea. Hence it must either evaporate or sink into the soil. Now nearly all rivers contain some small percentage of salt, which forms a distinct ingredient in alluvial plains. The result of this drainless irrigation is an efflorescence of salt on the surface of the field. The spring level rises, so that water can be reached by digging only a few feet, and the land, soured and water-logged, relapses into barrenness. Of this description was the irrigation of Lower Egypt previous to 1883. To the left of the diagram is shown (by firm lines) a system of canals laid out scientifically, and of drains (by dotted lines) flowing between them. It is the effort of the British engineers in Egypt to remodel the surface of the fields to this type.

Further information may be found in MONCRIEFF. *Irrigation in Southern Europe.* London, 1868.—MONCRIEFF. "Lectures on Irrigation in Egypt," *Professional Papers of the Corps of Royal Engineers,* vol. xix. London, 1893.—WILLCOCKS. *Egyptian Irrigation,* 2nd edition. London, 1899. (C. S. M.)

II. EGYPT.

Characteristics of the Nile Valley and flood.

The very life of Egypt depends on its irrigation, and, ancient as this irrigation is, it was never practised on a really scientific system till after the British occupation. As every one knows, the valley of the Nile outside of the tropics is practically devoid of rainfall. Yet it was the produce of this valley that formed the chief granary of the Roman Empire. Probably nowhere in the world is there so large a population per square mile depending solely on the produce of the soil. Probably nowhere is there an agricultural population so prosperous, and so free from the risks attending seasons of drought or of flood. This wealth and prosperity are due to two very remarkable properties of the Nile. First, the regimen of the river is nearly constant. The season of its rise and its fall, and the height attained by its waters during the highest flood and at lowest Nile, vary to a comparatively small extent. Year after year the Nile rises at the same period, it attains its maximum in September and begins to diminish first rapidly till about the end of December, and then more slowly and more steadily until the following June. A late rise is not more than about three weeks behind an early rise. From the lowest to the highest gauge of water-surface the rise is on an average 25·5 feet at the First Cataract. The highest flood is 3·5 feet above this average, and this means peril, if not disaster, in Lower Egypt. The lowest flood on record has risen only to 5·5 feet below the average, or to 20 feet above the mean water-surface of low Nile. Such a feeble Nile flood has occurred only twice in modern history: in 1877, when it caused widespread famine and death throughout Upper Egypt, 947,000 acres remained barren, and the land revenue lost £1,112,000; and in 1899, when by the thorough remodelling of the whole system of canals since 1883 all famine and disaster were avoided, and there occurred a loss of only £300,000 to the revenue of the country. This regularity of flow is the first exceptional excellence of the river Nile. The second is hardly less valuable, and consists in the remarkable richness of the alluvium brought down the river year after year during the flood. The object of the engineer is so to utilize this flood-water that as little as possible of the alluvium may escape into the sea, and as much as possible may be deposited on the fields. It is the possession of these two properties that imparts to the Nile a value quite unique among rivers, and gives to the farmers of the Nile Valley advantages over those of any rain-watered land in the world.

Irrigation during high Nile.

Until the 19th century irrigation in Egypt on a large scale was practised merely during the Nile flood. Along each edge of the river and following its course has been erected an earthen embankment high enough not to be topped by the highest floods. In Upper Egypt, the valley of which rarely exceeds six miles in width, a series of cross embankments have been constructed, abutting at the inner ends on those along the Nile, and at the outer ends on the ascending sides of the valley. The whole country has thus been divided into a series of oblongs, surrounded by embankments on three sides and by the desert slopes on the fourth. These oblong areas vary from 60,000 to 1500 or 2000 acres in extent. Throughout all Egypt the Nile is deltaic in character; that is, the slope of the country in the valley is away from the river, and not towards it. It is easy, then, when the Nile is low, to cut short, deep canals in the river banks, which fill as the flood rises, and carry the precious mud-charged water into these great flats. There the water remains for a month or more, some three feet deep, depositing its mud, and thence at the end of the flood the almost clear water may either be run off directly into the receding river, or cuts may be made in the cross embankments, and it may be allowed to flow from one flat to another, and ultimately into the river. In November the waters have passed off; and whenever a man can walk over the mud with a pair of bullocks, it is roughly turned over with a wooden plough, or merely the branch of a tree, and the wheat or barley crop is immediately sown. So soaked is the soil after the flood, that the grain germinates, sprouts, and ripens in April, without a shower of rain or any other watering. In Lower Egypt this system was somewhat modified, but it was the same in principle. No other was known in the Nile Valley until the country fell, early in the 19th century, under the vigorous rule of Mehemet Ali Pasha. He soon recognized that with such a climate and soil, with a teeming population, and with the markets of Europe so near, they might produce in Egypt something more profitable than wheat and maize. Cotton and sugar-cane would fetch far higher prices, but they could only be grown while the Nile was low, and they required water at all seasons.

It has already been said that the rise of the Nile is about 25½ feet, so that a canal constructed to draw water out of the river while at its lowest must be 25½ feet

deeper than if it is intended to draw off only during the highest floods. Mehemet Ali began by deepening the canals of Lower Egypt by this amount, a gigantic and futile task; for as they had been laid out on no scientific principles, the deep channels became filled with mud during the first flood, and all the excavation had to be done over again, year after year. With a serf population even this was not impossible; but as the beds of the canals were graded to no even slope, it did not follow that if water entered the head it would flow evenly on. As the river daily fell, of course the water in the canals fell too, and since they were never dug deep enough to draw water from the very bottom of the river, they occasionally ran dry altogether in the month of June, when the river was at its lowest, and when, being the month of greatest heat, water was more than ever necessary for the cotton crop. Thus large tracts which had been sown, irrigated, weeded, and nurtured for perhaps three months, perished in the fourth, while all the time the precious Nile water was flowing useless to the sea. The obvious remedy was to throw a weir across each branch of the river to control the water, and force it into canals taken from above it. The task of constructing this great work was committed to Mougel Bey, a French engineer of ability, who designed and constructed the great barrage across the two branches of the Nile at the apex of the delta, about 12 miles north of Cairo (Fig. 2). It was built to consist of two bridges—one over the eastern or Damietta branch of the river having 71 arches, the other, over the Rosetta branch, having 61 arches, each arch being of 5 metres, or 16·4 feet, span. The building was all of stone, the floors of the arches were inverts. The height of pier from edge of flooring to spring of arch was 28·7 feet, the spring of the arch being about the surface-level of maximum flood. The arches were designed to be fitted with self-acting drop gates; but they were not a success, and were only put into place on the Rosetta branch. The gates were intended to hold up the water 4·5 metres, or 14·76 feet, and to divert it into three main canals—the Behera on the west, the Menufia in the centre, and the Tewfikia on the east. The river was thus to be emptied, and to flow through a whole network of canals, watering all Lower Egypt. Each barrage was provided with locks, to pass Nile boats 160 by 28 feet in area.

Irrigation during low Nile.

The Nile barrage.

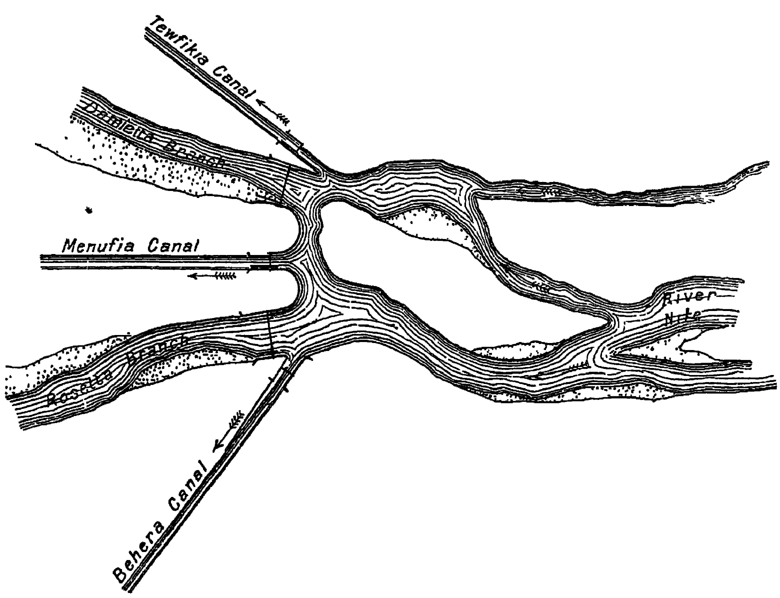


Fig. 2.—Map showing the Damietta and Rosetta dams on the Nile.

Mougel's barrage, as it may now be seen, is a very imposing and stately work. Considering his want of experience of such rivers as the Nile, and the great difficulties he had to contend with under a succession of ignorant Turkish rulers, it would be unfair to blame him because, until it fell into the hands of British engineers in 1884, the work was condemned as a hopeless failure. It took long years to complete, at a cost which can never be estimated, since much of it was done by serf labour. In 1861 it was at length said to be finished; but it was not until 1863 that the gates of the Rosetta branch were closed, and they were reopened again immediately, as a settlement of the masonry took place. The experiment was repeated year after year till 1867, when the barrage cracked right across from foundation to top. A massive coffer-dam was then erected, covering the eleven arches nearest the crack; but the work was never trusted again, nor the water-surface raised more than about three feet.

An essential part of the barrage project was the three canals, taking their water from just above it, as shown in Fig. 2. The heads of the existing old canals, taken out of the river at intervals throughout the delta, were to be closed, and the canals themselves all put into connexion with the three high-level trunk lines taken from above the barrage. The central canal, or Menufia, was more or less finished, and, although full of defects, has done good service. The eastern canal was never dug at all until the British occupation. The western, or Behera, canal was dug, but within its first 50 miles it passes through desert, and sand drifted into it. *Corvées* of 20,000 men used to be forced to clear it out year after year, but at last it was abandoned. Thus the whole system broke down, the barrage was pronounced a failure, and attention was turned to watering Lower Egypt by a system of gigantic pumps, to raise the water from the river and discharge it into a system of shallow surface-canals, at an annual cost of about £250,000, while the cost of the pumps was estimated at £700,000. Negotiations were on foot for carrying out this system when the British engineers arrived in Egypt. They soon resolved that it would be very much better if the original scheme of using the barrage could be carried out, and after a careful examination of the work they were satisfied that this could be done. The barrage rests entirely on the alluvial bed of the Nile. Nothing more solid than strata of sand and mud is to be found for more than 200 feet below the river. It was out of the question, therefore, to think of founding on solid material, and yet it was desired to have a head of water of 13 or 14 feet upon the work. Of course, with such a pressure as this, there was likely to be percolation under the foundations and a washing-out of the soil. It had to be considered whether this percolation could best be checked by laying a solid wall across the river, going down to 50 or 60 feet below its bed, or by spreading out the foundations above and below the bridge, so as to form one broad water-tight flooring—a system practised with eminent success by Sir Arthur Cotton in Southern India. It was decided to adopt the latter system. As originally designed, the flooring of the barrage from up-stream to down-stream face was 111·50 feet wide, the distance which had to be travelled by water percolating under the foundations. This width of flooring was doubled to 223 feet, and along the up-stream face a line of sheet piling was driven 16 feet deep. Over the old flooring was superposed 15 inches of the best rubble

masonry, an ashlar floor of blocks of close-grained trachyte being laid directly under the bridge, where the action was severest. The working season lasted only from the end of November to the end of June, while the Nile was low; and the difficulty of getting in the foundations was increased, as, in the interests of irrigation and to supply the Menufia canal, water was held up every season while the work was in progress to as much as 10 feet. The work was begun in 1886, and completed in June 1890. Moreover, in the meantime the eastern, or Tewfikia, canal was dug and supplied with the necessary masonry works for a distance of 23 miles, to where it fed the network of old canals. The western, or Behera, canal was thoroughly cleared out and remodelled; and thus the whole delta irrigation was supplied from above the barrage.

The outlay on the barrage between 1883 and 1891 amounted to about £460,000. The average cotton crop for the 5 years preceding 1884 amounted to 123,000 tons, for the 5 years ending 1898 it amounted to 251,200 tons. At the low rate of £40 per ton, this means an annual increase to the wealth of Lower Egypt of £5,128,000. Since 1890 the barrage has done its duty without accident, but a work of such vast importance to Lower Egypt required to be placed beyond all risk. It having been found that considerable hollow spaces existed below the foundations of some of the piers, five bore-holes from the top of the roadway were pierced vertically through each pier of both barrage, and similar holes were drilled at intervals along all the lock walls. Down these holes cement grout was injected under high pressure on the system of Mr Kinipple. The work was successfully carried out during the seasons 1896 to 1898. During the summer of 1898 the Rosetta barrage was worked under a pressure of 14 feet. But this was looked on as too near the limit of safety to be relied on, and in 1899 subsidiary weirs were started across both branches of the river a short distance below the two barrages. These were estimated to cost £530,000 altogether, and were to stand 10·8 feet above the river's bed, allowing the water-surface up-stream of the barrage to be raised 7·2 feet, while the pressure on that work itself would not exceed 10 feet. These weirs were satisfactorily completed in 1901.

The barrage is the greatest, but by no means the only, important masonry work in Lower Egypt. Numerous regulating bridges and locks have been built, to give absolute control of the water and facilities for navigation; and in 1901 a second weir was begun opposite Zifta across the Damietta branch of the Nile, to improve the irrigation of the Dakhleh province.

In the earlier section of this article it is explained how necessary it is that irrigation should always be accompanied by drainage. This had been totally neglected in Egypt; but very large sums have been spent on it, and the country is now covered with a network of drains nearly as complete as that of the canals.

Basin irrigation of Upper Egypt.

The ancient system of basin irrigation is still generally pursued in Upper Egypt. It seems simple enough; but in order really to flood the whole Nile Valley during seasons of defective as well as favourable floods, a system of regulating sluices, culverts, and syphons is necessary; and for want of such a system it was found, in the feeble flood of 1888, that there was an area of 260,000 acres over which the water never flowed. This cost a loss of land revenue of about £300,000, while the loss of the whole season's crop to the farmer was of course much greater. The attention of the British engineers was then called to this serious calamity; and fortunately for Egypt, there was serving in the country Col. J. C. Ross, R.E., an officer who had devoted many years of hard work to the irrigation of the North-West Provinces of India, and who possessed quite a special knowledge as well as a glowing enthusiasm for the subject. Fortunately, too, it was possible to supply him with the necessary funds to complete and remodel the canal system. When the surface-water of a river is higher than the fields right and left, there is nothing easier than to breach the embankments and flood the fields—in fact, it may be more difficult to prevent their being flooded than to flood them —but in ordinary floods the Nile is never higher than all the bordering lands, and in years of feeble flood it is higher than none of them. To water the valley, therefore, it is necessary to construct canals having bed-slopes less than that of the river, along which the water flows until its surface is higher than that of the fields. If, for instance, the slope of the river be 4 inches per mile, and that of the canal 2 inches, it is evident that at the end of a mile the water in the canal will be 2 inches higher than in the river; and if the surface of the land is 3 feet higher than that of the river, the canal, gaining on it at 2 inches per mile, will reach the surface in 18 miles, and from thence onwards will be above the adjoining fields. But to irrigate this upper 18 miles, water must either be raised artificially, or supplied from another canal taking its source 18 miles farther up. This would, however, involve the country in great lengths of canal between the river and the field, and circumstances are not so unfavourable as this. Owing to the deltaic nature of the Nile Valley, the fields on the banks are 3 feet above the flood, at 2 miles away from the banks they may not be more than 1 foot above that level, so that the canal, gaining 2 inches per mile and receding from the river, will command the country in 6 miles. The slope of the river, moreover, is taken in its winding course; and if it is 4 inches per mile, the slope of the axis of the valley parallel to which the canals may be made to flow is at least 6 inches per mile, so that a canal with a slope of 2 inches gains 4 inches per mile.

The system of having one canal overlapping another has one difficulty to contend with. Occasionally the desert cliffs and slopes come right down to the river, and it is difficult, if not impossible, to carry the higher-level canals past these obstructions. It should also be noticed that on the higher strip bordering the river it is the custom to take advantage of its nearness to raise water by pumps, or other machinery, and thereby to grow valuable crops of sugar-cane, maize, or vegetables. When the river rises, these crops, which often form a very important part of the year's produce and are termed *Nabári*, are still in the ground, and they require water in moderate and regulated quantities, in contradistinction to the wholesale flooding of the flats beyond. Fig. 3 will serve to explain this system of irrigation, the firm lines representing canals, the dotted lines embankments. It will be seen, beginning on the east or right bank of the river, that a high-level canal from an upper system is carried past a steep slope, where perhaps it is cut entirely out of rock, and it divides into two. The right branch waters all the desert slopes within its reach and level. The left branch passes, by a syphon aqueduct, under what is the main canal of the system, taken from the river close at hand (and therefore at a lower level). This left branch irrigates the *Nabári* on the high lands bordering the river. In years of very favourable flood this high-level canal would not be wanted at all: the irrigation could be done from the main canal, and with this great advantage, that the main canal water would carry with it much more fertilizing matter than would be got from the tail of the high-level canal, which left the river perhaps

25 miles up. The main canal flows freely over the flats C and D, and, if the flood is good, over B and part of A. It is carried round the next desert point, and to the north becomes the high-level canal. The masonry works required for this system are a syphon to pass the high level under the main canal near its head, bridges fitted with sluices where each canal passes under an embankment, and an escape weir at the tail of the system, just south of the desert point, to return surplus water to the river. Turning to the left bank, there is the same high-level canal from the upper system irrigating the basins K, P, and L, as well as the large basin E in such years as it cannot be irrigated from the main canal. Here there are two main canals—one following the river, irrigating a series of smaller basins, and throwing out a branch to its left, the other passing under the desert slopes and supplying the basins F, G, H, and S. For this system two syphons will be required near the head, regulating bridges under all the embankments, and an escape weir back into the river.

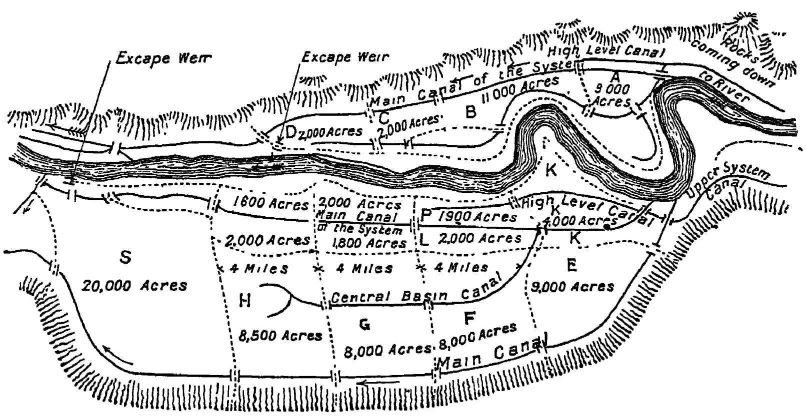


FIG. 3.—Map of the basin system of irrigation.

In the year following 1888 about 100 new masonry works of this kind were built in Upper Egypt, nearly 400 miles of new canal were dug, and nearly 300 miles of old canal were enlarged and deepened. The outlay altogether was about £800,000, and the result has been, as already stated, that with a complete failure of the Nile flood the loss to the country has been trifling compared with that of 1877.

There is one exception in Upper Egypt to the basin system of irrigation. The Khedive Ismail having acquired vast estates in the provinces of Assiut, Minieh, Beni-Suef, and the Fayúm, resolved to grow sugar-cane on a very large scale, and with this object constructed a very important perennial canal, named the Ibrahimia, taking out of the left bank of the Nile at the town of Assiut, and flowing parallel to the river for about 200 miles, with an important branch which irrigates the Fayúm. This canal was badly constructed, and by entirely blocking the drainage of the valley did a great deal of harm to the lands. Most of its defects have been remedied, but one remains. There being at its head no weir across the Nile, the water in the Ibrahimia canal rises and falls with that of the river, and so the supply is apt to run short during the hottest months, as was the case with the canals of Lower Egypt before the barrage was built. To supply the Ibrahimia canal at all during low Nile, it had been necessary to carry on dredging operations at an annual cost of about £12,000. This has now been rectified, in the same way as in Lower Egypt, by the construction of a weir across the Nile, intended to give complete control over the river and to raise the water-surface 8·2 feet. The Assiut weir is constructed on a design very similar to that of the barrage in Lower Egypt. It consists of a bridge of 111 arches, each 5 metres span, with piers of 2 metres thickness. In each arch are fitted two gates. There is a lock 80 metres long and 16 metres wide at the left or western end of the weir, and adjoining it are the regulating sluices of the Ibrahimia canal. The Assiut weir across the Nile is just about half a mile long. The work was begun at the end of 1898, and finished early in 1902.

Assiut weir.

This weir, as well as that in Lower Egypt, is intended to raise the water-surface above it, and to control the distribution of its supply, but in no way to store that supply. The idea of ponding up the superfluous flood discharge of the river is not a new one, and if Herodotus is to be believed, it was a system actually pursued at a very early period of Egyptian history, when Lake Moeris in the Fayúm was filled at each Nile flood, and drawn upon as the river ran down. When British engineers first undertook the management of Egyptian irrigation, many representations were made to them of the advantage of storing the Nile water; but they consistently maintained that before entering on that subject it was their duty to utilize every drop of the water at their disposal. This seemed all the more evident, as at that time financial reasons made the construction of a costly Nile dam out of the question. Every year, however, between 1890 and 1902 the supply of the Nile during May and June was actually exhausted, no water at all flowing then out into the sea. In these years, too, owing to the extension of drainage works, the irrigable area of Egypt was greatly enlarged, so that if perennial cultivation was at all to be increased, it was necessary to increase the volume of the river, and this could only be done by storing up the flood supply. The first difficulty that presented itself in carrying this out, was that during the months of highest flood the Nile is so charged with alluvial matter that to pond it up then would inevitably lead to a deposit of silt in the reservoir, which would in no great number of years fill it up. It was found, however, that the flood water was comparatively free from deposit by the middle of November, while the river was still so high that, without injuring the irrigation, water might go on being stored up until March. Accordingly, the dam is supplied with sluices large enough to discharge unchecked the whole volume of the river as it comes down until the middle of November, and then to begin the storage.

Storage.

The site selected for the great Nile dam was at the head of the First Cataract above Assuan. A dyke of syenite granite here crosses the valley, so hard that the river had nowhere scoured a deep channel through it, and so it was found possible to construct the dam entirely in the open air, without the necessity of laying under-water foundations. The length of the dam is about 6400 feet—nearly $1\frac{1}{4}$ mile. The greatest head of water in it is 65 feet. It is pierced by 140 under-sluices of 150 square feet each, and by 40 upper-sluices, each of 75 square feet. These, when fully open, are capable of discharging the ordinary maximum Nile flood of 350,000 cubic feet per second, with a velocity of 15·6 feet per second and a head of 6·6 feet. The top width of the dam is 23 feet, the bottom width, at the deepest part, about 82 feet. On the left flank of the dam there will be a canal, provided with four locks each 262 by 31 feet in area, so that navigation will be possible at all seasons. It was

Nile dam.

intended at first to raise the dam 26 feet higher, but this would have involved the yearly submergence of the celebrated classical temples of Philæ, situated on an island just up-stream of the dam. Had the natives of Egypt been asked to choose between the preservation of Ptolemy's famed temple and the benefit to be derived from an additional 20 feet depth of water storage, there can be no question that they would have preferred the latter; but they were not consulted, and the classical sentiment and artistic beauty of the place, skilfully pleaded by archæologists and artists, carried the day. As at present designed, the storage capacity of the reservoir is estimated at about 3,750,000 millions of cubic feet, which will create a lake extending up the Nile Valley for about 200 miles. It is calculated that yearly the reservoir should be full before the end of March; after that the water-surface in it will remain constant, the volume reaching the reservoir from the south being passed on through the sluices. In May, when the demand for water increases, first the upper and then the under sluices will be gradually opened, so as to increase the river supply, until July, when all the gates will be open, to allow of the free passage of the flood. In 1902 this magnificent work was completed. The engineer who designed it was Mr W. Willcocks, C.M.G. The contractors were Messrs John Aird & Co., the contract price being £2,000,000. The financial treaties in which the Egyptian Government are bound up would prevent their ever paying so large a sum as this within five years; but a company was formed in London which advances periodically the sum due to the contractors, on receipt from the Government of Egypt of promissory notes to pay sixty half-yearly instalments of £78,613, commencing on the 1st July 1903. There are no treaties to prevent the Government of Egypt from paying so moderate a sum as this year by year, and the payments do not begin until the first year that a return may be expected from the additional irrigation to be effected.

See WILLCOCKS, *Egyptian Irrigation*, 2nd edition, 1899; MONCRIEFF, *Lectures on Irrigation in Egypt*. *Professional Papers of the Corps of Royal Engineers*, vol. xix., London, 1893. (C. S. M.)

III. INDIA.

At pp. 754, 755 of vol. xii. of this work (9th edition) will be found some account of the irrigation works of India, of the outlay incurred and of the revenue obtained up to the year 1878. That year, which saw the end of a most disastrous famine, may be considered as the commencement of a new era as regards irrigation. It had at last been recognized that such famines must be expected to occur at no very long intervals of time, and that the cost of relief operations must not be met by increasing the permanent debt on the country, but by the creation of a famine relief and a famine insurance fund. For this purpose it was fixed that there should be an annual provision of Rx.1,500,000, to be spent on—(1) relief, (2) protective works, (3) reduction of debt. Among protective works the first place was given to works of irrigation. These works were divided into three classes—(i.) productive works; (ii.) protective works; (iii.) minor works.

Productive works, as their name implies, are such as may reasonably be expected to be remunerative, and they include all the larger irrigation systems. Their capital cost is provided from loan funds, and not from the relief funds mentioned above. In the seventeen years ending 1896–97 the capital expenditure on such works was Rx.10,954,948, including a sum of Rx.1,742,246 paid to the Madras Irrigation Company as the price of the Kurnool-Cuddapah canal, a work which can never be financially productive, but which nevertheless did good service in the famine of 1896–97 by irrigating 87,226 acres. In the famine year 1877–78 the area irrigated by productive canals was 5,171,497 acres. In the famine year 1896–97 the area was 9,571,779 acres, including an area of 123,087 acres irrigated on the Swat river canal in the Punjab. The revenue of the year 1879–80 was nearly 6 per cent. on the capital outlay. In 1897–98 it was $7\frac{1}{2}$ per cent. In the same seventeen years Rx.2,099,253 were spent on the construction of protective irrigation works, not expected to be directly remunerative, but of great value during famine years. On four works of this class were spent Rx.1,649,823, which in 1896–97 irrigated 200,733 acres, a valuable return then, although in an ordinary year their gross revenue does not cover their working expenses. Minor works may be divided into those for which capital accounts have been kept and those where they have not. In the seventeen years ending 1896–97, Rx.827,214 were spent on the former, and during that year they yielded a return of 9·13 per cent. In the same year the irrigation effected by minor works of all sorts showed the large area of 7,442,990 acres. Such are the general statistics of outlay, revenue, and irrigated area up to the end of 1896–97. The Government might well be congratulated on having through artificial means ensured in that year of widespread drought and famine the cultivation of 27,326 square miles, a large tract even in so large a country as India.

Some description will now be given of the chief of these irrigation works. Beginning with the Punjab, the province in which most progress has been made, the great Sutlej canal, which irrigates the country to the left of that river, was opened in 1882, and the Western Jumna canal (perhaps the oldest in India) was extended into the dry Hissar and Sirsa districts, and generally improved so as to increase by nearly 50 per cent. its area of irrigation between 1878 and 1897. Perhaps this is as much as can well be done with the water at command for the country between the Sutlej and the Jumna, and it is enough to secure it for ever from famine. The Bari Doab canal, which irrigates the Gurdaspur, Amritsar, and Lahore districts, has been enlarged and extended so as to double its irrigation since 1877–78. The Chenab canal was only begun in 1889–90, and is finished. In 1896–97 it irrigated 520,279 acres, and yielded a revenue of 6·75 per cent. on the capital cost. In constructing this canal an experiment was made which proved a great success. Former canals were made in populous districts where the people were ready at once to take the water offered to them. The Chenab canal flows through what was practically a desert. Doubt was expressed as to whether colonists from more populous tracts would migrate to the banks of the new canal. But these doubts soon vanished, and in 1897 550,000 acres had been allotted to new settlers, while there were many more applicants. A much smaller work, but one of great interest, is the Swat river canal in the Peshawar valley. It was never expected that this would be a remunerative work, but it was thought for political reasons expedient to construct it, in order to induce turbulent frontier tribes to settle down into peaceful agriculture. This has had a great measure of success, and the canal itself has proved remunerative, irrigating 123,0C0 acres in 1896–97. Another great canal drawing its water from the Jhelum will irrigate the country between that river and the Chenab. It is intended to irrigate 424,000 acres, and the capital cost is estimated at Rx.1,228,000. A much greater scheme than any of the above is that of the Sind Sagar canal, which it is proposed to draw from the left bank of the Indus opposite Kalabagh, to irrigate 1,750,000 acres at a cost of Rx.6,000,000. Another great canal scheme under consideration in the Punjab proposes to take off from the right bank of the Sutlej, and to irrigate about 600,000 acres in the Montgomery and Multan districts, at

a cost of Rx.2,500,000. These three last projects would add 2,774,000 acres to the irrigated area of the province, and as they would flow through tracts almost unpeopled, they would afford a most valuable outlet for the congested districts of Northern India. In addition to these great perennial canals, much has been done since 1878 in enlarging and extending what are known as the "inundation canals" of the Punjab, which utilize the flood waters in the rivers during the monsoon season, and are dry at other times. By these canals large portions of country throughout most of the Punjab are brought under cultivation, and the area thus watered has increased from about 180,000 to 500,000 acres since 1878.

It is on inundation canals such as these that the whole cultivation of Sind depends. In 1878 the area was about 1,500,000 acres; in 1896–97 it had increased to 2,484,000 acres. This increase was not due to famine in Sind, for that rainless province depends always on the Indus, as Egypt does on the Nile, and where there is no rainfall there can be no drought. But the famine prices obtained for agricultural produce doubtless gave an impetus to cultivation. In Sind, too, there is room for much increase of irrigation. It has been proposed to construct two new canals, the Jamrao and the Shikárpur, and to improve and extend three existing canals—Nasrat, Naulakhi, and Dad. The total cost of these five projects, some of which are now in progress, will be Rx.1,596,682, and the extension of irrigation is estimated at 660,563 acres.

Turning from the basin of the Indus to that of the Ganges, the commissioners appointed to report on the famine of 1896–97 found that in the country between the Ganges and the Jumna little was left to be done beyond the completion of some distributary channels. The East India Company's great work, the Ganges canal, constructed between 1840 and 1854, before there was a mile of railway open in India, still holds its place unsurpassed among later irrigation work for boldness of design and completeness of execution, a lasting monument to the genius of Sir Proby Cautley, an officer of the Bengal Artillery but a born engineer. Ever since 1870 consideration has been given to projects for irrigating the fertile province of Oudh by means of a great canal to be drawn from the river Sarda. The water is there in abundance, the land is well adapted for irrigation, but as there is a considerable rainfall, it is doubtful whether the scheme would prove remunerative, and a large section of the landowners have hitherto opposed it, as likely to waterlog the country. Among the four protective works of irrigation which were said above to have irrigated 200,733 acres in 1896–97, one of the most important is the Betwa canal, in the parched district of Bundelkhand. This canal has cost Rx.428,086, and causes an annual loss to the state in interest and working expenses of about Rx.20,000. It irrigated, however, in 1896–97 an area of 87,306 acres, raising crops valued at Rx.231,081, or half the cost of the canal, so it may be said to have justified its construction. A similar canal from the river Ken in the same district has long been under consideration, but was not yet sanctioned in 1901. Proceeding farther east, we find very satisfactory progress in the irrigation of southern Behar, effected by the costly system of canals drawn from the river Sone. In 1877–78 these canals irrigated 241,790 acres. Rapid progress was not expected here, and 792,000 acres was calculated as being the maximum area that could be covered with the water supply available. In the five years preceding 1896–97 the average irrigated area was 392,921 acres, and during that year the area was 555,156 acres.

The canal system of Orissa was never expected to be remunerative, since in five years out of six the local rainfall is sufficient for the rice crop. In 1878–79 the area irrigated was 111,250 acres, and the outlay up to date was Rx.1,750,000. In 1896–97 the area was 185,048 acres, and the capital outlay amounted to Rx.2,623,703. It should be mentioned in favour of these canals that although the irrigation is not of yearly value, they supply very important water communication through a province which, from its natural configuration, is not likely to be soon intersected by railways. If, moreover, such a famine were again to occur in Orissa as that of 1866–67, there would be no doubt of the value of these fine canals.

In the Madras Presidency and in Mysore irrigation has long assumed a great importance, and the engineering works of the three great deltas of the Godaveri, Kistna, and Kaveri, the outcome of the genius and indefatigable enthusiasm of Sir Arthur Cotton, have always been quoted as showing what a boon irrigation is to a country. In 1878 the total area of irrigation in the Madras Presidency amounted to about 5,000,000 acres. The irrigation of the eight productive systems was 1,680,178 acres, and the revenue Rx.739,778. In 1898 there were ten of these systems, with an irrigation area, as shown by the accompanying table, of 2,685,915 acres, and a revenue of Rx.1,163,268:—

Irrigation.	Area Watered.	Total Revenue.	Total Expenditure.	Net Revenue.	Capital and Indirect Charges	Percentage of Net Revenue to Capital.
Major Works—	Acres.	Rx.	Rx.	Rx.	Rx.	
1. Godaveri Delta .	779,435	328,443	68,376	260,067	1,297,807	19 15
2. Kistna " .	520,373	254,579	74,142	180,437	1,319,166	13·18
3. Penner Weir System .	70,464	28,160	5,037	23,123	189,919	7·59
4. Sangam System .	76,277	32,627	7,037	25,590	385,601	3·68
5. Kurnool Canal .	47,008	15,622	12,404	3,218	2,171,740	·15
6. Barur Tank System	4,421	1,162	385	777	4,250	1 39
7. Kaveri Delta . .	989,808	434,346	43,464	390,882	199,458	44·87
8. Srivaikuntam System .	41,668	19,349	4,680	14,669	147,192	5·45
9. Periyar Project .	89,143	37,526	10,751	26,775	852,914	·27
10. Rushikulya Canal .	67,318	11,454	3,678	7,776	464,423	·54
Total . .	2,685,915	1,163,268	229,954	933,314	7,032,470	7·88
Minor Works—						
23 Works for which Capital and Revenue Accounts are kept . .	535,813	200,558	34,655	165,903	1,693,878	4·44
Minor Works for which such Accounts are not kept . .	3,131,009	830,175	193,295	636,880	...	...
Grand Total .	6,352,737	2,194,001	457,904	1,736,097	...	...

In the three great deltas, and the small southern one that depends on the Srivaikuntam weir over the river Tumbraparni, extension and improvement works have been carried on. The Sangam and Penner systems depend on two weirs on the river Penner in the Nellore district, the former about 18 miles above and the latter just below the town of Nellore. The former irrigates on the left, the latter on the right bank of the river. This district suffered severely in the famine of 1877–78, and the irrigation works were started in consequence. The Barur tank system in the Salem district was also constructed after the famine of 1877–78. As yet it has not fulfilled expectations. The Periyar scheme has for its object both the addition of new irrigation and the safeguarding of that which exists in the district of Madura, a plain watered by means of a great number of shallow tanks drawing their supply from a very uncertain river, the Vaigai. This river takes its rise on the eastern slopes of the Ghat range of mountains, and just opposite to it, on the western face of the range, is the source of the river Periyar. The rainfall on the west very much exceeds that on the east, and the Periyar

used to find its way by a short torrent course to the sea, rendering no service to mankind. Its upper waters are now stemmed by a masonry dam 178 feet high, forming a large lake, at the eastern end of which is a tunnel 5700 feet long piercing the watershed, and discharging 1600 cubic feet per second down the eastern side of the mountains into the river Vaigai. No bolder or more original work of irrigation has been carried out in India, and the credit of it is due to Colonel J. Pennycuick, C.S.I. The dam and tunnel were works of unusual difficulty. The country was roadless and uninhabited save by wild beasts, and fever and cholera made sad havoc of the working parties; but it was successfully accomplished. The last of those given in the table above was not expected to be remunerative, but it should prove a valuable protective against famine. The system consists of weirs over the rivers Gulleri, Mahanadi, and Rushikulya in the backward province of Ganjam, south of Orissa. From these weirs flow canals altogether about 127 miles long, which, in connexion with two large reservoirs, are capable of irrigating 120,000 acres. The works were not yet finished in 1901, but already irrigated 67,318 acres.

In addition to all these great engineering systems, southern India is covered with minor works of irrigation, some drawn from springs in the sandy beds of rivers, some from the rainfall of half a square mile ponded up in a valley. In other cases tanks are fed from neighbouring streams, and the greatest ingenuity is displayed in preventing the precious water from going to waste.

Allusion has been already made to the canals of Sind. Elsewhere in the Bombay Presidency, in the Deccan and Gujarat, there are fewer facilities for irrigation than in other parts of India. The rivers are generally of uncertain volume. The cost of storage works is very great. The population is backward, and the black soil is of a nature that in ordinary years can raise fair crops of millet and maize without artificial watering. Up to the end of 1896–97 the capital spent on the irrigation works of the Deccan and Gujarat was Rx.2,616,959. The area irrigated that year was 262,830 acres. The most important works are the Mutha and Nira canals in the Poona district.

In Upper Burma three productive irrigation works have been proposed—the Mandalay, the Shwebo, and the Mon canals, of which the first was in progress in 1901. It was estimated to cost Rx.323,280, and to irrigate 72,000 acres. The area estimated from the whole three projects is 262,000 acres, situated in the only part of Burma that is considered liable to famine.

See *Annual Reports Irrigation Department Local Governments of India. Reports of the Indian Famine Commissions of 1878 and 1898.*

(C. S. M.)

IV. United States.

On account of the aridity of the climate throughout the greater part of the western third of the United States, the practice of agriculture is dependent upon an artificial supply of water. On most of the country west of the 97th meridian and extending to the Pacific Ocean less than 20 inches of rain falls each year. The most notable exceptions are in the case of a narrow strip west of the Cascade Range and of some of the higher mountain masses. In ordinary years the climate is too dry for successful cultivation of the field crops, although under favourable conditions of soil and cultivation there are certain areas where cereals are grown by what is known as "dry farming." The eleventh census of the United States, 1890, showed that 3,564,416 acres were irrigated in 1889. This included only the lands from which crops were produced. Besides this, there were probably 10 million acres under irrigation systems constructed in whole or in part. An estimate for the year 1899 gave the following figures of area cropped by irrigation, these being, in round numbers :—

Arizona	180,000
California	1,500,000
Colorado	1,250,000
Idaho	500,000
Montana	800,000
Nevada	500,000
New Mexico	200,000
Oregon	300,000
Utah	500,000
Washington	100,000
Wyoming	500,000
Total	6,330,000

In addition to the area above given, about 100,000 acres are under irrigation in what is known as the subhumid region, east of the states above mentioned and including portions of the states of North and South Dakota, Nebraska, Kansas, and Texas, and the territory of Oklahoma.

The greater part of these lands is irrigated by canals or ditches built by individuals acting singly or in co-operation with their neighbours, or by corporations. The national and state governments have not built any works of reclamation excepting where the Federal Government, through the Indian department, has constructed irrigation ditches for Indian tribes, notably the Crow Indians of Montana. A few of the state governments, such, for example, as Colorado, have built small reservoirs or portions of canals from internal improvement funds.

The construction of irrigation canals and ditches has for the most part been brought about by farmers joining to plough out or dig ditches from the rivers, descending on a gentle grade. The cost of those under 5 feet in width has been less than \$500 per mile, and from 5 to 10 feet in width, \$1500 per mile. Some of the corporations constructing works for the sale of water have built structures of notable size, such, for example, as the Sweetwater and Hemet dams of southern California, the Bear river canal of Utah, and the Arizona canal, taking water from Salt river, Arizona. The cost of bringing water to the land has averaged about \$8 per acre where the ordinary ditches have been built. The owners of extensive works have charged from \$12 to \$20 per acre and upwards for so-called "water rights," or the privilege to take water from the canal, this covering cost of construction.

Besides the first cost of construction, the irrigator is usually called upon to pay annually a certain amount for maintenance, which may often be worked out by labour on the canal. The cost ranges from 50 cents to \$1 per acre; or, with incorporated companies, from \$1·50 to \$2·50 per acre and upwards. The largest expense for water rights and for annual maintenance is incurred in southern California, where the character of the crops, such as citrus fruits, and the scarcity of the water makes possible expensive construction and heavy charges. The legal expense for the maintenance of water rights is often large because of the interminable suits brought during the times of water scarcity. The laws regarding water in most of the arid states are indefinite or contradictory, being based partly on the common law regarding riparian rights, and partly upon the Spanish law allowing diversion of water from natural streams. Few fundamental principles have been established, except in the case of the state of Wyoming, where there is an official charged with the duty of ascertaining the amount of water in the streams and apportioning this to the claimants in the

order of their priority of appropriation for beneficial use.

Irrigation has progressed to such an extent, that in the year 1900 there remained few localities where water could not be easily or cheaply diverted from creeks and rivers for the cultivation of farms. The claims for the available supply from small streams now exceed the water to be had in the latter part of the irrigating season. There remain large rivers and opportunities for water storage which can be brought under irrigation at considerable expense. The large canals and reservoirs built by corporations have, however, rarely been successful from a financial standpoint, and irrigation construction during the latter part of the decade 1890–99 was relatively small.

Owing to the difficulty and expense of securing water from running streams by gravity systems, a great variety of methods has been developed of pumping water by windmills, gasoline or hot-air engines, and steam. Ordinary reciprocating pumps are commonly employed, and also air lifts and similar devices for raising great quantities of water to a height of from 20 to 50 feet. For greater depths the cost is usually prohibitive. Throughout the Great Plains region, east of the Rocky Mountains, and in the broad valleys to the west, windmills are extensively used, each pumping water for from 1 to 5 acres of cultivated ground. In a few localities, notably in South Dakota, the Yakima valley of Washington, San Joaquin, and San Bernardino valleys of California, San Luis valley of Colorado, and Utah valley of Utah, water from artesian wells has also been used for the irrigation of from 1 to 160 acres. The total acreage supplied by such means is probably less than 1 per cent. of that watered by gravity systems.

The development of irrigation has in part been retarded by the improper or wasteful use of water. On permeable soils, especially those of the terrace lands along the valleys, the soluble salts commonly known as alkali are gradually leached out and carried by the percolating waters towards the lower lands, where, reaching the surface, the alkali is left as a glistening crust or as pools of inky blackness. Farms adjacent to the rivers are for a time increased in richness by the alkaline salts, which in diffuse form may be valuable plant foods, and then suddenly become valueless when the concentration of alkali has reached a degree beyond that which the ordinary plants will endure.

The conditions governing the practice of irrigation vary widely in different parts of the arid region of the United States, and may best be summed up by taking the larger political divisions in geographical order.

In the states of *Oregon* and *Washington* there is great diversity of climate. The western third of these states, extending from the sea-coast to the tops of the Cascade Range, is humid, and in the valleys crops are successfully raised, although the yield per acre is increased by irrigation during the summer droughts. Fully two-thirds of the area of these states lies east of the Cascade Range, and the broad valleys and open plains are arid, the rainfall being from 8 to 12 inches per annum. Irrigation is practised wherever water can be diverted from the streams—notably the Yakima river of Washington and its tributaries rising in the Cascade Mountains. In the eastern part of these states wheat and other cereals are raised without irrigation, owing to peculiar conditions of soil. Columbia river and its principal tributary, Snake river, have ample water-supply for navigation, but these streams have cut deep gorges or cañons, and the water cannot be taken out upon the adjacent plateaus. A small amount is pumped by water-wheels, irrigating orchards and gardens on the narrow strip of bottom land between the river and the high cliffs.

In *Idaho* agriculture by irrigation is practised on the lava-covered plains in the southern portion of the state and in the valleys of streams tributary to Snake river. This stream, issuing from the mountains of Wyoming, flows for a time on the surface of the lava, and then by a series of falls, of which the principal are American and Shoshone, descends into narrow cañons. In the upper part of its course the greater part of the summer flow is diverted for the irrigation of lands in south-eastern Idaho. In the south-western part of the state waters are taken from Boise, Payette, and Weiser rivers.

In *Montana* agriculture is confined mainly to valleys at the headwaters of Missouri river. The Gallatin, Madison, and Jefferson rivers, which unite at Threeforks to form the Missouri, each supply numerous ditches and systems of canals. The small streams which issue from the eastern front of the main range of the Rocky Mountains are also used, the principal of these being the Teton, Sun, Marias, and Milk. Along the Missouri itself the difficulties of diverting water are such that irrigation has been practised only to a small extent. Along the Yellowstone, in the southern part of the state, where the fall of the stream is considerable, irrigation canals of considerable size have been taken out. In the vicinity of Miles City a small area is watered from artesian wells.

In the state of *Wyoming* the general altitude is greater than that of any other part of the United States, and, as a consequence, agricultural operations are limited by the short growing season. Irrigation is, however, practised in the valleys in the northern part of the state, where the altitude is relatively low, particularly in the country east of the Bighorn Range, water being obtained from streams flowing from these mountains. On the Laramie plains, whose altitude is 7000 feet and upwards, irrigation, mainly of forage crops, is practised. Water is taken also from Laramie river by means of a tunnel through the Laramie Hills out on the plains, in the vicinity of Wheatland, which lies about 70 miles northerly from Cheyenne, the capital of the state. The irrigation of forage crops is also practised throughout the mountain valleys of the state.

In the state of *Colorado* irrigation is practised in the valleys and on the plains immediately adjacent to the Rocky Mountains front, water being had from the small streams which form the South Platte river, or, to the south of this, the Arkansas river. On the divide between these streams, cereals, and occasionally field crops, are raised by dry farming. Great success has been had in the cultivation of the potato by irrigation in the vicinity of Greeley, and in the production of melons of superior quality and in enormous quantities near Rockyford. In the western portion of the state orchards are irrigated in the lower or more open valleys, the country being notable for the production of peaches and apples. In the San Luis valley, in the southern part of the state, whose altitude is over 7500 feet, wheat is raised by using the waters of the Rio Grande, and to a small extent by water-supply from artesian wells.

The state of *Utah*, lying in the centre of the arid region, affords typical examples of irrigation. Here the system of artificially applying water to the soil to any considerable extent was first practised by people emigrating from humid regions. The Mormons on coming into the country in 1847 found that crops could not be raised without water, and, forced by circumstances, developed methods suited to the physical conditions. The principal streams used are those issuing from the Wasatch Range and flowing towards the west into the valleys of Utah and Great Salt lakes. From each of these creeks or rivers water has been diverted, mainly by community effort, and used upon the lands surrounding the Mormon settlements. Until recently there have been no corporate enterprises, all of the construction having been done by associations of irrigators. Since 1890, however, a few large irrigation works have been built by outside or foreign capital, but these were financially unsuccessful. In the north-eastern portion of the state, in Cache valley, the lowlands are irrigated, and the high terrace lands are used for raising winter wheat without an artificial supply of moisture. In the southern part of the state, along the streams of the high plateaus, irrigation is practised in a small way; and in the extreme south-western corner, in the vicinity of St George, a small amount of cotton is reported to be produced by the aid of irrigation.

The state of *Nevada*, lying west of Utah, and between it and Colorado, contains the largest proportion of desert land and the smallest available water-supply. The principal river is the Humboldt, which flows south-westerly across the state, and along which irrigation is practised in a crude way, mainly for the production of grass. The principal part of the population of the state is in the extreme western angle adjacent to California. The Truckee, Carson, and Walker rivers, issuing from the mountains of California, are used in the low valleys, the excess water collecting in sinks and disappearing by evaporation.

California contains not only the largest area irrigated, but offers examples of the most complete utilization of water, especially in the southern end, where high-class citrus fruits are produced. Along the north-western coast the climate is humid, and there is also ample precipitation upon the high mountains extending along the eastern side of the state. The great interior valley, drained by the Sacramento river coming from the north and the San Joaquin from the south, is arid, and crops must be irrigated. Along the foothills on the eastern side of the valley ample water can usually be obtained from the streams issuing from the high sierras. The water of many of these was diverted during the period of active

gold-mining, from 1850 to 1870, and expensive dams and canals built for bringing out water to the placer mines. With the decline of these, following the enforcement of the *débris* law, these works were gradually used and enlarged for irrigation, particularly of orchards and vineyards. In the southern or upper end of the San Joaquin valley raisin grapes have been particularly successful.

Southern California is shut off from the remainder of the state by the abrupt Sierra Madre Range, giving it a distinctive climate, which has been found to be particularly adapted to the cultivation of oranges, lemons, walnuts, and various high-priced fruits. Water is relatively scarce, and the works for its development and control are most elaborate and expensive. The perennial streams are small, but during floods these have brought down from the high mountains enormous quantities of sand and gravel, which have been built up in great alluvial cones around the edges of the valleys. These pervious deposits are filled with water percolating from the mountains, which has been brought to the surface and used for irrigation by means of wells, some of which overflow, or by tunnels driven on a slightly ascending grade, out of which the percolating water flows. Large reservoirs have also been constructed for holding the flood waters. Owing to the unprecedented drought of 1898 and 1899, most of these were dry during the summer of the latter year. Water is also pumped from the sandy beds of the streams, and is used with great care and economy in the ratio of one miner's inch, or a fiftieth of a cubic foot, per second per acre, on every 5 to 10 or even more acres.

The territory of *Arizona*, lying south of Utah and east of California, has in the southern portion the warmest climate of the arid region. The northern part of the territory consists of high plateaus, deeply cut by the Colorado river and its tributaries. The Gila river flows westerly across the southern part of the state, receiving its water-supply from the abrupt southern front of the high plateau region, its principal tributaries being Salt and Verde rivers. Extensive irrigation works have been built to divert water below the junction of these latter streams, covering what is known as Salt river valley, within which the capital, Phœnix, is located. Water is also taken out of the Gila river by a number of canals rising both above and below the junction with Salt river. The principal crops are alfalfa and cereals, a considerable area being planted in groves of oranges and similar fruits.

The territory of *New Mexico* lies south of Colorado, and receives a considerable portion of its water from the Rio Grande, which rises in this state and flows south through New Mexico, and then forms the international boundary between the republics of the United States and Mexico. This river passes alternately through deep cañons and open valleys, and in the latter its waters are diverted by ditches, many of which are of unknown antiquity, having been constructed by the Pueblo, or town-dwelling, Indians long before the advent of the white men. The diversion and loss of water through evaporation is so complete, that during a portion of the year the river is dry in southern New Mexico and along the border of western Texas. To the east of the Rio Grande is the Pecos, its main tributary from the north. The waters of this stream come largely from enormous springs, and irrigation systems of considerable size have been constructed, using the greater part of the flow.

The country lying to the east of the states and territories just described consists for the most part of the high plains, which extend from the Rocky Mountains range, sloping gradually into the Mississippi valley. Perennial streams are comparatively rare, and are at long distances from each other. The plains region is, however, underlaid over considerable areas by water-bearing sands and gravels, and wells are successfully dug or drilled to depths of from 50 to 300 feet. Water is pumped from these by innumerable windmills of various descriptions, most of them being of the modern rapid-running steel construction, designed to operate in light breezes, automatically throwing themselves out of the wind during sudden storms. Most of the water is pumped for cattle, the area being devoted mainly to grazing. Irrigation is practised in a small way at the home ranches scattered over this so-called semi-arid or sub-humid region, which is included in the states of North and South Dakota, Nebraska, Kansas, Texas, and the territory of Oklahoma. On these high plains there are occasional years when the rainfall is sufficient for the production of crops, and settlements have during these seasons rapidly sprung up, to be abandoned after the continued drought through a succession of years has destroyed the crops.

Irrigation is not wholly confined to the arid and semi-arid regions of the west, but is practised in the rice-fields of Texas and Louisiana bordering upon the Gulf of Mexico. It is also employed to a small extent in the orange groves of Florida, water being pumped and distributed in pipes. At various points along the Atlantic coast it is used in the production, on the sandy soils, of the early vegetables shipped to the larger cities, and even as far north as Massachusetts is employed in the raising of cranberries, and on water meadows. (F. H. N.)

Irun, a frontier town of north-east Spain, in the province of Guipuzcoa, 8 miles east of San Sebastian. A new suburb has sprung up between the station and the old town, where the massive town hall deserves notice. The local industries (tanning, brandy, brick and paper manufactures) have developed rapidly, but Irun derives its prosperity from the fact that it is the most important custom-house in Spain for the overland trade with the rest of Europe. The receipts amount to about 10 per cent. of the whole proceeds of the Peninsular customs. Irun is also on the chief highway for travellers and almost all the mails. The town was the first in Spain to use electricity for general lighting. It is the terminus of some important narrow-gauge mining railways and steam tramways, placing it in communication with the mining districts of Guipuzcoa and Navarre, and with the highlands of both provinces, where timber is extracted in larger amount every year from splendid forests of oak, beech, and pine. Population (1897), 9739.

Irvine, a royal and parliamentary burgh (Ayr group) of Ayrshire, Scotland, near the mouth of the river Irvine, 27 miles south-west of Glasgow by rail. In 1892 Irvine was restored to the status of a port. In 1898, 1119 vessels of 98,532 tons entered, and 1108 vessels of 97,791 tons cleared. Shipbuilding is a growing industry; 12 vessels of 3410 tons were launched in 1899. Additions have been made to the town hall, and the academy is being replaced by a larger secondary school. A bronze statue of Burns (who learned flax-dressing in Irvine) was unveiled in 1896. There are three excellent golf courses. Population (1881), 8498; (1901), 9603.

Irving, Sir Henry (John Henry Brodribb), (1838——), English actor, son of Samuel Brodribb, was born at Keinton, near Glastonbury, 6th February 1838. After a few years' schooling he became, at the age of fourteen, a clerk in the offices of a firm of East India merchants in London. His strong taste and capacity for acting soon led him to give up all idea of a commercial career, and before he was nineteen he obtained his first engagement on the stage. This was in a theatrical company at Sunderland, where, on 29th September 1856, he made his first appearance at the New Royal Lyceum Theatre. For stage purposes he discarded his patronymic of Brodribb, and was known as Henry Irving (eventually assuming Irving as an additional surname by royal licence in June 1889). For ten years he went through an arduous but invaluable training in various stock companies in Edinburgh, Glasgow, Liverpool, and Manchester, amassing a very wide and diversified store of experience, as may be inferred from the fact that during this period he performed between five and six hundred parts. By degrees (especially in Manchester, where he had achieved a marked success as Rawdon Scudamore in Boucicault's *Hunted Down*) his ability gained recognition, with the result that in October 1866 he was offered and accepted an engagement at the St James's Theatre, London, to play Doricourt in *The Belle's Stratagem.* A year later he joined the company of the newly-opened Queen's Theatre, Long Acre, where he acted in association with Charles Wyndham, J. L. Toole, Lionel Brough, John Clayton, Mr and Mrs Alfred Wigan, Miss Ellen Terry, and Miss Nelly Farren. Two years of useful work with them were followed by short engagements at the Haymarket and Drury Lane, until, in December 1869, Irving made his first conspicuous success as Mr Chevenix in H. J. Byron's play, *Uncle Dick's Darling*, at the Gaiety Theatre. He followed this up by a masterly performance of Digby Grand in *The Two Roses* at the Vaudeville Theatre in 1870. In 1869 he married Miss Florence O'Callaghan, daughter of a

surgeon-general in the Indian army; his two sons, Henry Brodribb and Laurence, both afterwards taking to the stage. In 1871 began his association with the Lyceum Theatre with his engagement to support Miss Bateman there, under her father's management. The fortunes of the house were at a very low ebb when the tide was turned by Irving's instantaneous success in *The Bells*, which "ran" for 150 nights. With Miss Bateman, Irving was seen in *Charles I.*, *Eugene Aram*, *Richelieu*, and eventually, in October 1874, in *Hamlet*. The unconventionality of his performance as Hamlet (during a "run" that lasted for 200 nights) aroused keen discussion, and singled him out as the most interesting actor of his day. In 1875 he was seen, still with Miss Bateman, as Macbeth; in 1876 as Othello, and as Philip in Tennyson's *Queen Mary;* in 1877 in *Richard III.* and *The Lyons Mail.* In 1878 the Bateman *régime* at the Lyceum ceased, and in December of that year Irving opened the theatre under his own management. Assisted by Miss Ellen Terry, whose Ophelia was the first of a long series of triumphs for her, he revived *Hamlet* for a further run of a hundred nights; and after appearing in *The Corsican Brothers*, he produced *The Merchant of Venice* in 1879. His Shylock was as much discussed as his Hamlet had been, the dignity with which he invested the Jew pleasing some as much as it offended others. This performance, and Miss Terry's as Portia, placed them definitely at the head of their profession. Two years later (after the production of Tennyson's *The Cup*, a revival of *Othello* in conjunction with the American actor Edwin Booth, and *Romeo and Juliet*) there began a period at the Lyceum Theatre which may be reckoned as in some respects the most notable in the recent history of the English stage. The Lyceum stage management, and the brilliancy of its productions in scenery, dressing, and accessories, were revelations in the art of *mise-en-scène*. *Much Ado about Nothing* in the autumn of 1882 was followed by *Twelfth Night* in 1884, *Olivia* in 1885, *Faust* in 1886, *The Dead Heart* in 1889, and *Ravenswood* in 1890; the winter of 1888 was remarkable for the production of *Macbeth*, and the year 1892 for two very fine assumptions of the characters of Wolsey in *Henry VIII.* and King Lear, followed by a peculiarly striking and dignified performance (in 1893) of the part of Becket in Tennyson's play of that name. During these years, too, Irving, with the whole Lyceum company, paid several visits to America, which met with conspicuous success and were repeated in succeeding years. The chief remaining novelties at the Lyceum during Irving's sole managership (the theatre passed, at the beginning of 1899, into the hands of a limited liability company) were Comyns Carr's *King Arthur* in 1895, *Cymbeline*, in which Irving played Iachimo, in 1896, Sardou's *Madame Sans-Gêne* in 1897, *Peter the Great*, a play by Laurence Irving, the actor's second son, in 1898, and Conan Doyle's *Waterloo* (1894). The new *régime* at the Lyceum was signalized by the production of Sardou's *Robespierre* in April 1899, in which Irving reappeared after a serious illness, and in 1901 by an elaborate revival of *Coriolanus*. Both on and off the stage he always maintained a high ideal of the actor's profession, and in 1895 he received the honour of knighthood. He was also the recipient of honorary degrees from the universities of Dublin, Cambridge, and Glasgow. Sir Henry Irving's acting, apart from his genius as a presenter of plays, has divided criticism, opinions differing as to the extent to which his undoubted mannerisms of voice and deportment interfered with or assisted the expression of his ideas. So strongly marked a personality as his could not help giving its own colouring to whatever part he might assume, but the richness and originality of this colouring at its best cannot be denied, any more than the spirit and intellect which characterized his renderings. At the least, extraordinary versatility must be conceded to an actor who could satisfy exacting audiences in *rôles* so widely different as Digby Grand and Louis XI., Richard III. and Becket, Benedick and Shylock, Mathias and Dr Primrose.

Irvington, a town of Essex county, New Jersey, U.S.A., in the north-eastern part of the state, just west of Newark, of which it is a residential suburb. Population (1900), 5255, of whom 993 were foreign-born.

Isabella II. (1830– ——), ex-queen of Spain, was born in Madrid on 10th October 1830. She was the eldest daughter of Ferdinand VII., king of Spain, and of his fourth wife, Maria Christina, a Neapolitan Bourbon, who became queen-regent on 29th September 1833, when her daughter, at the age of three years, was proclaimed on the death of the king. Queen Isabella succeeded to the throne because Ferdinand VII. induced the Cortes to assist him in setting aside the Salic law, which the Bourbons had introduced since the beginning of the 18th century, and to re-establish the older succession law of Spain. The brother of Ferdinand, Don Carlos, the first pretender, fought seven years, during the minority of Isabella, to dispute her title, and her rights were only maintained through the gallant support of the army, the Cortes, and the Liberals and Progressists, who at the same time established constitutional and parliamentary government, dissolved the religious orders, confiscated the property of the orders and of the Jesuits, disestablished the Church property, and attempted to restore order in finances. After the Carlist war the queen-regent, Christina, resigned to make way for Espartero, the most successful and most popular general of the Isabelline armies, who only remained regent two years. He was turned out in 1843 by a military and political *pronunciamiento*, led by Generals O'Donnell and Narvaez, who formed a cabinet, presided over by Joaquin Maria Lopez, and this Government induced the Cortes to declare Isabella of age at thirteen. Three years later the Moderado party or Castilian Conservatives made their queen marry, at sixteen, her cousin, Prince Francisco de Assisi de Bourbon (1822–1902), on the same day (10th October 1846) on which her younger sister married the duke of Montpensier. These marriages suited the views of France and Louis Philippe, who nearly quarrelled in consequence with Great Britain; but both matches were anything but happy. Queen Isabella reigned from 1843 to 1868, and that period was one long succession of palace intrigues, back-stairs and ante-chamber influences, barrack conspiracies, military *pronunciamientos* to further the ends of the political parties—Moderados, who ruled from 1846 to 1854, Progressists from 1854 to 1856, Union Liberal from 1856 to 1863; Moderados and Union Liberal quickly succeeding each other and keeping out the Progressists so steadily that the seeds were sown which budded into the revolution of 1868. Queen Isabella II. often interfered in politics in a wayward, unscrupulous manner that made her very unpopular. She showed most favour to her reactionary generals and statesmen, to the Church and religious orders, and was constantly the tool of corrupt and profligate courtiers and favourites who gave her court a deservedly bad name. She went into exile at the end of September 1868, after her Moderado generals had made a slight show of resistance that was crushed at the battle of Alcolea by Marshals Serrano and Prim. The only redeeming traits of Queen Isabella's reign were a war against Morocco, which ended in an advantageous treaty and some cession of territory; some progress in public works, especially railways; a slight improvement in commerce and

finance. Isabella was induced to abdicate in Paris on 25th June 1870 in favour of her son, Alphonso XII., and the cause of the restoration was thus much furthered. She had separated from her husband in the previous March. She continued to live in France after the restoration in 1874. On the occasion of one of her visits to Madrid during Alphonso XII.'s reign she began to intrigue with the politicians of the capital, and was peremptorily requested to go abroad again.

Isar, a river of Bavaria, in many respects the national stream of the Bavarian people. It rises in the Alps of Tirol, north-east from Innsbruck, at an altitude of 5840 feet, winds in deep, narrow glens and gorges through the Alps, and at Tölz (2100 feet), due north from its source, enters the Bavarian plain, which it traverses in a generally north and north-east direction, flowing through Munich and past Freising and Landshut, and pours its green waters into the Danube immediately below Deggendorf after a course of 219 miles. The area of its drainage basin is 38,200 square miles. Below Munich the stream is 140 to 350 yards wide, and is studded with islands. It is not navigable, except for rafts. The total fall of the river is 4816 feet.

Isbarta (ancient BARIS), the chief town of the Hamid-abad sanjak of the Konia viláyet, in Asia Minor, well situated on the edge of a fertile plain at the foot of Aghlasún Dagh. It suffered severely from the earthquake of 16th–17th January 1889. Population 20,000 (Moslems 13,000, Christians 7000). Baris was once an important city, striking coins, and the seat of a bishopric.

Ischia, an island of Italy, on the north-west side of the Gulf of Naples, with far-famed mineral baths. In 1881 it was visited by an earthquake, and in 1883 by another, much more destructive, which laid Casamicciola almost entirely in ruins. The town has, however, been rebuilt, and contains about 3500 inhabitants. The town of Ischia has about 7000, and Forio more than 7000 inhabitants.

Ischl, a watering-place in the district of Gmunden (Salzkammergut), Upper Austria, the favourite summer resort of the Emperor Francis Joseph I. and the imperial family. The population of the commune in 1890 was 8473, in 1900 9646, German, and mostly Catholic. There are about 18,000 visitors during the season. The salt-works yield about 15,000 tons of salt annually, of a value of £120,000, in addition to large quantities of brine. There is a rack-and-pinion mountain railway (1893) from St Wolfgang to the top of the neighbouring Schafberg.

Isère, a department in the south-east of France, crossed by the Alps of the Dauphiné, and watered by the Rhône and the Isère.

Area, 3180 square miles. The population decreased from 581,680 in 1886 to 563,813 in 1901. Births in 1899, 10,936, 552 of them illegitimate; deaths, 11,127; marriages, 4078. There were in 1896 1576 schools, with 85,000 pupils, and the illiterate constituted 1⅓ per cent. of the population. The area under cultivation comprised, in 1896, 1,504,926 acres, of which 756,169 acres were plough-land and 61,660 vineyards. The land in wheat produced the value of £1,064,000; rye, £122,000; buckwheat, £65,000; oats, £198,000; vines, £720,000; potatoes, £483,280; natural pastures, £480,000. Among the industrial cultures, those of linen and hemp deserve mention. The live stock in 1899 included 33,540 horses, 213,540 cattle, 163,550 sheep, 40,850 pigs, and 63,720 goats. Mining in 1898 produced 204,000 metric tons of fuel, of the value of £120,000, 9000 tons of turf, 12,000 tons of iron; and the industry in metals, which is developed in this department, produced 35,000 tons of cast iron, 2000 tons of iron, and 5300 tons of steel. Among the other industries the most important are the manufacture of gloves, cement, and paper (Rives). Vizille is an important weaving centre. Grenoble, the capital, had (1900) 68,052 inhabitants.

Iserlohn, a town of Prussia, province of Westphalia, 30 miles by rail east-north-east of Barmen. It is a seat of the metal industries, especially in iron, steel, and brass, manufactures of needles and pins, lamp and similar fittings, bronze ornaments, furniture, and tinned and silvered wares. In 1883 a bronze statue of the Emperor William I. was unveiled. Population (1885), 20,102; (1900), 27,268.

Isfahán (older form ISPAHÁN), an important province of Persia, situated in the centre of the country, and bounded on the S. by Fars, on the E. by Yezd, on the N. by Kashán, Natanz, and Irák, and on the W. by the Bakhtiári district and Arabistán. It pays a yearly revenue of about £100,000, and its population exceeds 500,000. It is divided into twenty-five districts, its capital, the town of Isfahán, forming one of them. These twenty-five districts, some very small and consisting of only a little township and a few hamlets, are Isfahán, Jai, Barkhár, Kaháb, Kararaj, Baraán, Rúdasht, Marbin, Lenján, Kerven, Rár, Kiar, Mizdej, Ganduman, Somairam, Jarkúyeh, Ardistan, Kúhpáyeh, Najafabad, Komisheh, Chadugan, Varzek, Tokhmaklu, Gurji, Chinarúd. Most of these districts are very fertile, and produce great quantities of wheat, barley, rice, cotton, tobacco, and opium. Lenján, west of the city of Isfahán, is the greatest rice-producing district; the finest cotton comes from Jarkúyeh; the best opium and tobacco from the villages in the vicinity of the city. ISFAHÁN, the capital of the above province, is situated on the Záyendeh river, in 32° 36′ N. and 51° 40′ E., at an elevation of 5370 feet. Its population, excluding that of the Armenian colony of Julfa, on the right bank of the river (about 4000), is about 82,000. In 1882 it was 73,654 (37,529 males, 36,125 females), including 5883 Jews (2930 males, 2953 females). It is divided into 37 mahallehs (parishes), and has 210 mosques and colleges, 84 caravanserais, 150 public baths, and 68 flour mills. The water-supply is principally from open canals led off from the river, and from streams and canals which come down from the hills in the north-west. The name of the Isfahán river was originally Zendek, "the great"; it then became Zindeh, "the living," and is now Záyendeh, "the life-giving." The river flows into the Gavkháni depression, about 70 miles east of Isfahán, and its volume of water at Isfahán during the spring season has been estimated at 60,000 cubic feet per second; in autumn the quantity is reduced to one-third. (A. H.-S.)

Ishim, a district town of West Siberia, government of Tobolsk, 276 miles E.N.E. of Kurgan railway station, on a river of the same name, tributary, on the left, of the Irtysh. The fair is one of the most important in Siberia, being the central market for the fertile prairies around, and its returns are estimated at £500,000. Population (1897), 7161.

Ishpeming, a city of Marquette county, Michigan, U.S.A., in the Marquette iron range, at an altitude of 1400 feet. It is on the Chicago and North-Western, the Duluth, South Shore and Atlantic, and the Lake Superior and Ishpeming railways. In and about the city are great iron mines of red hematite ore, and the business of mining and shipping the ore is practically the only industry. Population (1880), 6039; (1890), 11,197; (1900), 13,255, of whom 5970 were foreign-born.

Ismail Pasha (1830–1895), Khedive of Egypt, was born at Cairo on the 31st of December 1830, being the second of the three sons of Ibrahim and grandson of Mehemet Ali. After receiving a European education at Paris, where he attended the École d'État-Major, he returned home, and on the death of his elder brother

became heir to his uncle Said Mohammed, the Vali of Egypt. Said, who apparently conceived his own safety to lie in ridding himself as much as possible of the presence of his nephew, employed him in the next few years on missions abroad, notably to the Pope, the Emperor Napoleon III., and the Sultan of Turkey. In 1861 he was despatched at the head of an army of 14,000 to quell an insurrection in the Sudan, and this he successfully accomplished. On the death of Said, on 18th January 1863, Ismail was proclaimed viceroy without opposition. Being of an Orientally extravagant disposition, he found with considerable gratification that the Egyptian revenue was vastly increased by the rise in the value of cotton which resulted from the American Civil War, the Egyptian crop being worth about £25,000,000 instead of £5,000,000. Besides acquiring luxurious tastes in his sojourns abroad, Ismail had discovered that the civilized nations of Europe made a free use of their credit for raising loans. He proceeded at once to apply this idea to his own country by transferring his private debts to the State and launching out on a grand scale of expenditure. Egypt was in his eyes the ruler's estate which was to be exploited for his benefit and his renown. His own position had to be strengthened, and the country provided with institutions after European models. To these objects Ismail applied himself with energy and cleverness, but without any stint of expense. During the 'sixties and 'seventies Egypt became the happy hunting-ground of self-seeking financiers, to whose schemes Ismail fell an easy and a willing prey. In 1866 he obtained from the Sultan of Turkey, in exchange for an increase in the tribute, a firman giving him the title of Khedive, and changing the law of succession to direct descent from father to son; and in 1873 he obtained a new firman making him virtually independent. He projected vast schemes of internal reform, remodelling the Customs system and the Post Office, stimulating commercial progress, creating a sugar industry, introducing European improvements into Cairo and Alexandria, building palaces, entertaining lavishly, and maintaining an opera and a theatre. It has been calculated that, of the total amount of debt incurred by Ismail for his projects, about 10 per cent. may have been sunk in works of permanent utility—always excluding the Suez Canal. Meanwhile the opening of the Canal had given him opportunities for asserting himself in foreign Courts. On his accession he refused to ratify the concessions to the Canal Company made by Said, and the question was referred in 1864 to the arbitration of Napoleon III., who awarded £3,800,000 to the company as compensation for the losses they would incur by the changes which Ismail insisted upon in the original grant. Ismail then used every available means, by his own undoubted powers of fascination and by judicious expenditure, to bring his personality before the foreign sovereigns and public, and he had no little success. He was made G.C.B. in 1867, and in the same year visited Paris and London, where he was received by Queen Victoria and welcomed by the Lord Mayor; and in 1869 he again paid a visit to England. The result was that the opening of the Canal in November 1869 enabled him to claim to rank among European sovereigns, and to give and receive royal honours: this excited the jealousy of the Sultan, but Ismail was clever enough to pacify his overlord. In 1876 the old system of consular jurisdiction for foreigners was abolished, and the system of mixed courts was introduced, by which European and native judges sat together to try all civil cases without respect of nationality. In all these years Ismail had governed with *éclat* and profusion, spending, borrowing, raising the taxes on the fellaheen, and combining his policy of independence with dazzling visions of Egyptian aggrandizement. In 1874 he annexed Darfur, and was only prevented from extending his dominion into Abyssinia by the superior fighting power of the Abyssinians. But at length the inevitable financial crisis came. A national debt of over one hundred millions sterling (as opposed to three millions when he became viceroy) had been incurred by the Khedive, whose fundamental idea of liquidating his borrowings was to borrow at increased interest. The bondholders became restive. Judgments were given against the Khedive in the international tribunals. When he could raise no more loans he sold his Suez Canal shares (in 1875) to Great Britain for £3,976,582; and this was immediately followed by the beginning of foreign intervention. In December 1875 Mr Stephen Cave was sent out by the British Government to inquire into the finances of Egypt, and in April 1876 his report was published, advising that in view of the waste and extravagance it was necessary for foreign Powers to interfere in order to restore credit. The result was the establishment of the Caisse de la Dette. In October Mr (afterwards Lord) Goschen and M. Joubert made a further investigation, which resulted in the establishment of Anglo-French control. A further commission of inquiry by Major Baring (afterwards Lord Cromer) and others in 1878 culminated in Ismail making over his estates to the nation and accepting the position of a constitutional sovereign, with Nubar as Premier, Mr (afterwards Sir Charles) Rivers Wilson as Finance Minister, and M. de Blignières as Minister of Public Works. Ismail professed to be quite pleased. "Egypt," he said, "is no longer in Africa; it is part of Europe." The new *régime*, however, only lasted six months, and then Ismail dismissed his ministers, an occasion being deliberately prepared by his getting Arabi (*q.v.*) to foment a military *pronunciamiento*. England and France took the matter seriously, and insisted (May 1879) on the reinstatement of the British and French ministers; but the situation was no longer a possible one: the Tribunals were still giving judgments for debt against the Government, and when Germany and Austria showed signs of intending to enforce execution the Governments of Great Britain and France perceived that the only chance of setting matters straight was to get rid of Ismail altogether. He was first advised to abdicate, and a few days afterwards (26th June), as he did not take the hint, he received a telegram from the Sultan (who had not forgotten the earlier history of Mehemet Ali's dynasty), addressed to him as ex-Khedive, and informing him that his son, Tewfik, was his successor (see also EGYPT, sections *Finance* and *History*). He at once left Egypt for Naples, but eventually was permitted by the Sultan to retire to his palace of Ermighian on the Bosphorus. There he remained, more or less a State prisoner, till his death on 2nd March 1895. Ismail was a man of undoubted ability and remarkable powers. But beneath a veneer of French manners and education he remained throughout a thorough Oriental, though without any of the moral earnestness which characterizes the better side of Mahommedanism. Some of his ambitions were not unworthy, and though his attitude towards Western civilization was essentially cynical, he undoubtedly helped to make the Egyptian upper classes realize the value of European education. Moreover, spendthrift as he was, it needed—as is pointed out in Milner's *England in Egypt*—a series of unfortunate conditions to render his personality as pernicious to his country as it actually became. "It needed a nation of submissive slaves, not only bereft of any vestige of liberal institutions, but devoid of the slightest spark of the spirit of liberty. It needed a bureaucracy which it would

have been hard to equal for its combination of cowardice and corruption. It needed the whole gang of swindlers—mostly European—by whom Ismail was surrounded." It was his early encouragement of Arabi, and his introduction of swarms of foreign concession-hunters, which precipitated the "national movement" that led to British occupation. His greatest title to remembrance in history must be that he made European intervention in Egypt compulsory. (H. CH.)

Ismailiya, a town of Lower Egypt, the central station on the Suez Canal, on Lake Timsah, about 50 miles from the Mediterranean and the Red Sea. It is connected by rail with Cairo and Suez, and by steam tramway and steamer with Port Said; has sprung up since 1860 in connexion with the works of the Suez Canal; and has a population of nearly 4000. The town is divided into two quarters by the road leading from the landing-place to the railway station, and has numerous public offices, warehouses, and other buildings, including a palace of the Khedive, which was used as a military hospital during the British occupation of the place in 1882, but is now in a dilapidated state.

Ismay, Thomas Henry (1837–1899), British shipowner, was born at Maryport, Cumberland, on 7th January 1837. He received his education at Croft House School, Carlisle, and at the age of sixteen was apprenticed to Messrs Imrie & Tomlinson, shipowners and brokers, of Liverpool. He then travelled for a time, visiting the ports of South America, and on returning to Liverpool started in business for himself. In 1867 he took over the White Star line of Australian clippers, and in 1868, perceiving the great future which was open to steam navigation, established, in conjunction with William Imrie, the Oceanic Steam Navigation Company, which has since become famous as the White Star Line. While continuing the Australian service, the firm determined to engage in the American trade, and to that end ordered from Messrs Harland & Wolff, of Belfast, the first *Oceanic*, which was launched in 1870. This vessel, which had a gross tonnage of 3807, was the first to have her saloon accommodation amidships, and may fairly be said to have marked an era in North Atlantic travel. The same is true of the successive types of steamer which Mr Ismay, with the co-operation of the Belfast shipbuilding firm, subsequently provided for the American trade. Each one of these made its appearance only when the time was fully ripe, and in consequence each was a complete success. In 1875 the *Britannic* and *Germanic*—the first ships over 5000 tons, always excepting the *Great Eastern*, whose great fault was that she was built some forty years before she was needed—were added to the fleet, and performed the journey between Liverpool and New York in about seven and a half days. Fourteen years later came the *Teutonic* and *Majestic*, of nearly double the tonnage, which reduced the time of the passage to less than six days. In another ten years, in 1899, Mr Ismay's supreme creation, the second *Oceanic*, started on her maiden voyage, to be followed two years later, though after his death, by the *Celtic*. These two vessels were the largest that had ever been built up to that date, the former being a mail boat of 21 knots speed and a gross tonnage of over 17,000 tons, and the latter a cargo steamer (capable, nevertheless, of carrying over 3000 persons) of nearly 21,000 tons gross register. To Mr Ismay is mainly due the credit of the arrangement by which some of the fastest ships of the British mercantile marine are held at the disposal of the Government in case of war. The origin of this plan dates from the Russo-Turkish war, when there seemed a likelihood of England being involved in hostilities with Russia, and when, therefore, Mr Ismay offered the Admiralty the use of the White Star fleet. In building the *Teutonic* and *Majestic* their possible employment as armed merchant cruisers was kept specially in view, and the former, armed with sixteen guns, took part in the naval review held at Spithead in 1897 in honour of the Diamond Jubilee of Queen Victoria. Mr Ismay died at Birkenhead on 23rd November 1899.

Ismid, Nicomedia, in Asia Minor, the chief town of the Khoja Ili sanjak of Constantinople, situated on rising ground near the head of the Gulf of Ismid. The sanjak has an area of 4650 square miles, and a population of 225,000 (Moslems 131,000, Christians and others 94,000). It is an agricultural district, producing cocoons, tobacco, &c., and there are large forests of oak, beech, and fir. Near Yalova there are hot mineral springs, much frequented in summer. The town is connected by the lines of the Anatolian Railway Company with Haidar Pasha, the western terminus, and with Angora, Konia, and Smyrna. It contains a fine 16th-century mosque, built by the celebrated architect Sinan. The population is 20,000 (Moslems 9500, Christians 8000, Jews 2500). There is a British consular agent. The head of the Gulf of Ismid is gradually silting up. The dockyard was closed in 1879, and the port of Ismid is now at Darinje, $3\frac{3}{4}$ miles distant, where the Anatolian Railway Company have established their workshops and have built docks and a quay.

Isola del Liri, a town of the province of Caserta, Campania, Italy, on an island enclosed between two arms of the Liris (Garigliano), 26 miles north-west of Cassino by rail. It is the seat of large paper, cloth, and woollen mills, which derive their motive power from falls in the river. There are also steel and iron works. Population (1881), 4569; (1899), about 6000.

Ispahán. See Isfahán.

Israëls, Josef (1824– ——), Dutch painter, was born at Groningen, of Hebrew parents, on 27th January 1824. His father intended him to be a man of business, and it was only after a determined struggle that he was allowed to enter on an artistic career. However, the attempts he made under the guidance of two second-rate painters in his native town—Buÿs and Van Wicheren—while still working under his father as a stockbroker's clerk, led to his being sent to Amsterdam, where he became a pupil of Jan Kruseman and attended the drawing class at the academy. He then spent two years in Paris, working in Picot's studio, and returned to Amsterdam. There he remained till 1870, when he moved to The Hague for good. Israels is justly regarded as one of the greatest of Dutch painters. He has often been compared to J. F. Millet. As artists, even more than as painters in the strict sense of the word, they both, in fact, saw in the life of the poor and humble a motive for expressing with peculiar intensity their wide human sympathy; but Millet was the poet of placid rural life, while in almost all Israëls' pictures we find some piercing note of woe. Duranty said of them that "they were painted with gloom and suffering." He began with historical and dramatic subjects in the romantic style of the day. By chance, after an illness, he went to recruit his strength at the fishing-town of Zandvoort near Haarlem, and there he was struck by the daily tragedy of life. Thenceforth he was possessed by a new vein of artistic expression, sincerely realistic, full of emotion and pity. Among his more important subsequent works are "The Zandvoort Fisherman" (in the Amsterdam gallery), "The

"David singing before Saul." By Joseph Israëls.
(*From a Photograph by Guy de Coral and Co., Amsterdam.*)

Silent House" (which gained a gold medal at the Brussels Salon, 1858), and "Village Poor" (a prize at Manchester). In 1862 he achieved great success in London with his "Shipwrecked," purchased by Mr Young, and "The Cradle," two pictures of which the *Athenæum* spoke as "the most touching pictures of the exhibition." We may also mention among his maturer works "The Widower" (in the Mesdag collection), "When we grow Old" and "Alone in the World" (Amsterdam gallery), "An Interior" (Dordrecht gallery), "A Frugal Meal" (Glasgow museum), "Toilers of the Sea," "A Speechless Dialogue," "Between the Fields and the Seashore," "The Bric-à-brac Seller" (which gained medals of honour at the great Paris Exhibition of 1900). "David Singing before Saul" is one of his latest works, and seems to hint at a return on the part of the venerable artist to the Rembrandtesque note of his youth (see PLATE). As a water-colour painter and etcher he produced a vast number of works which, like his oil paintings, are full of deep feeling. They are generally treated in broad masses of light and shade, which give prominence to the principal subject without any neglect of detail.

See JAN VETH. *Mannen of Beteekenis: Jozef Israëls.*—CHESNEAU. *Peintres Français et Étrangers.*—PH. ZILCKEN. *Peintres Hollandais Modernes*, 1893.—DUMAS. *Illustrated Biographies of Modern Artists*, 1882–84.—J. DE MEESTER, in Max Rooses' *Dutch Painters of the Nineteenth Century*, 1898.—JOZEF ISRAËLS. *Spain: the Story of a Journey*, 1900.

Istria (German, *Istrien*), a margraviate and crownland of the Cisleithan part of the Austro-Hungarian monarchy. It forms, together with Görz, Gradisca, and Trieste, the so-called Austro-Illyrian Küstenland or littoral, united for certain administrative purposes. The population in 1880 was 292,006, and in 1890, including garrison of 8630 men, 317,610, or 166·44 inhabitants per square mile. The proportion of females to males was 923 to 1000. Forty-five per cent. are Serbo-Croatians, 38 per cent. Italians, 15 per cent. Slovenes, and 2 per cent. Germans. The population is almost exclusively Roman Catholic (99·7 per cent.), a small minority being Greek Orthodox, Protestant, and Jewish. The population in 1900 was 344,173. In 1897 the marriage-rate was 7·64, the birth-rate 40·36, or excluding still-births 39·48, and the death-rate 23·99. Of the births, 3·97 per cent. were illegitimate. The birth-rate steadily increases. Istria sends 5 representatives to the Reichsrath (3 Italians and 2 Slovenes). The provincial Diet is composed of 21 Italians and 12 Croatians. (For education, communications, &c., see KÜSTENLAND.) Only 11·7 per cent. of the population are engaged in industry, principally shipbuilding, the recovery of salt from sea water (nearly 15 per cent. of the total Austrian product), fish-curing, and mining (lignite and alum). Naturally fishing and seafaring pursuits are also considerable resources in a territory possessing such important harbours as Pirano, Pola, and Lussin-Piccolo, and visited by a total in all its ports and roadsteads of nearly 40,000 vessels, with a total tonnage of 2½ millions. The chief agricultural resources are viticulture, oil, fig-, fruit-, and corn-growing, and cattle-breeding (principally sheep, horned cattle, mules and asses, and pigs). The timber trade is now of less importance, but gall-nuts, oak bark, cork, and charcoal are largely exported.

See GORACUCHI. *Die Adria und ihre Küsten.* Trieste, 1872.—A. RUTHNER. *Das Küstenland und das Königreich Dalmatien.* Vienna, 1880.—COMBI. *Istria: Studi storici e politica.* Milan, 1886.—T. G. JACKSON. *Dalmatia, the Quarnero, and Istria.* Oxford, 1887.—STACHE. *Übersicht der geolog. Verhältnisse der oesterr. Küstenländer.* Vienna, 1889.—TOMASIN. *Die Volksstämme im Gebiet von Triest und in Istrien.* Trieste, 1890.

(Æ. O'N.)

Iswar Chandra (1820–1891), writer and social reformer of Bengal, was born at Birsinha (Midnapur district) in 1820. He was removed to Calcutta by his father at the age of nine, was admitted in the Sanskrit College, and carried on his studies in the midst of privations and extreme poverty. In 1839 he finished his education, and obtained the title of *Vidyasagar* (= "Ocean of learning") after passing a brilliant examination, and in 1841 was appointed head Pandit of Fort William College in Calcutta. In 1847 appeared his first great literary work in Bengali prose, *The Twenty-five Tales of a Betal.* This was succeeded by his *Sakuntala* in 1855, and by his greatest work, *The Exile of Sita*, in 1862. These works are marked by a literary grace and beauty which Bengali prose had never known before. The literature of Bengal, previous to the 19th century, was entirely in verse. Ram Mohan Roy, the religious reformer of Bengal, created the literary prose of Bengal early in the 19th century by his numerous translations and religious tracts; and Iswar Chandra Vidyasagar and his fellow-worker, Akhay Kumar Datta, added to its power and beauty about the middle of that century. These three writers are generally recognized as the fathers of Bengali prose literature. As a social reformer and educationist, too, Iswar Chandra made his mark. He associated himself with Drinkwater Bethune in the cause of female education; and the management of the girls' school, called after Bethune, was entrusted to him in 1850. And when Rosomoy Datta, a cultured and distinguished Indian gentleman of the time, resigned the post of secretary to the Sanskrit College of Calcutta, a new post of principal was created, and Iswar Chandra was appointed to it. Iswar Chandra's influence in the education department was now unbounded. He simplified the method of learning the Sanskrit language, and thus spread a knowledge of that ancient tongue among his countrymen. He was consulted in all educational matters by Sir Frederick Halliday, the first Lieutenant-Governor of Bengal. And when the great scheme of education under Sir Charles Wood's despatch of 1854 was inaugurated in India, Iswar Chandra established numerous aided schools under that scheme in the most advanced districts of Bengal. But a greater task than literary work or educational reforms claimed the attention of the patriot and reformer. The wrongs of Hindu widows awakened his sympathy and aroused his energies. He had discovered that the ancient Hindu scriptures did not enjoin perpetual widowhood, and in 1855 he startled the Hindu world by his work on the *Remarriage of Hindu Widows.* Such a work, from a learned and presumably orthodox Brahman, caused the greatest excitement, but Iswar Chandra remained unmoved amidst a storm of indignation. Associating himself with the most influential men of the day, like Prosonno Kumar Tagore and Ram Gopal Ghosh, he appealed to the British Government to declare that the sons of remarried Hindu widows should be considered legitimate heirs. The British Government responded; the Act was passed in 1856, and some years after Iswar Chandra's own son was married to a widow. In the last years of his life Iswar Chandra wrote works against Hindu polygamy; but that custom, never very widely prevalent, is dying out without the aid of any legislative measures. Iswar Chandra was as well known for his charity and wide philanthropy as for his educational and social reforms. His vast income, derived from the sale of school-books, was devoted almost entirely to the succour of the needy: hundreds of young men owed their education to him; hundreds of widows depended on him for their daily bread. The Indian Government made him a Companion of the Indian Empire in 1877. He died in 1891.

(R. C. D.)

ITALY.

Geography and Statistics.

According to the calculation of the Italian Military Geographical Institute, the area of the kingdom of Italy is 110,646 square miles. Pending the completion of the Institute's labours, the Statistical Bureau provisionally measured the outstanding provinces and districts whose area has still to be exactly determined. The following table indicates the areas thus calculated for the several provinces (sixty-nine in number), the population of each according to the censuses of 31st December 1881 and of 9th February 1901, together with the density per square mile at that date. (The larger divisions or compartments in which the provinces are grouped are not officially recognized.)

Provinces and Compartments.	Area, Square Miles.	Population. 1881.	1901.	Density per Square Mile, 1901.
Alessandria	1,950	729,710	812,022	416·42
Cuneo	2,882	635,400	641,172	222·47
Novara	2,553	675,926	745,357	291·95
Turin	3,955	1,029,214	1,127,760	285·15
Piedmont	11,340	3,070,250	3,326,311	293·33
Genoa	1,582	760,122	935,483	591·33
Porto Maurizio	455	132,251	145,461	319·69
Liguria	2,037	892,373	1,080,944	530·65
Bergamo	1,098	390,775	457,983	417·02
Brescia	1,845	471,568	537,690	291·44
Como	1,091	515,050	576,276	528·21
Cremona	695	302,097	327,802	471·67
Mantua	912	295,728	312,329	342·47
Milan	1,223	1,114,991	1,442,767	1,179·69
Pavia	1,290	469,831	496,916	385·21
Sondrio	1,232	120,534	126,425	102·62
Lombardy	9,386	3,680,574	4,278,188	455·81
Belluno	1,293	174,140	191,400	148·03
Padua	823	397,762	443,100	538·40
Rovigo	685	217,700	222,005	324·09
Treviso	960	375,704	410,684	427·80
Udine	2,541	501,745	594,334	233·90
Venice	934	356,708	400,030	428·30
Verona	1,188	394,065	422,355	355·52
Vicenza	1,052	396,349	446,521	424·45
Venetia	9,476	2,814,173	3,130,429	330·35
Bologna	1,448	464,879	527,642	364·39
Ferrara	1,012	230,807	271,467	268·25
Forlì	725	251,110	279,072	384·93
Modena	987	279,254	322,617	326·87
Parma	1,250	267,306	294,312	235·45
Piacenza	954	226,758	245,049	256·86
Ravenna	715	218,359	235,766	329·74
Reggio (Emilia)	876	244,959	275,827	314·87
Emilia	7,967	2,183,432	2,451,752	307·74
Arezzo	1,273	238,744	272,359	213·95
Florence	2,265	790,776	937,786	414·03
Grosseto	1,738	114,295	144,825	83·33
Leghorn	133	121,612	124,088	932·99
Lucca	558	284,484	318,610	570·99
Massa and Carrara	687	169,469	195,840	285·07
Pisa	1,179	283,563	320,020	271·43
Siena	1,471	205,926	234,626	159·50
Tuscany	9,304	2,208,869	2,548,154	273·88

Provinces and Compartments.	Area, Square Miles.	Population. 1881.	1901.	Density per Square Mile, 1901.
Ancona	762	267,338	302,460	396·93
Ascoli Piceno	796	209,185	245,883	308·90
Macerata	1,087	239,713	261,953	240·99
Pesaro and Urbino	1,118	223,043	254,453	227·59
Marches	3,763	939,279	1,064,749	282·95
Perugia—Umbria	3,748	572,060	644,367	171·92
Rome—Lazio	4,663	903,472	1,206,354	258·71
Aquila degli Abruzzi (Abruzzo Ulteriore II.)	2,484	353,027	397,645	160·08
Campobasso (Molise)	1,691	365,434	366,341	216·64
Chieti (Abruzzo Citeriore)	1,138	343,948	371,293	326·27
Teramo (Abruzzo Ulteriore I.)	1,067	254,806	307,086	287·80
Abruzzi and Molise	6,380	1,317,215	1,442,365	226·08
Avellino (Principato Ulteriore)	1,172	392,619	402,898	343·77
Benevento	818	238,425	257,101	314·30
Caserta (Terra di Lavoro)	2,033	714,131	783,495	385·39
Naples	350	1,001,245	1,135,906	3,245·45
Salerno (Principato Citeriore)	1,916	550,157	562,978	293·83
Campania	6,289	2,896,577	3,142,378	499·66
Bari delle Puglie (Terra di Bari)	2,065	679,499	823,998	399·03
Foggia (Capitanata)	2,688	356,267	418,510	155·70
Lecce (Terra di Otranto)	2,623	553,298	706,915	269·51
Apulia	7,376	1,589,064	1,949,423	264·29
Potenza—Basilicata	3,845	524,504	490,000	127·44
Catanzaro (Calabria Ulteriore II.)	2,030	433,975	482,788	237·83
Cosenza (Calabria Citeriore)	2,568	451,185	462,893	180·25
Reggio di Calabria (Calabria Ult. I.)	1,221	372,723	430,079	352·24
Calabria	5,819	1,257,883	1,375,760	236·43
Caltanissetta	1,263	266,379	330,972	262·06
Catania	1,917	563,457	711,923	371·37
Girgenti	1,172	312,487	371,471	316·95
Messina	1,246	460,924	548,898	440·53
Palermo	1,948	699,151	785,016	402·99
Syracuse	1,442	341,526	427,429	296·41
Trapani	948	283,977	353,557	372·95
Sicily	9,936	2,927,901	3,529,266	355·20
Cagliari	5,204	420,635	482,000	92·62
Sassari	4,090	261,367	307,314	75·14
Sardinia	9,294	682,002	789,314	84·92
Kingdom of Italy	110,623	28,459,628	32,449,754	293·28

Of the total, 91,393 square miles represent the Italian mainland, the remainder belonging to the islands, mainly Sicily and Sardinia. The total length of the land frontiers is 1203 miles, the Italo-French frontier being 302 miles long, the Italo-Swiss 417 miles, and the Italo-Austrian 484. The length of the mainland coast-line is 2100 miles, and that of the islands 2169 miles.

No change has taken place in the chief territorial divisions, and the kingdom is still divided into 69 provinces, 284 regions (of which 197 are classed as *circondarii* and 87 as districts), 1806 administrative divisions (*mandamenti*), and 8262 communes. The *mandamenti* or administrative divisions no longer correspond to the judicial divisions (*mandamenti giudiziarii*), which in November 1891 were reduced in number from 1806 to 1535 by a law which provided that the judicial reform should not modify existing administrative and electoral divisions.

Population.—The population of Italy, which, according to the census of 1881, was 28,459,628, was, according to the census of 9th February 1901, 32,449,754. In consequence of this increase in number, the average density of the population has increased from 257·21 per square mile in 1881, to 293·28 in 1901. The density, however, varies considerably, as will be seen in the above table. Modes of life also vary considerably, according as the inhabitants live scattered over the country, congregated in rural towns and villages, or aggregate themselves around farmhouses of importance. In Venetia, Emilia, the Marches, Umbria, and Tuscany the proportion of concentrated population is only from 40 to 55 per cent.; in Piedmont, Liguria, and Lombardy the proportion rises to from 70 to 76 per cent.; in southern Italy, Sicily, and Sardinia it attains a maximum of from 76 to 93 per cent. The majority of Italians (19,000,000) live in communes of less than 10,000 inhabitants, and only 3,000,000 in communes of more than 50,000. As a rule, they prefer living in hamlets and small towns to isolated life in the country or the urban life of large cities.

The population of the chief provincial towns, according to the census of 9th February 1901, is given in the following table:—

Town.	Population.	Town.	Population.
Alessandria	71,293	Messina	149,823
Ancona	56,825	Milan	491,460
Aquila	21,215	Modena	64,941
Arezzo	44,350	Naples	563,731
Ascoli Piceno	28,882	Novara	44,928
Avellino	23,790	Padua	82,283
Bari	79,693	Palermo	310,352
Belluno	18,649	Parma	49,370
Benevento	24,650	Pavia	35,372
Bergamo	45,785	Perugia	61,453
Bologna	152,009	Pesaro	25,115
Brescia	70,618	Piacenza	36,064
Cagliari	53,734	Pisa	61,279
Caltanissetta	44,600	Porto Maurizio	7,207
Campobasso	15,046	Potenza	16,520
Caserta	32,729	Ravenna	63,839
Catania	149,694	Reggio (di Calabria)	44,417
Catanzaro	31,887		
Chieti	26,406	Reggio (Emilia)	59,176
Como	38,902	Rome	463,000
Cosenza	21,402	Rovigo	11,174
Cremona	37,651	Salerno	42,736
Cuneo	27,182	Sassari	38,178
Ferrara	87,697	Siena	28,678
Florence	204,950	Sondrio	8,700
Foggia	53,351	Syracuse	32,074
Forlì	43,457	Teramo	24,578
Genoa	234,800	Turin	335,639
Girgenti	25,069	Trapani	60,257
Grosseto	9,600	Treviso	34,004
Lecce	32,485	Udine	37,933
Leghorn	98,505	Venice	151,841
Lucca	74,718	Verona	74,261
Macerata	22,806	Vicenza	44,261
Mantua	29,160		
Massa	26,325	Total	5,614,587

Occupations.—In the census of 1871 all inhabitants of communes with a population of less than 6000 were assigned to the rural population, and those of larger communes to the urban population. In southern Italy, however, the population of many peasant communes exceeds 6000, and it is scarcely possible to classify the inhabitants of Italy except according to their occupations. Thus:—

	Percentages of Population (persons of nine years and upwards).
Agriculture, hunting, and fishing	38
Manufactures and mining	19
Trade and transport	3
Public and private employees (including domestic servants)	4
Carry forward	64

	Percentages of Population (persons of nine years and upwards).
Brought forward	64
Liberal professions, education, fine arts, and public worship	2
Capitalists and proprietors	4
Army and navy	1
Other professions	1
Unclassified (including housewives, students, &c.)	28
	100

Although the percentage of Italians employed in agriculture and allied occupations is probably destined, as in other countries, to undergo some diminution in favour of the percentage employed in trade and industry, the generality of the population of Italy preserves its rural character.

Marriages, Births, Deaths.—The proportion of marriages in Italy showed a slight diminution between 1881 and 1899, the rate having been 8·11 per 1000 in the former and 7·42 in the latter year. During the same period the birth-rate decreased from 38·10 to 34·27 per 1000, and the death-rate from 27·63 to 22·15. Thus:—

Year.	Marriages.		Births.		Deaths.	
	Total.	Per 1000 Inhabitants.	Total.	Per 1000 Inhabitants.	Total.	Per 1000 Inhabitants.
1881	230,143	8·11	1,081,125	38·10	784,181	27·63
1885	233,931	8·03	1,125,970	38·67	787,217	27·03
1891	227,656	7·53	1,132,139	37·42	795,327	26·29
1895	228,152	7·36	1,092,102	35·22	783,813	25·28
1898	219,597	6·96	1,070,074	33·89	732,265	23·19
1899	235,665	7·42	1,088,558	34·27	703,393	22·15

The marriage-rate varies considerably in the different Italian regions. It is highest in Umbria, Apulia, the Abruzzi and Molise, and Calabria; and lowest in Liguria, Piedmont, and Venetia. The highest birth-rate is found in Apulia, the Marches, Calabria, the Abruzzi and Molise; the lowest in Piedmont, Liguria, and Sardinia. The death-rate is lowest in the northern provinces, and particularly in Venetia and Piedmont; and highest in Apulia, in the Abruzzi and Molise, and in Sardinia. Out of 1,070,074 births registered in 1898, 1,002,812 were legitimate and 67,262 illegitimate. The latter total comprises natural children recognized by their fathers (38,900), as well as the unrecognized and the foundlings. The percentage of illegitimate births tends to decrease; thus:—

Year.	Illegitimate Births.	Per Cent.
1881	79,508	7·35
1891	80,041	7·07
1895	70,539	6·46
1897	70,199	6·37
1898	67,262	6·29
1899	66,852	6·14

The regions which give the highest proportion of illegitimates continue to be the Romagna, with 203·6 per 1000; Lazio, with 217·6 per 1000; and Umbria, with 142·2 per 1000.

The fall in the death-rate is principally due to improvement of hygienic and sanitary conditions (better water supply, improved drainage, &c.), and partly to the increase of general welfare.

Emigration.—The movement of emigration may be divided into two currents, temporary and permanent—the former going chiefly towards neighbouring European countries, and consisting of manual labourers, the latter towards trans-oceanic countries, principally Brazil, Argentina, and the United States. These emigrants remain abroad for several years, even when they do not definitively establish themselves there. They are composed principally of peasants, unskilled workmen, and other manual labourers. The provinces which furnish the chief contingents of emigrants to non-European countries are those of Genoa, Cosenza, Potenza, Salerno, Avellino, Campobasso, and Catanzaro; but Venetia, Lombardy, and Piedmont also provide considerable numbers. As shown by the following table, there was, on the whole, a tendency towards increased emigration during the last quarter of the 19th century. The principal causes are the growth of population, and the over-supply of and low rates of remuneration for manual labour in various Italian provinces:—

Year.	Temporary Emigration.		Permanent Emigration.	
	Total No. of Emigrants.	Per every 100,000 of Population.	Total No of Emigrants.	Per every 100,000 of Population.
1881	94,225	333	41,607	147
1885	80,164	276	77,029	265
1891	118,111	389	175,520	578
1895	123,668	397	169,513	543
1896	123,862	394	183,620	585
1897	134,426	425	165,429	523
1898	156,928	493	126,787	398
1899	177,031	553	131,308	410

From the next table will be seen the direction of emigration in the years specified:—

Emigrants to	1897.	1898.	1899.
European Countries . . .	125,310	144,528	162,899
North Africa	2,457	3,251	4,566
United States and Canada. .	47,139	56,703	64,177
Brazil, Argentine, Central and other South American States .	123,075	76,737	74,897
"America" (country not named)	1,080	1,753	860
Other Countries . . .	794	743	940
Total	299,855	283,715	308,339

Up to 1901, Italian emigration was regulated by the Law of 1888, which dealt principally with the relations between emigration agents and the emigrants, and made some provision for the protection of the latter during the journey. At the beginning of 1901 a new Emigration Law was finally sanctioned by Parliament. It suppressed emigration agents, strictly established the liability of the steamship companies towards the emigrants, provided for proper sanitation on board emigrant ships, and created a special Commissionership of Emigration (attached to the Ministry for Foreign Affairs) to administer the provisions of the Law, and to deal with the foreign countries whither emigrants chiefly go, and to fix the passenger rates.

Agriculture.—Accurate statistics with regard to the area occupied in different forms of cultivation are difficult to obtain, both on account of their varied and piecemeal character and from the lack of a complete cadastral survey. A complete survey was ordered by the Law of 1st March 1886, but many years must elapse before its completion. The law enabled provinces most heavily burdened by land tax to accelerate their portion of the survey, and to profit by the reassessment of the tax on the new basis. In eighteen provinces, therefore, the cadastral operations are completed; they have been begun, and in some cases nearly completed, in twenty-one other provinces. Thirty provinces are still outstanding. An idea of the probable effects of the new survey may be gathered from the fact that the assessments in the four provinces of Mantua, Ancona, Cremona, and Milan, which formerly amounted to a total of 36,367,400 lire, are now 69,702,000, an increase of 91 per cent. Similar results will probably be attained in the other provinces of the kingdom. Of the total area of Italy, 71 per cent., or 20,283,000 hectares out of 28,704,843 hectares, are classed as "productive." The unproductive area comprises 16 per cent. of the total area, or 4,647,451 hectares; and the uncultivated area 13 per cent., or 3,774,392 hectares.

The cultivated area of Italy may be divided into five agrarian regions or zones, named after the variety of tree culture which flourishes in them, and around which the herbaceous cultures most readily group themselves. (1) Proceeding from south to north, the first zone is that of the *agrumi* (oranges, lemons, and similar fruits). It comprises a great part of Sicily. In Sardinia it extends along the southern and western coasts. It predominates along the Ligurian Riviera from Bordighera to Spezia, and on the Adriatic, near S. Benedetto del Tronto and Gargano, and, crossing the Italian shore of the Ionian Sea, prevails in some regions of Calabria, and terminates around the gulfs of Salerno, Sorrento, and Naples. (2) The region of *olives* comprises the internal Sicilian valleys and part of the mountain slopes; in Sardinia, the valleys near the coast on the south-east, south-west, and north-west; on the mainland it extends from Liguria and from the southern extremities of the Romagna to Cape Santa Maria di Leuca in Apulia, and to Cape Spartivento in Calabria. Some districts of the olive region are to be found near the lakes of Upper Italy and in Venetia, and the territories of Verona, Vicenza, Treviso, and Friuli. (3) The *vine* region completes, so to speak, the orange region, wherever the olives fail to find a suitable climate. It begins on the sunny slopes of the Alpine spurs and in those Alpine valleys which are open towards the south. In Sardinia it covers the mountain slopes to a considerable height, and in Sicily covers the sides of the Madonie range, reaching the level of 1000 metres on the southern slope of Etna. The Calabrian Alps, the less rocky sides of the Apulian Murge, and the whole length of the Apennines are covered at different heights, according to their situation. The hills of Tuscany, and of Monferrato in Piedmont, produce the most celebrated Italian vintages. (4) The region of *chestnuts* extends from the valleys to the high plateaux of the Alps, along the northern slopes of the Apennines in Liguria, Modena, Tuscany, Romagna, Umbria, the Marches, and along the southern Apennines to the Calabrian and Sicilian ranges, as well as to the mountains of Sardinia. (5) The *wooded* region covers the Alps and Apennines above the chestnut level. The woods consist chiefly of pine and hazel upon the Apennines, and upon the Calabrian, Sicilian, and Sardinian mountains of oak, ilex, hornbeam, and similar trees. Between these regions of tree culture lie zones of different herbaceous culture, cereals, vegetables, and textile plants, according to the different conditions of climate and soil.

Agrarian Production.—Herbaceous cultures occupy the first place in extension and importance, covering nearly 15,000,000 hectares, or three-fifths of the productive area, and more than half the total area of Italy. Wheat stands first, with an area (in 1895) of 4,593,274 hectares. From 1884 to 1899 the wheat harvest varied between 38 and 51 million hectolitres, equal to an average of 6·5 to 11 hectolitres per hectare. In some fertile spots, however, the yield reaches 20 or even 30 hectolitres per hectare.

Next in importance to wheat comes maize, which is cultivated almost everywhere as an alternative crop. The area under maize is now about 2,000,000 hectares, and the yield approximately 27,000,000 hectolitres. During the period 1884–99 the maximum maize crop was that of 34,000,000 hectolitres in 1884, and the minimum 21,000,000 in 1894. In 1899, 31,200,000 hectolitres were produced. The average crop per hectare is between 16 and 18 hectolitres.

Rice is cultivated in low-lying, moist lands, where spring and summer temperatures are high. The Po valley and the valleys of Emilia and the Romagna are most adapted for rice, but the area is diminishing on account of the competition of foreign rice and of the impoverishment of the soil by too intense cultivation. The average area is 200,000 hectares, with an average annual crop of from 7,000,000 to 8,000,000 hectolitres. Rye, barley, and oats are less cultivated. The area under rye is about 150,000 hectares, of which about two-thirds lie in the Alpine and about one-third in the Apennine zone. The average annual crop is about 1,500,000 hectolitres. The barley zone is geographically extensive, but embraces not more than 300,000 hectares, of which half are situated in Sardinia and Sicily. The average annual production is between 10 and 11 hectolitres per hectare. Oats, which are cultivated in the Roman and Tuscan maremma and in Apulia, are used almost exclusively for horses and cattle. The area of oats cultivation is 450,418 hectares, giving a crop of 7,000,000 hectolitres, or 16 hectolitres per hectare. The other cereals, millet and *panico sorgo*, have lost much of their importance in consequence of the introduction of maize and rice. Millet, however, is still cultivated in the north of Italy, and is used as bread for agricultural labourers, and as forage when mixed with buckwheat (*sorghum saccaratum*).

The cultivation of various forms of green forage is extensive, and is divided into the two categories of temporary and perennial. The temporary includes vetches, pulse, lupine, clover, and

trifolium; and the perennial, meadow-trefoil, lupinella, sulla (*Hedysarum coronarium*), lucerne, and darnel. The natural grass meadows are extensive, and hay is grown all over the country, but especially in the Po valley. The area covered by green fodder is 5,500,000 hectares, exclusive of Alpine and flat pasturages, which cover 3,000,000 hectares. Returns for this zone of cultivation are only approximate, and, judged by the quantity of live stock in Italy, are probably below reality. According to these returns, the average annual crop of hay is 68,000,000 quintals; that of beet-root, turnips, and tuberous growths, 3,500,000 quintals; and of green fodder, 159,000,000 quintals. Seed-bearing vegetables are comparatively scarce in Italy. The principal are, white beans, which are largely consumed by the working classes; lentils, much less cultivated than beans; and green peas, largely consumed in Italy, and exported as a spring vegetable. Chick-pease are extensively cultivated in the southern provinces. These varieties of seed-bearing vegetables occupy about 200,000 hectares, and yield from 10 to 30 hectolitres per hectare. Horse beans (*vicia faba*) are grown especially in the south and in the larger islands; they occupy altogether about 400,000 hectares, and yield from 15 to 25 hectolitres per hectare.

Among tuberous vegetables the potato (*solanum tuberosum*) comes first. Some 200,000 hectares are devoted to its cultivation, the yield being from 18 to 20 tons per hectare. Turnips (*brassica rapa*) are grown principally in the central provinces as an alternative crop to wheat. They yield as much as 30 tons per hectare. Beet-root (*beta vulgaris*) is used as fodder, and yields between 20 and 30 tons per hectare. Sugar beet is extensively grown to supply the seventeen large sugar factories now existing in Italy.

Market gardening is carried on both near towns and villages, where products find ready sale, and along the great railways, on account of transport facilities.

Among the chief industrial plants cultivated in Italy must be mentioned tobacco, which grows wherever suitable soil exists. Since tobacco is a Government monopoly, its cultivation is subject to official concessions and prescriptions. In 1898 the cultivation of 134,175,000 plants was authorized, and concessions were issued by the provincial commissions for 93,258,226, but only 80,569,176 were actually planted, over an area of 4951 hectares. The gross yield for that year was 5,625,124 kilogrammes. Experiments hitherto made show that the cultivation of Oriental tobacco may profitably be extended in Italy.

The chief Italian textile plants are hemp, flax, and cotton. Hemp (*cannabis sativa*) is largely cultivated in the provinces of Turin, Ferrara, Bologna, Forlì, Ascoli Piceno, and Caserta. Bologna hemp is specially valued. More than 100,000 hectares are employed in hemp cultivation, the average crop being 800,000 quintals. Flax (*linum usitatissimum*) covers between 60,000 and 70,000 hectares, with a product, in fibre, amounting to about 200,000 quintals, or 3 quintals per hectare, and, in seed, of 18 hectolitres per hectare. Cotton (*gossypium herbaceum*), which at the beginning of the 19th century, at the time of the Continental blockade, and again during the American War of Secession, was so largely cultivated in Italy as to cover an area of 90,000 hectares, and to yield 623,000 quintals of raw cotton, has now almost completely died out, and is cultivated only in parts of Sicily and in a few southern provinces.

The most important of the ligneous plants cultivated in Italy is the vine (*vitis vinifera*), which is to be found in 7212 out of the 8262 Italian communes. The vine-growing area covers about 3,446,000 hectares. In 1898 the vintage amounted to 32,940,000 hectolitres, and in 1899 to 31,800,000 hectolitres; the maximum vintage was 38,227,000 hectolitres in 1886. Within the last few years the vine has been attacked by three terrible enemies—the *oidium Tuckeri*, the *phylloxera vastatrix*, and the *peronospora viticola*, which in rapid succession have wrought great havoc in Italian vineyards. Government and vine-growers are, however, energetically combating these scourges.

Olives are cultivated in every region of Italy except Piedmont. The olive-growing area occupies 1,033,796 hectares, yielding:—

1884–85	. .	3,323,120 hectolitres.
1896–97	. .	1,912,009 ,,
1897–98	. .	1,600,000 ,,
1898–99	. .	2,300,009 ,,
1899–1900	. .	920,000 ,,

The falling off of the crop was due to bad seasons and to insects, notably the *cycloconium oleoginum* and the *dacus oleæ*, or oil fly, which have ravaged the olive-yards. With the development of agricultural knowledge, notable improvements have been effected in the manufacture of oil. In 1895 the number of oil-mills in Italy was 14,500, and at present is probably 17,500. Between 70,000 and 80,000 workmen find employment in the mills, five-sixths of which are worked by animal power, 2000 by hydraulic, and 250 by steam power. The steam mills give the best results. Very little oil is made in Italy from oil-seeds, although a certain amount of linseed-oil is made in Lombardy, Sicily, Apulia, and Calabria; colza in Piedmont, Lombardy, Venetia, and Emilia; and castor-oil in Venetia and Sicily. The total product is calculated to be 120,000 quintals, principally used for industrial purposes, but partly in the preparation of food.

Agrumi (oranges, lemons, citrons, &c.) are cultivated especially in Sicily, Calabria, Sardinia, and Liguria. In northern and central Italy, except in the province of Brescia, they are almost non-existent. The trees are planted on irrigated soil, and the fruit gathered at various times between November and August. The area occupied in orange and lemon cultivation is calculated to be 40,000 hectares. In the quinquennium 1879–83 the number of trees was 15,698,000, and in 1890–98 17,000,000, with an average annual crop of 3,000,000,000 of fruit. In the year 1899–1900 the crop was 4,500,000,000. The value of the crop varies considerably, according to the market price. Considerable trade is done in *agro di limone*, or lemon extract, which forms the basis of citric acid. Extraction is extensively carried on in the provinces of Messina and Palermo. During recent years, however, the cultivation of *agrumi* as a whole has not given favourable results, a falling-off, amounting to some £400,000 per annum, having taken place between 1895 and 1899.

Among other fruit trees, apple-trees have special importance. In 1899 the total apple crop was calculated to be 475,930 quintals, worth £571,000. Almonds are widely cultivated in Sicily, Sardinia, and the southern provinces; walnut-trees throughout the peninsula, their wood being more important than their fruit; hazel nuts, figs, prickly pears, locust beans, and pistachio nuts are among the other fruit trees. The mulberry-tree (*morus alba*), whose leaves serve as food for silkworms, has particular importance in Italy. It is cultivated in every region, considerable progress having been made in its cultivation and in the rearing of silkworms since 1850. Silkworm-rearing establishments of importance now exist in the Marches, Umbria, in the Abruzzi, Tuscany, Piedmont, and Venetia. In 1899, 41,557,000 kilogrammes of cocoons were produced, worth £6,649,120. The chief silk-producing provinces are Lombardy (15,100,000 kilogrammes of cocoons), Venetia (8,720,000 kilogrammes), and Piedmont (7,270,000 kilogrammes). During the period 1880–99 the production oscillated about a mean of 40,000,000 kilogrammes per annum, but it is noteworthy that while, at the outset, three-fourths of the cocoons were Chinese or Japanese, almost all are now native Italian cocoons. Moreover, while the yield per cocoon tends to increase, the number of eggs hatched tends to diminish. In 1880, 1,700,000 ounces of eggs were hatched; now only 900,000 ounces are required, a result due to the selection of the species most fertile in silk, and to improved methods of culture.

Woods and Forests.—Woods and forests play an important part in Italy, especially in regard to the consistency of the soil and to the character of the watercourses. Three great zones may be distinguished—(*a*) up to 1200 feet above sea-level, (*b*) from 1200 to 3000 feet, and (*c*) from 3000 feet upwards. The first region is losing importance on account of the continual spread of land under cultivation. Nevertheless, along the Roman and Tuscan littoral, in the province of Ravenna, here and there in southern Italy, and in Sicily and Sardinia, pine, ash, and oak woods of considerable extent are to be found. In the second region the chestnut predominates, its wood being of great value and its fruit an article of popular consumption. The third region is characterized by beech and fir trees. Good timber is furnished by the pine and fir forests of the Alps and Apennines. Notwithstanding the efforts of the Italian Government to unify and co-ordinate the forest laws previously existing in the various Italian states, deforestation has continued in many parts of Italy. Between 1871 and 1898 the forest department has replanted 20,366 hectares at a cost of £205,930. Forest nurseries have also been founded. There are now forty-nine of them, covering 53 hectares, and producing on an average 7,000,000 nurselings per annum.

Live Stock.—According to an approximate calculation carried out in 1890, the number of head of live stock in Italy was 16,620,000, thus divided:—Horses, 720,000; asses, 1,000,000; mules, 300,000; cattle, 5,000,000; sheep, 6,000,000; goats, 1,800,000; swine, 1,800,000. The approximate value of this live stock was calculated to be £87,640,000, of which £55,000,000 was represented by cattle. In upper Italy cattle are principally reared in pens and stalls; in central Italy cattle are allowed to run half wild, the stall system being little practised; in the south and in the islands cattle are kept in the open air, few shelters being provided. The erection of shelters is, however, being encouraged by the State. Horse-breeding is on the increase. The State helps to improve the breeds by placing choice stallions at the disposal of private breeders at a low tariff. Cattle-breeding varies with the different regions. In the Lombard farms it is carried on intensively, *i.e.*, in stalls and enclosed spaces, on a large scale. Along the Mediterranean coast, in the south, and in the islands it is carried on in the open air.

Sheep are chiefly reared in Lazio, the Abruzzi, Apulia, Basilicata,

Calabria, and Sardinia, where extensive pasturage exists. In other provinces, where agriculture is more advanced, sheep-farming is confined to hilly districts. Old established habits prevent rapid improvement of method. The number of sheep is diminishing in Italy, especially in Apulia. Similarly, the number of goats, which are reared only in hilly regions, is decreasing, especially on account of the existing forest laws. The production of wool is less considerable than in the past, and in 1895 was estimated at 9,777,000 kg. Swine are extensively reared in many provinces, and less extensively throughout the whole peninsula. Fowls are kept on all Italian farms, and though methods are still antiquated, trade in fowls and eggs is rapidly increasing. The number of eggs exported more than doubled within the last decade of the 19th century.

The milk and cheese-making industry is acquiring great importance, especially in northern Italy, Lombardy, and Venetia, where co-operative dairy farms are numerous and flourishing. Modern methods have been generally introduced. In 1895 the production was calculated to be as follows:—Cheese, 74,328,000 kg.; butter, 15,922,000 kg.; curds, 1,874,000; other milk products, 5,278,000.

Drainage, &c.—The drainage of marshes and marshy lands has considerably extended. A law passed on 22nd March 1900 has given a special impulse to this form of enterprise by fixing the ratio of expenditure incumbent respectively upon the State, the provinces, the communes, and the owners or other private individuals directly interested. On 31st December 1897 seventy-five drainage operations had been completed, or were in course of completion, either directly or indirectly by the State. They affected a total area of 697,561 hectares, of which 309,970 had been completely drained and rendered susceptible of cultivation.

Agrarian Economics.—The Italian Federation of Agrarian Unions has greatly contributed to agricultural progress. In December 1899 the number of Unions (*Consorzii*) federated was 161, exclusive of the non-co-operative agricultural societies. Some of these unions annually purchase large quantities of merchandise for their members, especially chemical manures.

Income from land has diminished on the whole. The chief diminution has taken place in the south in regard to oranges and lemons, cereals and (for some provinces) vines. Since 1895, however, the heavy import corn duty has caused a slight rise in the income from corn lands. The principal reasons for the general decrease are the fall in prices through foreign competition and the closing of certain markets, the diseases of plants and the increased outlay required to combat them, and the growth of State and local taxation.

The relations between owners and tillers of the soil are still regulated by the ancient forms of agrarian contract, which have remained almost untouched by social and political changes. The possibility of reforming these contracts in some parts of the kingdom has been studied, in the hope of bringing them into closer harmony with the needs of rational cultivation and the exigencies of social justice.[1] The following forms of contract are most usual in the several Italian regions:—In Piedmont the *mezzadria* (*metayage*), the *terzieria*, the *colonia parziaria*, the *boaria*, the *schiavenza*, and the *affitto*, or lease, are most usual. Under *mezzadria* the contract generally lasts three years. Products are usually divided in equal proportions between the owner and the tiller. The owner pays the taxes, defrays the cost of preparing the ground, and provides the necessary implements. Stock usually belongs to the owner, and, even if kept on the half-and-half system, is usually bought by him. The peasant, or *mezzadro*, provides labour. Under *terzieria* the owner furnishes stock, implements, and seed, and the tiller retains only one-third of the principal products. In the *colonia parziaria* the peasant executes all the agricultural work, in return for which he is housed rent-free, and receives one-sixth of the corn, one-third of the maize, and has a small money wage. This contract is usually renewed from year to year. The *boaria* is widely diffused in its two forms of *cascina fatta* and *paghe*. In the former case a peasant family undertakes all the necessary work in return for payment in money or kind, which varies according to the crop; in the latter the money wages and the payment in kind are fixed beforehand. *Schiavenza*, either simple or with a share in the crops, is a form of contract similar to the *boaria*, but applied principally to large holdings. The wages are lower than under the *boaria*. In the *affitto*, or lease, the proprietor furnishes seed and the implements. Rent varies according to the quality of the soil.

In Lombardy, besides the *mezzadria*, the lease is common, but the *terzieria* is rare. The lessee, or farmer, tills the soil at his own risk; usually he provides live stock, implements, and capital, and has no right to compensation for ordinary improvements, nor for extraordinary improvements effected without the landlord's consent. He is obliged to give a guarantee for the fulfilment of his engagements. In some places he pays an annual tribute in grapes, corn, and other produce. In some of the Lombard *mezzadria* contracts taxes are paid by the cultivator.

In Venetia it is more common than elsewhere in Italy for owners to till their own soil. The prevalent forms of contract are the *mezzadria* and the lease. *Mezzadria* contracts are usually renewed year by year; if the stock belongs to the peasant, he retains all the profit from them, but if to the owner, they are held in simple partnership. In several districts, such as Padua and Rovigo, where farms are extensive, the implements and stock belong to the farmer, who gives a guarantee for the payment of rent.

In Liguria, also, *mezzadria* and lease are the chief forms of contract. Under *mezzadria*, however, live stock belongs to the owner of the soil, who pays for planting the olive-trees and provides manure. The olives, chestnuts, and other fruits usually go two-thirds to the owner and one-third to the peasant. Farm leases generally run from three to nine years, and provide compensation for certain improvements effected by the farmer.

In Emilia both *mezzadria* and lease tenure are widely diffused in the provinces of Ferrara, Reggio, and Parma; but other special forms of contract exist, known as the *famiglio da spesa*, *boaria*, *braccianti obbligati*, and *braccianti disobbligati*. Under the *mezzadria* produce is divided equally, except grapes (of which two-thirds go to the landlord) and mulberry leaves (which go to him entirely). Taxes and the cost of seed are equally divided. Stock, as a rule, belongs to the landlord. Leases are stipulated for periods varying from three to nine years, and the tenant must guarantee payment of rent. If stock, implements, fodder, and seed are furnished by the landlord, they are valued, and the tenant is obliged to restore the same value on the lapse of his lease. In the *famiglio da spesa* the tiller receives a small wage and a proportion of certain products. The *boaria* is of two kinds. If the tiller receives as much as 45 lire per month, supplemented by other wages in kind, it is said to be *boaria a salario*; if the principal part of his remuneration is in kind, his contract is called *boaria a spesa*.

In the Marches, Umbria, and Tuscany, *mezzadria* prevails in its purest form. Profits and losses, both in regard to produce and stock, are equally divided. In some places, however, the landlord takes two-thirds of the olives and the whole of the grapes and the mulberry leaves. Leasehold exists in the province of Grosseto alone. In Lazio leasehold and farming by landlords prevail, but cases of *mezzadria* and of "improvement farms" exist. In the *agro Romano*, or zone immediately around Rome, land is as a rule left for pasturage. It needs, therefore, merely supervision by guardians and mounted overseers, or *butteri*, who are housed and receive wages. Large landlords are usually represented by *ministri*, or factors, who direct agricultural operations and manage the estates. Wherever corn is cultivated, leasehold predominates. Near Velletri and Frosinone "improvement farms" prevail. A piece of uncultivated land is made over to a peasant for a period varying from 20 to 29 years. Vines and olives are usually planted, the landlord paying the taxes and receiving one-third of the produce. At the end of the contract the landlord either cultivates his land himself or leases it, repaying to the improver part of the expenditure incurred by him. This repayment sometimes consists of half the estimated value of the standing crops.

In the Abruzzi and in Apulia leasehold is predominant. Usually leases last from three to six years. In the provinces of Foggia and Lecce long leases (up to twenty-nine years) are granted, but in them it is explicitly declared that they do not imply *enfiteusi* (perpetual leasehold), nor any other form of contract equivalent to co-proprietorship. *Mezzadria* is rarely resorted to. On some small holdings, however, it exists with contracts lasting from two to six years. The landlord furnishes seed and implements, especially for oil-making, the whole being valued for restitution upon expiry of the contract. The produce is equally divided after the deduction of seed, except in the case of oil, of which the cultivator receives from one-sixth to one-fourth. Special contracts, known as *colonie inamovibili* and *colonie temporanee*, are applied to the *latifondi* or huge estates, the owners of which receive half the produce, except that of the vines, olive-trees, and woods, which he leases separately. "Improvement contracts" also exist. They consist of long leases, under which the landlord shares the costs of improvements and builds farm-houses; also leases of orange and lemon gardens, two-thirds of the produce of which go to the landlord, while the farmer contributes half the cost of farming besides the labour. Leasehold, varying from four to six years for arable land and from six to eighteen years for forest-land, prevails also in Campania, Basilicata, and Calabria. The *estaglio*, or rent, is often paid in kind, and is equivalent to half the produce of good land and one-third of the

[1] In 1899 special inquiries were carried out in regard to this subject by the Ministry of Agriculture. In 1893 a Government Commission studied and proposed changes in the existing laws with regard to agrarian contracts and labour contracts. Several reform Bills have been presented, including that of Baron Sidney Sonnino in November 1900, and that brought forward by the Zanardelli-Giolitti Cabinet in the spring of 1902.

produce of bad land. "Improvement contracts" are granted for uncultivated bush districts, where one-fourth of the produce goes to the landlord, and for plantations of fig-trees, olive-trees, and vines, half of the produce of which belongs to the landlord, who at the end of ten years reimburses the tenant for a part of the improvements effected. Other forms of contract are the *piccola mezzadria*, or sub-letting by tenants to under-tenants, on the half-and-half system; *enfiteusi*, or perpetual leases at low rents—a form which has almost died out; and *mezzadria* (in the provinces of Caserta and Benevento), upon the basis that two-thirds of the olive-oil belongs to the landlord, and varying proportions of other produce, all labour being provided by the tenant.

In Sicily leasehold prevails under special conditions. In pure leasehold the landlord demands at least six months' rent as guarantee, and the forfeiture of any fortuitous advantages. Under the *gabella* lease the contract lasts twenty-nine years, the lessee being obliged to make improvements, but being sometimes exempted from rent during the first years. *Inquilinaggio* is a form of lease by which the landlord, and sometimes the tenant, makes over to tenant or sub-tenant the sowing of corn. There are various categories of *inquilinaggio*, according as rent is paid in money or in kind. Under *mezzadria* or *metateria* the landlord divides the produce with the farmer in various proportions. The farmer provides all labour. *Latifondi* farms are very numerous in Sicily. The landlord lets his land to two or more persons jointly, who undertake to restore it to him in good condition with one-third of it "*interrozzito*," that is, fallow, so as to be cultivated the following year according to triennial rotation. These lessees are usually speculators, who divide and sub-let the estate. The sub-tenants in their turn let a part of their land to peasants in *mezzadria*, thus creating a system which is disastrous both for agriculture and the peasants. At harvest-time the produce is placed in the barns of the lessor, who first deducts 25 per cent. as premium, then 16 per cent. for *battiteria* (the difference between corn before and after winnowing), then deducts a proportion for rent and subsidies, so that the portion retained by the actual tiller of the soil is extremely meagre. In bad years the tiller, moreover, gives up seed corn before beginning harvest.

In Sardinia landlord-farming and leasehold prevail. In the few cases of *mezzadria* the Tuscan system is followed.

Industrial Progress.—The industrial progress of Italy has been great since 1880. Many articles formerly imported are now made at home, and some Italian manufactures have begun to compete in foreign markets. The amount of coal consumed in generating steam power for industrial purposes gives an index of this development. In 1887 the amount spent for coal was 116,930,849 lire; in 1891 it was 146,274,447 lire; and in 1898, 178,198,880 lire. The increase in the number of steam motors (including those for industrial and agricultural use, but excluding railway locomotives and steamships) amounted to more than one-third between 1890 and 1898. Thus:—

Year.	Steam Motors.
1890	14,502
1895	18,441
1898	20,472

The application of water power to industry is also growing, especially in the form of water-driven dynamos for the generation of electricity. At the end of 1898 600,000 horse-power are calculated to have been available for motive power.

Another sign of industrial development is to be found in the growing number of manufacturing companies, both Italian and foreign. In less than fifteen years their capital has doubled itself:—

Year.	Industrial Companies.			
	Italian.		Foreign.	
	Number	Paid-up Capital.	Number.	Paid-up Capital.
		Lire.		Lire.
1883	304	644,229,722	79	379,532,858
1890	483	1,310,273,741	121	449,822,351
1897	513	1,253,995,117	147	543,273,409

Particularly worthy of note is the rapid and continuous progress of applied electricity during recent years. During the triennium ending in 1899 the electrical horse-power produced in Italy rose from 50,000 to 100,000, of which about 80,000 was employed in central stations for public services and 20,000 for private use. In 1899 and 1900 the increase was still more rapid. Piedmont and Lombardy are the chief centres of electrical industry.

Mechanical Industries.—The chief development has taken place in mechanical industries, though it has also been marked in metallurgy. Sulphur mining supplies the industries of sulphur-refining and grinding. In 1899, 564,000 tons of raw sulphur, 110,000 tons of refined sulphur, and 162,000 tons of ground sulphur were produced. 698 factories with 6721 workmen are engaged in refining and grinding. Very little pig iron is made, most of the iron ore being exported. In 1883 24,000 tons of pig iron were produced and in 1899 only 19,000. The number of workmen was 296 in 1883 and 308 in 1899. Most of the iron manufactured in Italy consists of old iron resmelted. This branch of industry developed principally between 1883 and 1889, in which latter year 182,000 tons were produced. It subsequently fell off, but of late has again increased, 198,000 tons, worth nearly 55,000,000 lire, having been produced in 1899. Steel-making, for which foreign pig iron is chiefly used, increased from 3630 tons in 1881 to 158,000 in 1899, but diminished, with intermediate oscillations, to 108,000 tons in 1899. The manufacture of steel rails, carried on first at Terni and afterwards at Savona, began in Italy in 1886. The production in 1898 was 21,926 tons. Tin has been manufactured since 1892. Lead, antimony, mercury, and copper are also dealt with, the production of copper and its alloys having been 14,000 tons in 1899.

Whereas in 1880 the various machine workshops belonging to the Government, the railway companies, and private individuals turned out products worth about 70,000,000 lire, the output rose, between 1887 and 1890, to 100,000,000 lire on account of the great development of public works. During the early 'nineties it fell off, but afterwards rose again. Some of these workshops, particularly those of Lombardy and Piedmont, do an export trade.

Textiles.—The textile industries, some of which are of ancient date, are among those that have most rapidly developed. Hand-looms and small spinning establishments have, in the silk industry, given place to large establishments with steam looms.[1] The production of raw silk at least tripled itself between 1875 and 1900. The value of the silks woven in Italy, estimated in 1890 to be 15,000,000 lire, is now, on account of the development of the export trade, calculated to be 100,000,000 lire. Lombardy (especially Como, Milan, and Bergamo), Piedmont, and Venetia are the chief silk-producing regions. The cotton industry has also rapidly developed. The number of spindles, which in 1880 was 900,000, had increased to about 1,900,000 in 1897. Home products not only supply the Italian market in increasing degree, but find their way into foreign markets. While importation of raw cotton increases (272,340 quintals in 1871, 1,308,509 quintals in 1899) importations of cotton thread (85,804 quintals in 1871, 8116 in 1899) and of cotton stuffs (which amounted to 100,921 quintals in 1871) have rapidly decreased. At the same time exports of cotton thread and stuffs have increased, the exact figures being 235 quintals of thread in 1871, 85,596 in 1899; 1613 quintals of woven cotton stuffs in 1871, 123,262 quintals in 1899. In 1897 the number of cotton mills was 376, 80,000 workmen being employed in the industry. The value of the annual produce of the various branches of the cotton industry, which in 1885 was calculated to be 180,000,000 lire, was in 1900, notwithstanding the fall in prices, about 300,000,000 lire. The industry is chiefly developed in Lombardy, Piedmont, and Liguria; to some extent also in Campania, Venetia, and Tuscany, and to a less extent in Lazio (Rome), Apulia, Emilia, the Marches, Umbria, the Abruzzi, and Sicily.

In 1894 the number of woollen mills was 489. The industry gave employment to 30,625 hands, of whom 15,544 were males (2080 under fifteen years) and 15,081 females (1578 under fifteen years). The value of woollen fabrics was about 100,000,000 lire, exclusive of the output of home industry—an increase of some 20,000,000 lire since 1884. As in the case of cotton, Italian

[1] In 1891 the number of mills was 2084, with 1116 steam boilers, 1345 steam and water motors, and 54,588 basins for silk winding. The number of spindles was 1,534,849; that of carding machines 339; looms 14,949, of which 2535 were machine looms. 172,356 workmen were employed in the factories, of whom 154,644 were women (34,258 under fifteen years) and 17,712 men (2328 under fifteen years).

woollen fabrics are conquering the home market in increasing degree. The importation of raw wool increases (95,537 quintals in 1881, 133,982 in 1899), while the importation of spun and woven wool decreases. The industry centres chiefly in Piedmont (province of Novara), Venetia (province of Vicenza), Tuscany (Florence), Lombardy (Brescia), Campania (Caserta), Genoa, Umbria, the Marches, and Rome. To some extent the industry also exists in Emilia, Calabria, Basilicata, the Abruzzi, Sardinia, and Sicily.

The other textile industries (flax, jute, &c.) have made notable progress. The jute industry is concentrated in a few large factories, which from 1887 onwards have more than supplied the home market, and have begun considerably to export.

Chemical industries show an output worth 52,000,000 lire in 1899, as against 26,000,000 in 1893. Between 1893 and 1898 the number of workmen employed rose from 3275 to 5311. The chief products are sulphuric acid (valued at 6,000,000 lire in 1899), sulphate of copper (5,000,000 lire), employed chiefly as a preventive of certain maladies of the vine; carbonate of lead (about 3,000,000 lire), hyperphosphates and chemical manures (21,500,000 lire in 1899, with a total output of 270,000 tons as compared with 72,000 tons in 1893). Pharmaceutical industries, as distinguished from those above mentioned, have kept pace with the general development of Italian activity. The principal product is quinine, the manufacture of which has acquired great importance, notwithstanding the fall in prices. Milan and Genoa are the principal centres. Other industries of a semi-chemical character are candle-, soap-, glue-, and perfume-making, and the preparation of india-rubber. The last named has succeeded, by means of the large establishments at Milan, not only in supplying the whole Italian market, but in doing an export trade. The products of this group of industries are worth approximately 12,000,000 lire.

The *match-making* industry is subject to special fiscal conditions. In 1898–99 there were 312 match factories scattered throughout Italy, but especially in Piedmont, Lombardy, and Venetia. For some years the industry has been almost stationary. In 1898–99 47,379 million matches were made. The number of hands employed was 6400.

The *beetroot-sugar* industry has attained considerable proportions in Umbria, the Marches, Lazio, Venetia, and Piedmont since 1890. In 1899 59,724 quintals were produced. The rise of the industry has been favoured by protective tariffs and by a system of excise which allows a considerable premium to manufacturers.

Alcohol has undergone various oscillations, according to the legislation governing distilleries. In 1871 only 20 hectolitres were produced, but in 1881 the output was 318,000 hectolitres, the maximum hitherto attained. Since then special laws have hampered development, some provinces, as for instance Sardinia, being allowed to manufacture for their own consumption but not for export. In other parts the industry is subjected to an almost prohibitive excise-duty. The average production is about 180,000 hectolitres per annum. The greatest quantity is produced in Lombardy, Piedmont, Venetia, and Tuscany.

Paper-making is highly developed in Italy, and is carried on in the provinces of Novara, Caserta, Milan, Vicenza, Turin, Como, Lucca, Ancona, Genoa, Brescia, Cuneo, Macerata, and Salerno. In 1897 there existed 424 paper mills, giving employment to about 16,000 workmen. The output, which in 1887 was 680,000 quintals, had risen to 1,000,000 quintals in 1897, and has since increased.

Furniture-making in different styles is carried on all over Italy, especially as a result of the establishment of industrial schools. Each region produces a special type, Venetia turning out imitations of 16th and 17th century styles, Tuscany the 15th century or cinquecento style, and the Neapolitan provinces the Pompeian style. Furniture and cabinet-making in great factories are carried on particularly in Lombardy and Piedmont. Bent-wood factories have been established in Venetia and Liguria.

A characteristic Italian industry is that of *straw-plaiting* for hat-making, which is carried on principally in Tuscany, in the district of Fermo, in the Alpine villages of the province of Vicenza, and in some communes of the province of Messina. The plaiting is done by country women, while the hats are made up in factories. Both plaits and hats are largely exported, trade in the former having increased steadily to the level of 23,000 quintals in 1899, and in the latter, though somewhat reduced during recent years, to 37,506 hundreds in 1899.

Ceramics and *glass-working* also show great development, particularly in Tuscany, the Romagna, Venetia, and Naples, and are extending their foreign markets to a considerable degree.

Fisheries.—The number of boats and smacks engaged in the fisheries has remarkably increased. Thus:—

Year.	Boats and Smacks.	
	Number.	Tonnage.
1881 . . .	15,914	49,103
1891 . . .	19,885	54,019
1898 . . .	23,578	68,654
1899 . . .	23,668	69,259

In 1899, 185 boats were engaged in coral fishing, 267 in sponge fishing, and 23,216 in fishing proper. The boats engaged in deep-sea fishing numbered, in 1899, 1608, with a total tonnage of 18,177 and crews numbering 10,012; of these 139 fished for coral, 141 for sponges, and 1328 for fish of various kinds. Most of the fishing boats, properly so called, start from the Adriatic coast, the coral boats from the western Mediterranean coast, and the sponge boats from the western Mediterranean and Sicilian coasts. Fishing and trawling are carried on chiefly off the Italian (especially Ligurian), Austrian, and Tunisian coasts; coral is found principally near Sardinia and Sicily, and sponges almost exclusively off Sicily and Tunis, in the neighbourhood of Sfax.

Fishing proper is steadily increasing; coral fishing, which fell off between 1889 and 1894 on account of the temporary closing of the Sciacca coral reefs by royal decree on 29th December 1888, is again developing. Sponge fishing has notably increased, particularly in 1899. The total value of fish caught in 1899 was estimated to be 12,759,584 lire. Though the fishing industry is extending as regards the number of boats and crews, the value of the aggregate catch tends to diminish. The tunny fisheries in 1899 gave employment to fifty establishments with 3661 workmen, who handled 43,450 quintals of tunny worth 2,564,099 lire. The coral fisheries in the same year produced 350,892 kilogrammes, worth 1,772,970 lire. Sardinian coral commands from 80 to 95 lire per kilogramme, and is much more valuable than the Sicilian coral.

Mines.—The number of Italian mines increased from 589 in 1881 to 1548 in 1899. The number of miners has grown from 45,420 in 1881 to 61,472 in 1899. The output in 1881 was worth about 70,000,000 lire, but by 1895 had decreased to 45,000,000, chiefly on account of the fall in the price of sulphur. But it afterwards rose, and was worth more than 91,000,000 lire in 1899. The chief minerals are sulphur and boracic acid, in the production of which Italy holds one of the first places. Iron, zinc, lead, and, to a smaller extent, copper of an inferior quality, are successfully mined.

Minerals.	Output (in Tons).				Value (in Lire).			
	1881.	1891.	1898.	1899.	1881.	1891.	1898.	1899.
Sulphur . . .	...	...	3,362,841	3,763,206	...	...	40,375,152	44,114,503
Boracic acid . .	2,659	1,775	2,650	2,674	2,127,280	887,500	848,000	855,680
Iron ore . . .	421,065	216,486	190,110	236,549	4,605,933	2,767,187	2,746,239	3,534,117
Zinc . . .	72,176	120,685	132,099	150,629	4,691,843	12,720,605	12,061,667	24,233,330
Lead . . .	39,533	30,233	33,930	31,046	8,184,377	5,984,231	5,221,240	5,610,806
Copper . . .	26,257	53,059	95,128	94,764	1,664,955	2,829,334	2,131,497	3,438,861
Argentiferous ores .	1,444	2,006	435	540	2,238,951	1,973,484	380,238	582,262

The output of stone from quarries is greatly diminished (from 12,500,000 tons, worth 48,000,000 lire, in 1890, to 8,000,000 tons, worth 35,000,000 lire in 1899), a circumstance probably attributable to the slackening of building enterprise in many cities, as well as to the decrease in the demand for stone for railway, maritime, and river embankment works.

Communications.—Between 1881 and 1897 the length of the Italian railway system almost doubled itself; as the following statistics show in detail, the passenger traffic increased by 60 per cent., and the goods traffic by 97 per cent.:—

Year.	Length of lines open to traffic (kilometres).	Passengers. Number.	Passengers. Average length of journey (kilometres).	Goods. Quantity. (Tons).	Goods. Average distance (in kilometres) per ton.	Cattle. No. of Head.	Cattle. No. of Trucks.
1881	8,893	34,040,515	48	10,344,282	124	2,136,905	...
1891	13,393	49,570,716	44	17,153,806	116	961,685	69,452
1895	15,479	52,725,883	44	18,569,138	109	1,133,595	74,344
1897	15,696	54,415,294	44	20,429,709	112	1,159,287	73,755

The development of traffic depends not only upon the opening of new lines, but also upon the industrial and commercial development of the country and upon the general increase of economic activity. The opening of the St Gothard tunnel in 1881 placed Italy in more direct communication with central and northern Europe, and acted as a powerful stimulus to trade. By the law of 27th April 1885, which sanctioned the so-called Railway Conventions, the principal Italian lines, though remaining State property, were farmed out to three private companies known, from the regions through which they chiefly pass, as the "Mediterranean," "Adriatic," and "Sicilian" (*Sicule*). There is, besides, a Sardinian railway system worked by two companies, and several minor private lines on the mainland and in the islands. The State shares the profits of the various lines in different degrees, but assigns a part of its share to the upkeep of the permanent way and of the rolling stock. The State, besides, grants annual kilometric subsidies to certain lines. The cost of the lines, including rolling stock, was calculated to be, on 31st December 1897, 5,106,000,000 lire (£204,240,000), of which 4,765,000,000 lire (£190,600,000) represents the cost of the permanent way and plant, and 341,000,000 lire (£13,640,000) the value of the rolling stock :—

Names of Lines.	Length open to traffic on 31st December 1897 (metres).	No. of Railway Servants. Totals.	No. of Railway Servants. Average per kilometre.	Rolling Stock. Locomotives.	Rolling Stock. Passenger Carriages.	Rolling Stock. Trucks and Vans of all kinds.
Mediterranean.	5,806,751	49,644	8·58	1,322	3,753	24,164
Adriatic . .	5,742,375	39,108	6·91	1,111	3,158	21,210
Sicilian . .	1,083,055	4,566	4·22	156	456	2,107
Secondary lines	3,063,710	7,747	2·53	376	1,218	3,375
Totals .	15,695,891	101,065	6·49	2,965	8,585	50,856

Railway revenue, after deducting working expenses, was, in 1886, 76,852,176 lire (£3,074,087), equal to 7017 lire or, approximately, £280 per kilometre. It rose to 86,353,952 lire in 1899 (7282 lire per kilometre), but in 1897 fell to 81,493,266 lire (5234 lire per kilometre), a diminution chiefly due to the construction of unremunerative lines, the working expenses of which often exceed revenue. The net receipts vary considerably on different lines (6529 lire per kilometre in 1897 for the "Mediterranean," 7044 for the "Adriatic," 1445 for the "Sicilian"), and for some lines, like those of Sardinia, are insufficient to cover expenses. The principal Sardinian line loses 1152 lire per kilometre per annum, and the secondary lines 1570 per kilometre.

Steam and Electric Tramways.—Tramways with mechanical traction have developed rapidly. Between 1878, when the first line was opened, and 1898 the length of the lines grew to exceed 3000 kilometres :—

Length of Mechanical Tramways.

Year.	Kilometres.	Year.	Kilometres.
1878 . .	9	1891 . .	2539
1881 . .	960	1895 . .	2852
1885 . .	2061	1898 . .	3107

These lines exist principally in Lombardy (especially in the province of Milan, which on 31st December 1898 possessed 386 kilometres), in Piedmont, especially in the province of Turin (322 kilometres), and in other regions of northern and central Italy. In the south they are rare, partly on account of the mountainous character of the country and partly from the scarcity of traffic.

Carriage-roads have been greatly extended. On 31st December 1897 there existed 6873 kilometres of State roads, 38,970 of provincial roads, and 54,190 of compulsory communal roads, making a total of 100,033 km., corresponding to 35 km. of road per 100 sq. km. and to 318 km. per 100,000 inhabitants. Accurate statistics are lacking with regard to the optional communal roads and to the rights of way. The ratio of road to area varies in different provinces, Piedmont having 61 km. of road per 100 sq. km., Lombardy 56 km., Venetia 49 km., while other regions are almost roadless, like Sicily, Calabria, Basilicata, and Sardinia. Sardinia has only 16 km. of road per 100 sq. km.

Posts, Telegraphs, and Telephones.—The number of post offices increased from 4823 in 1881 to 6700 in 1891, and to 7707 on 30th June 1898. During the year 1897–98 the Italian post-offices transmitted 547,755,768 letters and post-cards, a total corresponding to an average of 8·41 per inhabitant, as compared with the average of 5·67 in 1887–88. The other services, more directly connected with the development of trade, have also increased. The number of parcels and post-office orders transmitted has kept pace with the growth of general activity, the value of money orders having almost tripled itself between 1875 and 1900. The telegraph system, which in 1881 covered 26,880 kilometres, had extended to 42,005 km. on 30th June 1898. Thirty-seven submarine cables of a total length of 1978 km. unite the various parts of Italy and provide telegraphic communication with neighbouring States. Between 1881 and 30th June 1898, telegrams sent from Italy abroad increased from 540,672 to 1,039,770. Internal telegrams increased less rapidly, 5,495,387 having been sent in 1881 and 7,555,564 in 1897–98. Telephones, first introduced in 1881, have rapidly extended, and on 30th June 1898 59 cities possessed a public telephone service. Inter-provincial telephone lines have been laid, and at the end of 1901 direct telephonic communication was opened between Rome and Paris. From 31st December 1884 to 30th June 1898 private telephone concessions increased in number from 192 to 1005.

Mercantile Marine.—Between the years 1881 and 1899 the number of ships visiting Italian ports for trading purposes decreased slightly (219,598 in 1881, and 211,536 in 1899), while their aggregate tonnage considerably increased (32,070,704 in 1881 and 60,470,392 in 1899), and the quantity of goods unloaded rose from 9,590,933 tons in 1881 to 16,676,751 tons in 1899. The diminution of the number of ships and the increase of their aggregate tonnage is due to the substitution of steam for sailing vessels. The following table illustrates this tendency :—

Year.	General Maritime Traffic. Sailing Vessels. Arrivals and Sailings.	Sailing Vessels. Aggregate Displacement (tons).	Sailing Vessels. Tons of Merchandise (loaded and unloaded).	Steamships. Arrivals and Sailings.	Steamships. Aggregate Displacement (tons).	Steamships. Tons of Merchandise (loaded and unloaded).
1881	169,590	7,078,237	5,059,866	50,008	24,992,467	4,531,067
1891	183,640	7,079,638	4,801,551	67,319	39,820,040	8,855,924
1898	132,911	5,753,085	4,089,058	75,352	53,729,997	11,743,565
1899	135,618	5,869,704	4,325,867	75,918	54,600,688	12,350,884

In the movement of shipping, trade with foreign countries prevails (especially as regards arrivals) over trade between Italian ports. Out of the 11,486,468 tons of merchandise unloaded in Italian ports in 1899, 9,058,529 hailed from abroad and only 2,427,939 from the interior ; out of the 5,190,283 tons embarked, 2,767,336 were sent abroad and 2,422,947 to home ports. Most of the merchandise and passengers bound for and hailing from foreign ports sail under foreign flags. Out of the 9,058,529 tons of merchandise landed in Italian ports from abroad in 1899, only 2,409,157 came in Italian bottoms, and the remaining 6,649,372 in foreign bottoms. Similarly, foreign vessels prevail over Italian

vessels in regard to goods embarked, 1,581,488 tons out of 2,767,336 loaded in 1899 having been carried in foreign bottoms. In the passenger traffic, out of a total of 510,407 passengers landed in Italy, 106,700 landed from Italian and 403,707 from foreign steamers; while 148,547 embarked upon Italian and 387,447 upon foreign steamers. European countries absorb the greater part of Italian sea-borne trade, whereas most of the passenger traffic goes to North and South America.

The substitution of steamships for sailing vessels has brought about a diminution in the number of vessels belonging to the Italian mercantile marine, whether employed in the coasting trade, the fisheries, or in traffic on the high seas. Thus:—

Year.	Total No. of Ships.	Steamships.			Sailing Vessels.	
		Number.	Tonnage (Net).	Horse-power.	Number.	Tonnage (Net).
1881	7,815	176	93,698	?	7,639	895,359
1891	6,617	305	199,945	220,641	6,312	625,812
1898	6,148	384	277,520	303,858	5,764	537,642
1899	6,074	409	314,830	317,942	5,665	558,224

Among the steamers the increase has chiefly taken place in vessels of more than 1000 tons displacement, but the number of large sailing vessels has also increased.

Foreign Trade.—Italian trade with foreign countries (imports and exports) during the quinquennium 1872–76 averaged 2,350,000,000 lire (£94,000,000) a year; in the quinquennium 1893-97 it fell to 2,244,000,000 lire (£88,960,000) a year. In 1898, however, the total rose to 2,617,000,000 lire (£104,680,000), but the increase was principally due to the extra importation of corn in that year. In 1899 it was nearly 3,000,000,000 lire, or £120,000,000. Thus:—

Year.	Trade with Foreign Countries (exclusive of precious metals).			
	Totals.	Imports.	Exports.	Excess of Imports over Exports.
1881	2,405,187,767	1,239,671,520	1,165,516,247	74,155,273
1891	2,003,384,738	1,126,584,583	876,800,155	249,784,428
1898	2,616,904,650	1,413,335,346	1,203,569,304	209,766,042
1899	2,937,977,586	1,506,561,188	1,431,416,398	75,144,790

The recent general depreciation of agricultural and industrial produce must, however, be taken into account, and the same money value probably represents an increased quantity of merchandise. Supposing the prices of 1884 to have been constant, the returns for 1898 would show an increase of 392,000 lire in exports and 270,000,000 lire in imports. From 1882 to 1887 imports steadily increased from 1,227,000,000 lire to 1,605,000,000 lire. In 1888, after the tariff reform of 1887, they fell considerably, and in 1894 were only 1,095,000,000 lire. During recent years the tendency has been towards a slight increase of imports.

The countries with which Italy carried on most active import trade in 1899 were:—

	Lire.		Lire.
Great Britain	299,537,000	Russia	96,157,000
Germany	193,964,000	British India	73,999,000
United States	168,449,000	China	68,754,000
Austria-Hungary	160,848,000	Switzerland	49,337,000
France	152,330,000	Rumania	27,299,000

With regard to exports alone, fully one-half of the total amount is absorbed by the markets of Switzerland (246,618,000 lire), Germany (236,107,000 lire), France (201,293,000 lire), and Austria-Hungary (158,698,000 lire). The remainder, worth about 500,000,000 lire, is distributed between Great Britain (147,958,000 lire), the United States (118,115,000 lire), and the Argentine Republic (60,574,000 lire). Switzerland has therefore been the chief customer of Italy since the rupture of Italian commercial relations with France, which prior to 1888 absorbed some 375,000,000 lire of Italian products. Now, in spite of the Franco-Italian commercial treaty of 1898, France only buys some 200,000,000 lire per annum. The other countries which absorb Italian products are, in order of importance, as follows:—

	Lire.		Lire.
British India	28,420,000	Uruguay	7,781,000
Egypt	27,719,000	Chile	4,872,000
Belgium	24,424,000	Sweden and Norway	3,654,000
Holland	19,194,000	Denmark	1,567,000
Spain	14,105,000	Mexico	704,000
Russia	13,720,000	Bulgaria	275,000
Greece	8,317,000		

The most important imports are minerals, including coal and metals (both in pig and wrought); silks, raw, spun, and woven; stone, potter's earths, earthenware, and glass; corn, flour, and farinaceous products; cotton, raw, spun, and woven; and live stock. The principal exports are silk in all its forms, live stock, wines, spirits, and oils; corn, flour, maccaroni, and similar products; and minerals, chiefly sulphur. The raw materials for manufacture represent about 60 per cent. of the imports and more than 50 per cent. of the exports.

Prior to the tariff reform of 1887 manufactured articles, alimentary products, and raw materials for manufacture held the principal places in the imports. In the exports, alimentary products came first, while raw materials for manufacture and manufactured articles were of little account. After 1888 the importation of alimentary products and manufactured articles fell off, while that of raw and semi-raw materials for manufacture increased. Exports, which fell off during the years 1888 and 1890, on account of the economic crisis, have more than recovered their position. The transformation of Italy from a purely agricultural into a largely industrial country is shown by the circumstance that trade in raw stuffs, semi-manufactured and manufactured materials, now preponderates over that in alimentary products and wholly-manufactured articles. The balance of Italian trade has undergone frequent fluctuations. The large predominance of imports over exports after 1884 was a result of the falling off of the export trade in live stock, olive oil, and wine, on account of the closing of the French market, while the importation of corn from Russia and the Balkan States increased considerably. In 1894 the excess of imports over exports fell to 68,000,000 lire, but by 1898 it had grown to 210,000,000 lire, in consequence chiefly of the increased importation of coal, raw cotton and cotton thread, pig and cast iron, old iron, grease, and oil-seeds for use in Italian industries. In 1899, however, the excess of imports over exports fell to 75,000,000 lire.

Currency.—The total amount of money coined in Italy (exclusive of Eritrean currency) from 1st January 1862 to the end of 1899, was 1,100,114,269·54 lire, thus divided: gold, 427,099,650 lire; silver at $^{900}/_{1000}$, 364,637,025 lire; silver at $^{835}/_{1000}$ 204,698,544 lire; nickel, 20,000,000 lire; copper, 83,679,050·54. During the same period coins to a nominal value of 731,676,238 lire were withdrawn from circulation in the following proportions: gold, 41,072,935; silver, 662,262,759; copper, 28,340,544. The forced paper currency, instituted by the decree of 1st May 1866, was abolished by the law of 7th April 1881, which also dissolved the Union of Banks of Issue created in 1874 to furnish to the State treasury a milliard of lire in notes, guaranteed collectively by the banks. The amount of notes actually furnished to the State was, however, only 940,000,000 lire. The law of 7th April 1881 enacted that all the notes of the Bank Union circulating on 1st July of that year should pass to the charge of the State treasury, and that 600,000,000 of the 940,000,000 lire of notes furnished to the State should be gradually redeemed with the proceeds of a loan which the Minister of the Treasury was authorized to contract for the sum of 644,000,000

lire. The remaining 340,000,000 lire of Union notes were to be replaced by 240,000,000 of ten-lire and 100,000,000 of five-lire State notes, such State notes to be payable at sight in metallic legal tender by certain State banks. Nevertheless the law of 1881 did not succeed in maintaining the value of the State notes at a par with the metallic currency, and from 1885 onwards there reappeared a gold premium, which during 1899 and 1900 remained at about 7 per cent., but which has since fallen to about 3 per cent. The paper circulation to the debit of the State on 31st December 1899 consisted of 451,431,780 lire in State notes, 42,138,152 in *bons de caisse*, making in all a total of 493,569,932 lire. At the same time the paper currency issued by the authorized State banks amounted to 1,180,110,330 lire, thus:—

Date.	Paper Currency.					
	Direct Liability of State.			Notes Issued by State Banks.	General Total.	
	Total.	State Notes.	Bons de Caisse.		Aggregate Paper Currency.	Ratio per Inhabitant.
	Lire.	Lire.	Lire.	Lire.	Lire.	Lire.
31st December 1881 . .	940,000,000	940,000,000	...	735,579,197	1,675,579,197	58·88
„ 1886 . .	446,665,535	446,665,535	...	1,031,869,712	1,478,535,247	50·28
„ 1891 . .	341,949,237	341,949,237	...	1,121,601,079	1,463,550,316	48·23
„ 1896 . .	510,000,000	400,000,000	110,000,000	1,069,233,376	1,579,233,376	50·47
„ 1899 . .	493,569,932	451,431,780	42,138,152	1,180,110,330	1,673,680,262	52·54

The metallic reserve of the Treasury on 31st December 1899 (exclusive of copper and nickel) was 122,037,827 lire, consisting of 30,565,434 lire in gold and 91,472,393 lire in silver, 6,036,595 of the latter being in five-franc pieces. At the same date the Treasury possessed 1,219,391 lire of nickel coins and 4,320,291 lire of copper coins. The metallic reserve of the State banks was altogether 541,125,623 lire, of which 488,043,793 was in gold or in securities equal to gold (foreign gold bills, foreign bank notes, foreign treasury bills, and credits in foreign current accounts), and 53,081,830 in silver.

Banks.—Prior to the year 1893 the juridical status of the Banks of Issue was regulated by the laws of 30th April 1874 on paper currency and of 7th April 1881 on the abolition of forced currency. At that time four limited companies were authorized to issue bank notes, namely, the National Bank, the National Bank of Tuscany, the Roman Bank, and the Tuscan Credit Bank; and two banking corporations, the Bank of Naples and the Bank of Sicily. In 1893 the Roman Bank was put into liquidation, and the other three limited companies were fused, so as to create the Bank of Italy, the privilege of issuing bank notes being thenceforward confined to the Bank of Italy, the Bank of Naples, and the Bank of Sicily. By the law of 10th August 1893 a new bank statute was instituted, but was modified subsequently by the laws of 1894, 1895, 1897, and 1898. The paid-up capital of the Bank of Italy, and of the two southern banks available for currency purposes, is 287,000,000 lire, thus divided: Bank of Italy, 210,000,000 lire; Bank of Naples, 65,000,000 lire; and Bank of Sicily, 12,000,000 lire. The following table gives an analysis of the condition of these banks on 31st December 1899:—

Banks of Issue.	Bank Notes in Circulation.	Metallic Reserve.	Securities, Bills, and Advances.
Bank of Italy .	881,813,128	422,258,152	407,273,365
Bank of Naples .	236,585,511	118,486,888	87,412,102
Bank of Sicily .	61,711,691	40,799,282	43,761,857
Totals .	1,180,110,330	581,544,322	538,447,324

The discount operations effected by the banks of issue increased from 2,273,706,411 lire in 1881 to 2,807,015,942 lire in 1899; and advances on current account from 269,735,002 in 1881 to 347,656,418 lire in 1899.

The price of Italian consolidated 5 per cent. stock, which is the security most largely negotiated abroad, and used in settling differences between large financial institutions, has steadily risen during recent years. After being depressed between 1885 and 1894, the prices in Italy and abroad reached, in 1899, on the Rome Stock Exchange, the average of 100·83, and of 94·8 on the Paris Bourse. By the end of 1901 the price of Italian stock on the Paris Bourse had, however, risen to par or thereabouts. Rates of exchange, or, in other words, the gold premium, favoured Italy during the years immediately following the abolition of the forced currency in 1881. In 1885, however, rates tended to rise, and though they fell in 1886, they subsequently increased to such an extent as to reach 110 per cent. at the end of August 1894. For the next four years they continued low, but rose again in 1898 and 1899. In 1900 the maximum rate was 107·32, and the minimum 105·40, but in 1901 rates fell considerably.

There are in Italy six Clearing Houses, namely, the ancient one at Leghorn, and those of Genoa, Milan, Rome, Florence, and Turin, founded since 1882. The total amount cleared in 1899 was nearly 36 milliards of lire, of which 28½ milliards were cleared by compensation. The difference of 7349 million lire was settled, partly by credits in current account (4738 million lire), and partly (2611 million lire) by money payments. Stock exchange transactions represented 9½ out of the total clearings of 36 milliards of lire. The amount cleared, which decreased considerably in 1890, 1891, and in 1894–95, has again increased, especially in 1898–99:—

Clearing House Operations.	
Year.	Lire.
1891 . .	13,423,249,649
1895 . .	15,379,192,320
1899 . .	35,869,587,721

The number of ordinary banks, which diminished between 1889 and 1894, increased again in the following years, and was 158 in 1898. At the same time the capital employed in banking decreased by nearly one-half, namely, from 309 millions in 1880 to 163 millions in 1898. This decrease was due to the liquidation of a number of large and small banks, amongst others the Bank of Genoa, the General Bank, and the Società di Credito Mobiliare Italiano of Rome, and the Genoa Discount Bank—establishments which alone represented 121 millions of paid-up capital. Ordinary credit operations are also carried on by the co-operative credit societies, of which there were 696 in 1898, with a capital of 103,736,000 lire.

Agrarian Credit Banks.—The banks which make a special business of lending money to owners of land or buildings (*credito fondiario*) are regulated by the laws of 17th July 1890, 6th May 1891, 10th August 1893, and 8th August 1895. Loans are repayable by instalments, and are guaranteed by first mortgages not greater in amount than half the value of the hypothecated property. The banks may, moreover, buy up mortgages and advance money on current account on the security of land or buildings. The development of building enterprise in the large cities has induced these land and mortgage banks to turn their attention rather to building enterprise than to mortgages on rural property. The transactions of these institutions have notably increased: the value of their land certificates or *cartelle fondiarie* (representing capital in circulation) rose from 263 millions in 1881 to 389 millions in 1886, and to 768 millions in 1891, but fell to 733 millions in 1896 and to 684 millions in 1898; the amount of money lent increased from 261 millions in 1881 to 390 millions in 1886, and 770 millions in 1891, but fell to 733 millions in 1896 and 684 millions in

1899. The diminution was due to the law of 10th April 1893 upon the banks of issue, by which they were obliged to liquidate the loan and mortgage business which they had previously carried on.

In view of the importance of agriculture in Italy, various laws have been passed to facilitate agrarian credit. The law of 23rd January 1887 (still in force) extended the dispositions of the Civil Code with regard to "privileges,"[1] and established special "privileges" in regard to harvested produce, produce stored in barns and farm buildings, and in regard to agricultural implements. Loans on mortgage may also be granted to land-owners and agricultural unions, with a view to the introduction of agricultural improvements. These loans are regulated by special disposition, and are guaranteed by a share of the increased value of the land after the improvements have been carried out. Agrarian credit banks may, with the permission of the Government, issue *cartelle agrarie*, or agrarian bonds, repayable by instalments and bearing interest. On 31st December 1898 only five agrarian banks proper were in existence, but the Monte dei Paschi of Siena and the Bologna Savings Bank have special sections for agrarian credit. The paid-up capital of these seven institutions was at that date 3,274,921 lire. The value of the agrarian bonds in circulation was 1,403,000, the discount operations 13,942,422 lire, and the sums advanced on current account, 1,006,419 lire.

Condition of the Working Classes.—The condition of the numerous agricultural labourers (who constitute one-third of the population) is, except in some regions, hard, and in places absolutely miserable. Much light was thrown upon their position by the agricultural inquiry (*inchiesta agraria*) completed in 1884. The large numbers of emigrants, who are drawn chiefly from the rural classes, furnish another proof of poverty. The terms of agrarian contracts and leases (except in districts where *mezzadria* prevails in its essential form), are in many regions disadvantageous to the labourers, who suffer from the obligation to provide guarantees for payment of rent, for repayment of seed corn, and for the division of products.

Examining in detail the position of the rural classes in Lombardy and Venetia, there exist—in addition to the factor, who superintends work and has a comfortable position, with 1200 to 1800 lire (£48 to £72) per annum, plus a share in the profits—the *casaro*, who conducts the industry of cheese-making, and receives in return from £4 to £8 a year in money, an allotment to cultivate for himself, and a certain proportion of wine, oil, and milk, earning altogether between £24 and £28 a year; the *bifolco*, who has charge of the draught cattle and horses, and receives a cottage, firewood, and an allotment, earning altogether about £20 a year; the *cavallaro* and *vaccaro*, who tend the horses and cows, and receive the same treatment as the *bifolco;* and the day labourers, who earn from 5d. to 8d. a day, plus an additional percentage at seed time, hoeing time, harvest, and threshing. Chance labourers are better paid (10d. a day in winter, 1s. 3d. a day in summer), but suffer from lack of regular employment. In Venetia the lives of the small proprietors and of the salaried peasants are often extremely miserable. There and in Lombardy the disease known as *pellagra* is most widely diffused. According to recent investigations, the disease is not due to the insufficient alimentary power of cereals, but to poisoning by micro-organisms produced by deteriorated maize, and can be combated successfully by care in ripening, drying, and storing the maize. The most recent statistics show the disease to be diminishing. Whereas in 1881 there were 104,067 (16·29 per 1000) peasants afflicted by the disease, in 1899 there were only 72,603 (10·30 per 1000) peasants, with a maximum of 39,882 (34·32 per 1000) peasants in Venetia, and 19,557 (12·90 per 1000) peasants in Lombardy. The decrease of the disease is a direct result of the efforts made to combat it, in the form of special hospitals or *pellagrosari*, economic kitchens, rural bakeries, and maize-drying establishments. A Bill for the better prevention of pellagra was introduced by the Zanardelli Cabinet in the spring of 1902.

In Liguria, on account of the comparative rarity of large estates, agricultural labourers are in a better condition. Men earn between 1s. 3d. and 2s. 1d. a day, and women from 5d. to 8d. In Emilia, the day labourers, known as *disobbligati*, earn, on the contrary, low wages, out of which they have to provide for shelter and to lay by something against unemployment. Their condition is miserable. In Tuscany, however, the prevalence of *mezzadria*, properly so called, has raised the labourers' position. Yet in some Tuscan provinces, as, for instance, that of Grosseto, where malaria rages, labourers are organized in gangs under "corporals," who undertake harvest work. They are poverty-stricken, and easily fall victims to fever. In the Abruzzi and in Apulia both regular and irregular workmen are engaged by the year. The *curatari* or *curatoli* (factors) receive £40 a year, with a slight interest in the profits; the stockmen hardly earn in money and kind £13; the muleteers and underworkmen get between £5 to £8, plus firewood, bread, and oil; irregular workmen have even lower wages, with a daily distribution of bread, salt, and oil. In Campania and Calabria the *curatoli* and *massari* earn, in money and kind, about £12 a year; cowmen, shepherds, and muleteers about £10; irregular workmen are paid from 8½d. to 1s. 8d. per day, but only find employment, on an average, 230 days in the year. The condition of Sicilian labourers is also miserable. The huge extent of the *latifondi*, or large estates, often results in their being left in the hands of speculators, who exploit both workmen and farmers with such usury that the latter are often compelled, at the end of a scanty year, to hand over their crops to the usurers before harvest. In Sardinia wage-earners are paid 10d. a day, with free shelter and an allotment for private cultivation. Irregular adult workmen earn between 10d. and 1s. 3d., and boys from 6d. to 10d. a day. Woodcutters and vine-waterers, however, sometimes earn as much as 3s. a day.

The condition of the workmen employed in the various branches of manufacturing industry has improved during recent years. Wages are higher, the cost of the prime necessaries of life is, as a rule, lower, so that an improvement, not merely nominal, but real, has taken place in the remuneration of work. Taking into account the variations in wages and in the price of wheat, it may be calculated that the number of hours of work requisite to earn a sum equal to the price of 100 kilogrammes of wheat fell from 183 in 1871 to 76 in 1894. In 1898 it was 105, on account of the rise in the price of wheat, which averaged 27 lire per quintal in bond, while in 1894 it was only 19 lire per quintal. Wages, however, have not risen in all industries. In the mining and woollen industries they have fallen, but have increased in mechanical, chemical, silk, and cotton industries. Wages vary greatly in different parts of Italy, according to the cost of the necessaries of life, the degree of development of working-class needs, and the state of working-class organization, which in some places has succeeded in increasing the rates of pay. Women are, as a rule, paid less than men, and though their wages have also increased, the rise has been slighter than in the case of men. In some trades, for instance, the silk trade, women earn little more than 10d. a day, and, for some classes of work, as little as 7d. and 4½d.

Strikes.—The number of industrial strikes has risen from year to year, although, on account of the large number of persons involved in some of them, the number of strikers has not always corresponded to the number of strikes. Accurate statistics are only forthcoming up to the end of 1899. During the years 1900 and 1901, however, strikes were increasingly numerous, chiefly on account of the growth of Socialist and working-class organizations. During 1901 the strikes numbered nearly 1500, and involved a considerable proportion (approximately 1,000,000) of the industrial and agricultural population of northern and central Italy. The following table indicates the increase during the two decades 1879–99:—

Year.	Number of Strikes.	Number of Strikers.
1879 . . .	32	4,011
1890 . . .	139	38,402
1895 . . .	126	19,307
1897 . . .	217	76,570
1898 . . .	256	35,705
1899 . . .	259	43,194

The greatest proportion of strikes takes place in northern Italy, especially Lombardy and Piedmont, where manufacturing industries are most developed. In 1897, however, a strike, involving 41,550 persons, took place among the Tuscan straw-plaiters (women). The smallest proportion occurs in the south, especially in Calabria, Apulia, and Sardinia. In 1896 strikes were numerous among the Sicilian sulphur-miners. Textile, building, and mining industries show the highest percentage of strikes, since they give employment

[1] "Privileges" assure to creditors priority of claim in case of foreclosure for debt or mortgage. Prior to the law of 23rd January 1887 harvested produce and agricultural implements were legally exempt from "privilege."

to large numbers of men concentrated in single localities. The strikes of day-labourers or *braccianti* who work in gangs upon railway embankments, railway cuttings, excavations, and similar undertakings are, however, frequent in central Italy, particularly in Romagna, but their number varies little from year to year. Printers, lithographers, carpenters, and hat-makers strike less than other trades. It may be noted that printers and hat-makers possess the oldest and soundest trade organizations. The days of work lost through strikes were in 1897 1,113,535, in 1898 239,292, and in 1899 231,590. The chief motives are demands for an increase of pay (44 per cent. in 1899), opposition to a decrease of pay (11 per cent. in 1899), attempts to obtain shorter hours of work (7 per cent. in 1899), and resistance to increased hours of work (2 per cent.). Of late a tendency has become apparent to demand simultaneously an increase of wages and reduction of the hours of work. Fifty-eight per cent. of the strikes in 1899 ended in favour of the workmen—31 per cent. wholly and 27 per cent. partially; 42 per cent. gave a purely negative result. Agricultural strikes, though less frequent than those in manufacturing industries, have special importance in Italy. They were exceptionally numerous in the years 1885, 1886, 1897, and 1898, but in the spring and summer of 1901 they were more numerous than ever before. Instead of occurring most frequently in the purely agricultural districts of the south, they are most common in the north and centre, a circumstance which shows them to be promoted less by the more backward and more ignorant peasants than by the better-educated labourers of Lombardy and Emilia, among whom Socialist organizations are widespread.

Although in some industrial centres the working-class movement has assumed an importance equal to that of other countries, there is a complete lack of any general working-class organization comparable to the English trade unions. Mutual benefit and co-operative societies often serve the purpose of working-class defence or offence against the employers, but it is difficult to ascertain the exact number of associations designed to protect the interest of workmen. Roughly speaking, they may be divided into two groups, Mazzinians and Socialists, the former of which makes little progress, while the latter is rapidly gaining ground. In 1893, after many vicissitudes, the Italian Socialist Labour Party was founded, and has now become the Italian Socialist Party, in which the majority of Italian workmen tend increasingly to enrol themselves. Printers and hat-makers, however, possess trade societies, that of the former being known as the *Federazione Italiana dei lavoratori del libro*. In 1899 an agitation began for the organization of "Chambers of Labour," intended to look after the technical education of workmen and to form commissions of arbitration in case of strikes. They act also as employment bureaux, and are often centres of political propaganda. At present such "chambers" exist in many Italian cities, while "leagues of improvement," or of "resistance," are rapidly spreading in the country districts. In many cases the action of these organizations has proved, at least temporarily, advantageous to the working classes.

Labour legislation is backward in Italy, on account of the late development of manufacturing industry and of working-class organization. A law dated 26th February 1886, on child labour, forbids—(*a*) the employment of children under nine years of age in factories, quarries, and mines, or under ten years if work is carried on underground; (*b*) the employment of children under fifteen years of age, unless furnished with medical certificates of physical fitness; (*c*) limiting the working day to eight hours for children between nine and twelve years of age; (*d*) forbidding employment of children under fifteen in dangerous or unhealthy trades. This law has not been strictly applied. On 17th April 1898 a species of Employers' Liability Act compelled employers of more than five workmen to insure their employees against accidents. The law applies to quarries, mines, building trades, shipyards, naval arsenals, railways and factories, and embraces between 1,700,000 and 2,000,000 workmen.[1] On 17th July 1898 a national fund for the insurance of workmen against illness and old age was founded by law on the principle of optional registration. In addition to an initial endowment by the State, part of the annual income of the fund is furnished in various forms by the State (principally by making over a proportion of the profits of the Post Office Savings Bank), and part by the premiums of the workmen. The minimum annual premium is six lire for an annuity of one lira per day at the age of sixty, and insurance against sickness. At present fewer than 20,000 workmen are inscribed. The low level of wages in many trades and the jealousies of the "Chambers of Labour" and other working-class organizations impede rapid development.

The French institution of *Prudhommes* was introduced into Italy in 1893, under the name of *Collegi di Probiviri*. Hitherto the institution has not attained great vogue, the number of colleges being only eighty-six. Milan has eleven, Rome six, Florence six, Turin five, and Bologna four; but many large cities have none. Most of the colleges deal with matters affecting textile and mechanical industries. Each "college" is founded by royal decree, and consists of a president, with not fewer than ten and not more than twenty members. A conciliation bureau and a jury are elected to deal with disputes concerning wages, hours of work, labour contracts, &c., and have power to settle the disputes, without appeal, whenever the amounts involved do not exceed £8.

Provident Institutions.—Provident institutions have considerably developed in Italy under the forms of savings banks, assurance companies, and mutual benefit societies. Besides the Post Office Savings Bank and the ordinary savings banks (the former regulated by the law of 27th March 1875, and the latter by the laws of 15th July 1888, and 17th July 1898), many co-operative credit societies and ordinary credit banks receive deposits of savings. Altogether these institutions now number 6226, namely, 404 ordinary savings banks, 680 co-operative credit societies, 113 ordinary credit banks,[2] and 5029 branches of the Post Office Savings Bank. The total number of savings bank books issued was 5,693,856, representing an aggregate deposit of 2,358,674,649 lire. These totals were split up as follows:—

	Savings Bank Books.	Sums Deposited.
Ordinary Savings Banks .	1,630,678	1,430,816,003
Co-operative Credit Societies .	297,990	233,841,979
Ordinary Credit Banks . .	100,570	66,016,667
Post Office Savings Bank .	3,664,618	628,000,000

The greatest increase has taken place in the deposits of the Post Office Savings Bank. In 1899 the number of books issued was nearly eight times and that of the deposits nearly ten times as much as in the year 1881. The books issued by the ordinary savings banks increased during the same period by nearly two-thirds, while the deposits doubled themselves.

Year.	Ordinary Savings Banks.			Co-operative and Ordinary Credit Societies used as Savings Banks.			Post Office Savings Bank.		
	No. of Banks.	No. of Books issued to Depositors.	Aggregate Deposits.	No. of Banks.	No. of Books issued to Depositors.	Aggregate Deposits.	No. of Branch Offices.	No. of Books issued to Depositors.	Aggregate Deposits.
1881 . .	355	997,026	714,805,451	249	205,488	197,586,249	3406	471,094	66,996,865
1890 . .	392	1,397,301	1,166,385,847	749	424,304	315,501,265	4479	2,126,289	310,483,635
1895 . .	402	1,588,424	1,343,720,018	793	374,294	266,053,032	4777	2,938,402	462,413,311
1899 . .	404	1,630,678	1,430,816,003	...	...	...	5029	3,664,618	628,000,000

The greatest number of savings banks exists in Lombardy; Piedmont and Venetia come next. Campania holds the first place in the south, most of the savings of that region being deposited in the provident institutions of Naples. In Liguria and Sardinia the habit of thrift is less developed.

Assurance societies in Italy are subject to the general dispositions of the commercial code regarding commercial companies. At the end of 1898 there were 158 assurance companies, of which 102 were Italian and 56 foreign. Thirty-eight carried on the business of life assurance, 58 that of fire insurance, 37 that of insurance of goods and persons during transport, 19 insurance against hail, 12 insurance against accidents, and 16 other forms of insurance.

Mutual benefit societies have increased rapidly, both because

[1] It has been proposed to extend this law to seamen, fishermen, navvies, workmen employed in fixing or repairing lightning conductors, drivers of traction engines and steam ploughs or reapers, &c.

[2] The data with regard to the co-operative credit societies refer to the year 1898, and those relating to the ordinary credit banks to the year 1895.

their advantages have been readily appreciated, and because, until recently, the State had taken no steps directly to insure workmen against illness. The present Italian mutual benefit societies strongly resemble the ancient beneficent corporations and institutions, of which in some respects they may be considered a continuation. The societies require Government recognition if they wish to enjoy legal rights. The State (law of 15th April 1896) imposed this condition in order to determine exactly the aims of the societies, and, while allowing them to give help to their sick, old, or feeble members, or aid the families of deceased members, to forbid them to pay old-age pensions, lest they assumed burdens beyond their financial strength. Nevertheless, the majority of societies have not sought recognition. The total number of societies, recognized and unrecognized, which was 2091 in 1878, had risen to 6725 in 1895, but the number of members is not known in all cases. In 1895 returns were made by 6587 societies, which possessed an aggregate membership of 994,183. For recognized societies more recent figures are obtainable. On 31st December 1897 they numbered 1166, with an aggregate membership of 187,657 and an aggregate capital of more than 18,000,000 lire.

Co-operation.—Co-operation, for the various purposes of credit, distribution, production, and labour, has attained great development in Italy. Some of the societies have complied with the dispositions of the commercial code, and possess a corporate juridical personality; others simply exist without juridical status. Credit co-operation is represented by a special type of association known as People's Banks (*Banche Popolari*), which have gradually spread throughout Italy. In 1881 they numbered 171, and in 1898 had increased to 696; with an increase of capital from 53,386,000 lire in 1881 to 103,736,000 lire in 1898, and of membership from 105,177 to 381,445.[1] People's banks, however, are not, as a rule, supported by workmen or peasants, but rather by small tradespeople, manufacturers, and farmers, who in 1898 made up 50 per cent. of their members, while workmen represented only 9 per cent., and peasants 4 per cent. A recent form of co-operative credit banks are the *Casse Rurali*, or rural banks, on the Raffeisen system, which lend money to peasants and small proprietors out of capital obtained on credit or by gift. These loans are made on personal security, but the members of the bank do not contribute any quota of the capital, though their liability is unlimited in case of loss. The first rural bank was founded in 1882. At present they number 904, and both their membership and the amount of business done have largely increased. They are especially widespread in Lombardy and Venetia, in part of which regions the Clerical party has, for purposes of political propaganda, worked to extend their sphere of action and to multiply their number.

Among co-operative societies those engaged in distribution are most numerous, having increased from 18 with a paid-up capital of 420,000 lire (£16,800) in 1883 to 508 with a paid-up capital of more than 4,500,000 lire (£180,000) in 1898. These, however, are all recognized by the State, and consequently possess juridical status. The unrecognized societies numbered about 700 in 1895. Distributive co-operation is confined almost entirely to Piedmont, Liguria, Lombardy, Venetia, Emilia, and Tuscany, and is practically unknown in Basilicata, the Abruzzi, and Sardinia. Most of the societies exist in thickly-populated centres, where the cost of commodities tends to increase. As in the case of the people's banks, many of them are supported rather by civil servants and officers than by working men proper, and even those supported by workmen differ from the English type of society in that they, as a rule, sell at cost price instead of selling at current prices so as to be able to distribute dividends at the end of the year.

In spite of the difficulties everywhere experienced in productive co-operation, Italian societies of production have attained considerable importance. Day labourers and bricklayers have succeeded in organizing themselves into societies requiring little capital and undertaking various public works. They contract directly for the work to be done, and distribute it between gangs of their members, who are paid at a fixed rate. They supply the necessary tools to the workmen who have none, and at the end of the contract divide the profits between members in proportion to the work done by each. The most important of these societies is that of the *braccianti* or labourers of Ravenna; though at the end of 1894, the latest date for which statistics have been collected, there existed 522 productive co-operative societies of this kind, which during the year had executed 126 contracts for an aggregate of 1,469,485 lire (£58,800). Co-operative house-building is also on the increase, and is supported not only by workmen, but also by persons of other classes in search of remunerative investments.

Education.—The number of persons unable to read and write has gradually decreased, both absolutely and in proportion to the number of inhabitants. The census of 1871 gave 73 per cent. of illiterate, that of 1881 67 per cent., while the proportion of illiterates to the population above six years of age diminished from 69 to 62 per cent. It may be calculated that at present less than one-third of the adult males and about one-half of the adult females are unable to read or write. The ratio of illiterates varies according to provinces, the north, especially the provinces of Turin, Sondrio, and Como, giving the lowest, and the south, especially Sicily (province of Girgenti) and Calabria, the highest percentages. As might be expected, progress has been most rapid wherever education, at the moment of national unification, was most widely diffused. For instance, the number of bridegrooms unable to write their names in 1872 was in the province of Turin 26 per cent., and in the Calabrian province of Cosenza 90 per cent.; in 1899 the percentage in the province of Turin had fallen to 5 per cent., while in that of Cosenza it was still 76 per cent. The decrease of illiteracy is a direct consequence of the increase of primary popular education. Infant asylums (where the first rudiments of instruction are imparted to children between two and a half and six years of age) and elementary schools have increased in number. There has been a corresponding increase in the number of scholars. Thus:—

Year.	Infant Asylums (Public and Private).		Daily Elementary Schools (Public and Private).	
	Number of Asylums.	Number of Scholars.	Number of Schoolrooms.	Number of Scholars.
1885–86	2083	240,365	53,628	2,252,898
1890–91	2296	278,204	57,077	2,418,692
1897–98	2989	324,751	57,384	2,531,744
1898–99	3205	346,837	60,483	2,636,957

The rate of increase in the public State-supported schools (1,873,723 scholars in 1882–83 and 2,444,288 in 1898–99) has been much greater than in the private schools (163,102 in 1882–83 and 192,669 in 1898–99). School buildings have been improved and the qualifications of teachers raised. Nevertheless, many schools are still defective, both from a hygienic and a teaching point of view; while the economic position of the elementary teachers, who in Italy depend upon the communal administrations and not upon the State, is still in many parts of the country extremely low. The law of 1877 rendering education compulsory for children between six and nine years of age has been the principal cause of the spread of elementary education. The law has been gradually applied in the various communes, but is still imperfectly enforced. At the end of 1898–99 only 66 per cent. out of the whole number of children between six and nine years of age were registered in the lower standards of the elementary and private schools. The evening schools, established for the benefit of those who have only been able to attend the lowest standards of the elementary schools, have to some extent helped to spread education. Their number and that of their scholars have, however, decreased since the withdrawal of State subsidies. In 1895–96 they numbered 4245, with 138,181 scholars. Regimental schools impart elementary education to illiterate soldiers. Whereas the levy of 1894 showed 40 per cent. of the recruits to be completely illiterate, only 27 per cent. were illiterate when the levy was discharged in 1897. Private institutions and working-class associations have for some years striven to improve the intellectual conditions of the working classes. Popular universities have lately attained considerable development in the principal Italian cities. The number of institutes devoted to secondary education remained almost unchanged between 1880–81 and 1895–96. In some places the number has even been diminished by the suppression of private educational institutes.

[1] These figures refer only to the 124 banks which made returns in 1881 and to the 594 which made returns in 1898.

On the other hand, the number of scholars has considerably increased, and shows a ratio superior to the general increase of the population. The greatest increase has taken place in technical education, where it has been much more rapid than in classical education. This is a result of the industrial and commercial development of the country. There are three higher commercial schools, with academic rank, at Venice, Genoa, and Bari, and eleven secondary commercial schools; and the technical and commercial schools for women at Florence and Milan should also be mentioned. The number of agricultural schools has also grown, although the total is relatively small when compared with population. The number of university students has almost doubled, having grown from 11,368 in 1881–82 to 22,257 in 1897–98, exclusive of the students attending university lectures in the lyceums and in the schools of superior studies. The faculties attended by the largest number of students are those of medicine and surgery (6374), law (6315), while those of physical and natural sciences counted 2269, and of letters and philosophy 1351. The schools of practical engineering were in 1898–99 attended by 1218 students. On the whole, the increase has been more rapid in the philosophical and scientific faculties than in those of jurisprudence and medicine. The most frequented State universities are those of Naples, Turin, Rome, Padua, Pavia, and Bologna; and of the free universities, Perugia and Camerino come first.

The number of students in the schools of fine art and in the State musical conservatories has remained almost stationary:—

Year.	Fine Art Students.	Music Students.
1888–89 . . .	1971	794
1897–98 . . .	2198	875

Libraries are numerous in Italy, those even of small cities being often rich in manuscripts and valuable works. Statistics, collected in 1893–94 and 1896, revealed the existence of 1831 libraries, either private (but open to the public) or completely public. Forty-two belonged to the State, 418 to the communal or provincial authorities, 378 were attached to institutes for primary or secondary education, 45 were military, 46 were attached to archives or State departments, 172 to academies, scientific institutes, or chambers of commerce, 478 belonged to mutual benefit societies and circulating libraries, 175 were archiepiscopal, parochial, or seminarist, 35 belonged to other institutes, and 40 to private individuals. There are no statistics of the works read or of the readers, except as regards the State libraries. In 1872 these libraries were visited by 853,900 persons, to whom 1,218,887 books or manuscripts were distributed; in 1898 the number of visitors had grown to 1,294,869, and that of the works and manuscripts read to 1,690,825. The increasing number of books and periodicals printed every year in Italy is a further sign of the improvement in general culture. In 1871 newspapers and reviews numbered 765; in 1895 they numbered 1901, a total equal to 1 per 16,361, as against 1 per 35,034 inhabitants in 1871. Of these periodicals 128 were daily newspapers, 613 weekly, and 458 monthly publications; 566 were political in character, including 87 politico-religious publications. Administrative, juridical, economic, and sociological periodicals numbered 327, while those devoted to agriculture, commerce, industry, or finance were 202. The new works published in 1898 were 9670. Deducting the 926 statutes and parliamentary estimates, 715 religious works, and 604 parliamentary reports, the total is reduced to 7425. Of these 1047 were devoted to agriculture, industry or trade, 942 to medicine, 632 to history and geography, while 596 were school-books. Three hundred and thirty-two works were published in foreign languages, among them being 224 in Latin and 58 in French.

Crime.—Crime, on the whole, has increased in Italy, 526,300 crimes having been reported in 1887, and 839,506 in 1898. This increase consists chiefly of simple contraventions of bye-laws and regulations (equivalent to the English summons), which in Italy, as elsewhere, tend to grow in number as laws and regulations are multiplied and are more strictly enforced. This fails, however, to account for the whole increase, for if contraventions or summonses increased from 168,870 in 1887 to 312,423 in 1898, crimes increased during the same period from 357,430 to 527,383. Analysing these more serious breaches of the law, it is found that murders and homicides decreased by one-third in less than twenty years (5418 in 1880, and 3749 in 1898). As culture spreads, violent crime tends to diminish, but Italy still remains one of the states in which it is most frequent; after Italy come Austria, France, and, at considerable distance, Ireland, Germany, England, and Scotland. Infliction of bodily hurt remains nearly stationary (about 88,000 cases per annum, nearly half of which refer to slight wounds and blows). Libels and insults steadily increase (48,704 in 1887, and 85,332 in 1898). Violent resistance to public authority is shown to be on the increase by the occurrence of 17,301 cases in 1898, as compared with 12,354 in 1887. Crimes against property, such as serious robbery, extortion, and blackmail, fluctuate from year to year; in 1880 they numbered 3947, in 1889 1924, and in 1898 3864. Thefts or petty larcenies vary according to the condition of the country from year to year. In 1887 there were only 89,774, but in 1898, chiefly on account of the distress prevailing in that year, they rose to 137,957. Thus during twenty years murders have decreased, petty offences against persons, frauds, and resistance to authority have increased, and thefts have varied according to distress. Generally speaking, crime, and particularly violent crime, is more common in Lazio, Sardinia, Sicily, and the south than the north.

As in most civilized countries, the number of *suicides* in Italy has increased from year to year:—

Year.	Suicides.
1881	1343
1891	1697
1895	1874
1899	2019

The Italian suicide rate of 6·36 per 1,000,000 is, however, lower than those of Denmark, Switzerland, Germany, and France, while it approximates to that of England. The Italian rate varies in different provinces, it being highest in the more enlightened and industrial north, and lowest in the south. Emilia gives a maximum rate of 10·48 per 100,000, while that of Liguria and Lazio is but little lower. The minimum of 1·27 is found in the Basilicata, though Calabria gives only 2·13. The greatest number of suicides (22 per cent.) are committed with firearms, 20 per cent. by drowning, 17 per cent. by hanging, and 9 per cent. by precipitation from some elevated spot. These percentages vary, however, according to sex.

Charities.—The patrimony of Italian charitable institutions is considerable and is constantly increasing. In 1880 the number of charitable institutions (exclusive of public pawnshops, or *Monti di Pietà*, and other institutions which combine operations of credit with charity) was approximately 22,000, with an aggregate patrimony of nearly two milliards of lire, equal to £80,000,000. The revenue was about 90,000,000 lire, or, after deduction of taxes, interest on debts, expenses of management, &c., 52,000,000 lire, or £2,080,000. Adding to this 31,000,000 lire of communal and provincial subsidies, the product of the labour of inmates, temporary subscriptions, &c., the net revenue available for charity was, during 1880, 96,500,000 lire, or £3,860,000. Of this sum 6,500,000 lire was spent for religious purposes. Between 1881 and 1898 the bequests to existing institutions and sums left for the endowment of new institutions amounted to 294,796,966 lire, or about £11,792,000.

The following table shows the gradual increase of bequests for charitable purposes between 1881 and 1898:—

Year.	Number of Bequests.	Total Value of Legacies in Personal and Real Estate.
		(In lire.)
1881 . .	831	11,254,914
1891 . .	1121	11,406,023
1895 . .	1357	13,787,515
1898 . .	1569	17,245,903

Charitable institutions take, as a rule, the two forms of outdoor and indoor relief and attendance. The latter, or indoor institutions, are the more important in regard to endowment, and consist of hospitals for the infirm (692,000,000 lire of patrimony at the end of 1898); of hospitals for chronic and incurable diseases (29,000,000 lire); of orphan asylums (346,000,000 lire); of

poorhouses and shelters for beggars (143,000,000 lire); of infant asylums or institutes for the first education of children under six years of age (64,000,000 lire); of lunatic asylums (19,000,000 lire); of homes for the deaf and dumb (11,000,000 lire); and of institutes for the blind (14,500,000 lire). The outdoor charitable institutions include those which distribute help in money or food (patrimony, 220,000,000 lire); those which supply medicine and medical help (73,000,000 lire); those which aid mothers unable to rear their own children (1,500,000 lire); those which subsidize orphans and foundlings (1,500,000 lire); those which subsidize educational institutes (45,000,000 lire); and those which supply marriage portions (65,000,000 lire). Between 1881 and 1898 the chief increases took place in the endowments of hospitals (90,000,000 lire); orphan asylums (32,000,000 lire); infant asylums (31,000,000 lire); poorhouses (28,500,000 lire); almshouses (19,000,000 lire); voluntary workhouses (11,000,000 lire); and institutes for the blind (10,500,000 lire).

Italian charity legislation was reformed by the law of 17th July 1890, which attempted to provide efficacious protection for endowments, and to ensure the application of the income to the purposes for which it was intended. The law considers as "charitable institutions" all poorhouses, almshouses, and institutes which partly or wholly give help to able-bodied or infirm paupers, or seek to improve their moral and economic condition; and also the *Congregazioni di carità* (municipal charity boards existing in every commune, and composed of members elected by the municipal council), which administer funds destined for the poor in general. All charitable institutions are under the protection of provincial administrative junta, existing in every province, and empowered to control the management of charitable endowments. The supreme control is vested in the Minister of the Interior. The law also concentrates under the management of the communal charity boards (*Congregazioni di carità*) all the institutions having less than £200 a year income; those intended to assist the poor in one or more communes which together have less than 10,000 inhabitants; and especially those which, in course of time, have either become superfluous or have ceased to promote the objects for which they were instituted. The law of 1890 also empowers every citizen to appeal to the tribunals on behalf of the poor, for whose benefit a given charitable institution may have been intended.

Public pawnshops, or *Monti di Pietà*, numbered 555 in 1896, with a net patrimony of 71,986,698 lire. In that year their income, including revenue from capital, was 10,409,537 lire, and their expenditure 7,505,754. The amount lent on security was 103,830,735 lire.

The *Monti frumentarii*, or co-operative corn deposits, which lend seed corn to farmers, and are repaid after harvest with interest in kind, numbered 1615 in 1894, and possessed a patrimony of 12,000,000 lire.

In addition to the regular charitable institutions, the communal and provincial authorities exercise charity, the former to the extent of 44,000,000, and the latter to the extent of 21,500,000 lire per annum. Part of these sums is given to hospitals, and part spent directly by the communal and provincial authorities. Of the 44,000,000 spent by the communes, about 21,000,000 goes for the sanitary service (doctors, midwives, vaccination), 5,500,000 for the maintenance of foundlings, 4,000,000 for the support of the sick in hospitals, and 2,000,000 for sheltering the aged and needy. Of the 21,500,000 spent by the provincial authorities, 13,000,000 goes to lunatic asylums and 6,000,000 to the maintenance of foundling hospitals.

Religions.—The great majority of Italians are Roman Catholics. Protestants number some 62,000, of whom half are Italian and half foreign. The number of Jews was returned as 38,000, but is certainly higher. There are, besides, in Italy several thousand members of the Greek Orthodox Church. There were, on 31st December 1896, 20,183 parishes in Italy, with the same number of parish priests and about 8000 assistant parish priests. The average size of an Italian parish is 14 square kilometres, with an average population of 1550 souls. The size of parishes varies, however, from province to province, Sicily having larger parishes in virtue of the old Sicilian church laws, and Naples, and some parts of central Italy, having the smallest. The Italian parishes have a total gross revenue, including assignments from the public worship endowment fund, of 32,000,000 lire, or an average of 1572 lire (nearly £63) per parish. Fifty-one per cent. of this gross sum consists of revenue from glebe lands. The average income per parish varies in different localities. The maximum of 3077 lire is found in Sicily, and the minimum of 843 lire in Umbria.

The kingdom is divided into 276 sees and ten abbeys, or prelatures *nullius dioceseos*. Besides, the diocese of San Giovanni di Moriana is administered by a bishop domiciled in France. Except the diocese of Rome, which is administered by the cardinal-vicar, there are in Italy six suburbicarian sees governed by cardinals of the Order of Bishops; 76 immediately subject to the Holy See, 12 of which are archiepiscopal and the rest episcopal; and 193 sees composing the so-called "ecclesiastical provinces," of which 45 are archiepiscopal and 148 episcopal. Excluding the diocese of Rome and suburbicarian sees, each see has an average area of 1111 square kilometres and a population of 121,285 souls. The largest sees exist in Venetia and Lombardy, and the smallest in the provinces of Naples, Leghorn, Forlì, Ancona, Pesaro, Urbino, Caserta, Avellino, and Ascoli. The Italian sees (exclusive of Rome and of the suburbicarian sees) have a total annual revenue of 5,150,000 lire, equal to an average of 20,000 lire per see. The richest is that of Girgenti, with 157,596 lire, and the poorest that of Porto Maurizio, with only 6160 lire.

The laws which govern ecclesiastical affairs in their relation to the State are still that of 7th July 1866, which suppressed religious corporations, converted their property into consolidated stock, instituted the public worship endowment fund (*fondo per il culto*), and regulated the division of the patrimony of the suppressed corporations; and that of 19th June 1873, which extended the law of 1866 to the province and city of Rome, creating a special charitable and religious fund for the city. The objects for which the public worship endowment fund was created, namely, to support worship out of the proceeds of the sale of ecclesiastical properties, have to a great extent been attained. The fund has relieved the State exchequer of the cost of public worship; has gradually furnished to the poorer parish priests an addition to their stipends, raising them to 800 lire per annum, with the prospect of further raising them to 1000 lire; and has contributed to the outlay incurred by the communes for religious purposes. The monastic buildings required for public purposes have been made over to the communal and provincial authorities, while the same authorities have been entrusted with the administration of the ecclesiastical revenues previously set apart for charity and education, and objects of art and historical interest have been consigned to public libraries and museums.

On 30th June 1899, the patrimony of the endowment fund amounted to 440,462,790 lire, of which only 11,817,937 lire were represented by buildings. The rest was made up of capital and interest. The liabilities of the fund (capitalized) amounted to a total of 237,106,310 lire, of which monastic pensions represented 87,167,415 lire; supplementary stipends to priests, 66,025,389 lire; assignments to the Sardinian clergy, and disbursements for worship, previously incumbent upon the State, 24,895,009 lire; other ecclesiastical assignments, 22,984,835 lire. The credit balance was thus 203,356,480 lire. The chief items of annual expenditure drawn from the fund are the supplementary stipends to priests and the pensions to members of suppressed religious houses. In 1898–99 the amounts paid respectively under these headings were 3,446,783 and 4,459,500 lire. The number of persons in receipt of monastic pensions on 30th June 1899 was still 13,255. While this item of expenditure is gradually decreasing by reason of the deaths of those entitled to pensions, the supplementary stipends are gradually increasing. The following table shows the course of the two main categories of the fund from 1876 to 1898–99:—

Year.	Monastic Pensions, Liquidation of Religious Property, and Provision of Shelter for Nuns.	Supplementary Stipends to Bishops and Parochial Clergy, Assignments to Sardinian Clergy, and Expenditure for Education and Charitable Purposes.
	Lire.	Lire.
1876	18,729,311	3,572,794
1881	18,279,440	4,253,045
1885–86 . . .	12,283,487	3,213,007
1890–91 . . .	9,819,106	3,718,642
1898–99 . . .	5,661,969	5,250,512

Roman Charitable and Religious Fund.—The law of 19th June 1873 contained special provisions, in conformity with the character of Rome as the seat of the papacy, and with the situation created by the Law of Guarantees. New parishes were created, old parishes were improved, the property of the suppressed religious corporations was assigned to charitable and educational institutions and to hospitals, while property having no special application was used to form a charitable and religious fund. On 30th June 1899 the balance-sheet of this fund showed a credit amounting to 45,030,151 and a debit of 13,589,414

lire. Expenditure for the year 1898–99 was 2,192,200 lire, and revenue 2,217,133 lire.

Political Constitution.—The constitution of the kingdom of Italy has undergone no substantial change since its promulgation by King Charles Albert on 4th March 1848. Nevertheless, the constitution has been so interpreted that government has become increasingly parliamentary. Some changes have taken place in the number and functions of the departments of State, the number of ministries having been increased from nine to eleven. Under the law of 12th February 1888, the number and the attributes of ministers are fixed by royal decree, each minister being aided by an under-secretary of State, whose duties are settled by regulations drawn up by the minister. The two new ministries are those of the Treasury and of Posts and Telegraphs. The latter was detached from the Ministry of Public Works by a decree dated 10th March 1889; the former was separated from the Ministry of Finance on 24th March 1889. The office of President of the Council of Ministers was, furthermore, created. It may be held by itself or in conjunction with any other portfolio. The Presidency of the Council, however, does not form a State department by itself.

Notwithstanding various proposals for reform, the composition of the Senate remains as it was fixed by the constitution of 1848, senators being chosen by the king from among the categories of persons therein enumerated. The following table shows the composition of the Senate and the categories of persons from which senators are by preference chosen:—

	Senators Created between 3rd April 1848 and 2nd March 1897.	Living and in Discharge of Senatorial Functions on 2nd March 1897.
Ministers, Deputies and Presidents of Provincial Councils (Categories II., V., and XVI.)	387	178
Higher Civil and Military Officials (Categories VI., XV., XVII.)	310	90
Large Taxpayers (Category XXI.)	286	84
Eminent Scientists, Men of Letters, Artists, or men having rendered signal service to the country (Categories XVIII., XIX., and XX.)	135	28
High Ecclesiastical Dignitaries (Category I.)	7	...
Totals	1125	380

Comparing the number of senators with the calculated population of the country on 31st December 1896, it is seen that the 66 provinces of the realm represented in the Senate were represented in very unequal proportions. While seven provinces (Genoa, Palermo, Porto Maurizio, Turin, Leghorn, Naples, and Milan) had each one senator for a unit of population varying from 36,385 to 44,658 inhabitants, four provinces (Treviso, Aquila, Sassari, and Parma) had only one senator for a minimum unit of 250,000 and a maximum of 413,635 inhabitants.

The Chamber of Deputies has been profoundly modified by the franchise extension of 1882, although the status and rights of its members are still those defined by the constitution of 1848. The franchise extension considerably enlarged the electorate, and, except for slight modifications, has not since been changed. On the other hand, the electoral system, which, according to the law of 1882, was to be that known as *scrutinio di lista*, has been repeatedly altered. On 5th May 1891 the *scrutinio di lista* was abandoned in favour of the old system of uninominal constituencies, which still remains in force, although attempts have again been made to return to the *scrutinio di lista*. Under the electoral law now in force (law of 28th March 1895) the electors must possess Italian civil and political rights either by birth or naturalization, must have completed twenty-one years of age, and must know how to read and write. In addition, electors must have gone through the first standard of primary education, and must pay in direct taxation not less than 19·80 lire a year, or a certain house rent, which varies according to the population of the different communes. The reform of 1882 more than tripled the number of electors, who in 1900 numbered more than 2,000,000. In proportion to population there are 7·08 electors per 100 inhabitants throughout the kingdom, but this ratio varies greatly from one district to another, Piedmont having, for instance, 11 per cent. of electors, and Sicily less than 4 per cent. The number of constituencies, which by the law of 1860 was fixed at 443, was raised subsequently to 508. Under the *scrutinio di lista*, in which each elector voted for a number of deputies, the list-constituencies numbered 135, but upon the abolition of the *scrutinio di lista* the number of constituencies again became 508. At present the average number of inhabitants per constituency is slightly more than 61,000, but only 44 of the 508 constituencies have a population approximating to the average, while half of the remainder are below the average and half above, the maximum being 75,000 inhabitants:—

Year.	Number of Constituencies.	Number of Deputies.	Number of Registered Electors.[1] Total.	Per 100 Inhabitants.
1879	508	508	621,896	2·22
1882	135	508	2,017,829	7·07
1890	135	508	2,752,658	9·16
1892	508	508	2,934,445	9·64
1898	508	508	2,247,031	7·12

[1] Exclusive of electors temporarily deprived of their rights owing to their positions as non-commissioned officers or men of the army and navy, or as members of corps organized on a military basis by the State, the provinces, or the communes.

The number of voters has considerably increased, but the proportion of electors who go to the poll has remained about 60 per cent., notwithstanding the reform of 1882:—

Date of General Election.	Number of Voters at First Ballot.	Number of Voters per 100 Registered Electors.
16th May 1880 (before extension of franchise)	369,627	59·44
29th October 1882 (immediately after extension)	1,223,851	60·65
3rd June 1900 (general election)	1,310,480	58·28

The proportion of qualified electors to population is higher in the north than in the south, on account of the greater diffusion of education. The number of voters to registered electors is, however, higher in the south, because the electorate is more organized and more directly under the influence of the upper classes and the party chiefs.

Administration of Justice.—No change has taken place in the organization of civil courts (offices of conciliation, praetors' offices, ordinary tribunals, courts of appeal, Court of Cassation), nor in that of penal courts (praetors' offices, offices of examining magistrates, ordinary tribunals, indictment divisions, courts of appeal, Court of Cassation); some changes have, however, been introduced in the competence and number of these authorities. By the law of 16th June 1892, offices of conciliation were made competent to deal with disputes involving sums up to 100 lire, instead of 50 lire as previously. No money limit

was set to their competence as conciliators in cases where their good offices are requested. Praetors were made competent to deal with cases involving sums above 100 lire, but below the limit (1500 lire) of the competence of the civil tribunals. The changes in the competence of conciliators affected the praetors, since conciliators' sentences, which had been final as long as their competence was limited to 50 lire, became susceptible of appeal before the praetors when relating to sums between 50 and 100 lire. More important were the changes introduced by the promulgation, on 1st January 1890, of a single penal code for the whole kingdom in place of the two codes previously existing. The new code reformed the whole penal system, both as regards the underlying juridical principles and the degrees of punishment. Penalties on the whole were rendered less severe, but were more strictly applied, especially as regards solitary confinement, while money fines were considerably extended as single and optional punishments. The competence of the praetors was reduced, and, in place of dealing with all offences liable to punishment by prison or exile for not more than three months, or by fines up to 300 lire, their action was limited to minor offences and to venal contraventions of the law. A part of their competence passed to the tribunals which now deal with all cases punishable by imprisonment up to ten years and with serious breaches of the law. The tribunals thus encroached upon the competence of the Assize Courts, which, with an assize jury, deal with all crimes liable to penalties of more than ten years' imprisonment, and with all political crimes. These changes in the competence of the tribunals of first instance affected also the courts of appeal, since the competence of the ordinary tribunals, sitting in appeal as judges on penal sentences passed by the praetors, has been enlarged, and these tribunals now deal with a larger proportion of cases. The competence of the courts of appeal proper, which deal principally with sentences of the ordinary tribunals, has on the one hand been restricted by the enlargement of the competence of praetors in regard to cases formerly dealt with by the ordinary tribunals, and on the other has been extended by the enlargement of the competence of the ordinary tribunals to deal with cases formerly reserved for assize courts. The sentences of assize courts continue to be final in points of merit, and can only be impugned on points of form on appeals to the Rome Court of Cassation.

Some changes have taken place in the number of judicial institutions. The tribunals of commerce were abolished in 1888; the *preture* or praetors' offices, which up to 31st December 1891 numbered 1819, were reduced to 1549; and the competence of the courts of cassation has been modified. Prior to 1888 there were five courts of cassation (Turin, Florence, Naples, Palermo, and Rome), which, while instituted for the purpose of ensuring exact observance of the law, dealt in penal cases with the sentences of praetors not otherwise subject to appeal; with sentences of the ordinary tribunals sitting as courts of appeal upon praetors' judgments; with sentences of the courts of appeal proper and of assize courts; and, in civil cases, with sentences pronounced by the courts of appeal. Since 1888, jurisdiction in penal cases has been reserved to the Rome Court of Cassation, which, besides sharing with the other four courts of cassation jurisdiction in civil affairs, possesses special competence to deal with disputes between the judicial and administrative authorities, and between lesser judicial authorities.

The number of commercial and civil suits annually begun increased from 1,201,560 in 1881 to 1,469,300 in 1898. The increase applies not to the higher grades of jurisdiction (appeals of all categories tend to diminish), but to the cases brought before the offices of conciliation and the praetors, which increased from 571,596 in 1875 to 1,340,324 in 1898.

The statistics of civil proceedings vary considerably from province to province. Lombardy, with 25 lawsuits per 1000 inhabitants, holds the lowest place; Emilia comes next with 31 per 1000; Tuscany has 39; Venetia, 42; Calabria, 144; Rome, 146; Apulia, 153; and Sardinia, 360 per 1000. The high average in Sardinia is chiefly due to cases within the competence of the conciliation offices, the difference between Sardinia and the mainland being much less noticeable in regard to cases within the jurisdiction of other courts. The number of penal proceedings, especially those within the competence of praetors, has also increased, chiefly on account of the frequency of minor contraventions of the law referred to in the section *Crime*. As in the case of civil suits, the ratio of criminal proceedings to population varies from province to province, but is, as a rule, much higher in the south than in the north.

The introduction of the new penal code in 1890 modified to some extent the prison system previously existing. A royal decree, dated 1st February 1891, established three classes of prisons:—judiciary prisons, for persons awaiting examination or persons sentenced to arrest, detention, or seclusion for less than six months; penitentiaries of various kinds (*ergastoli*, *case di reclusione*, *detenzione*, or *custodia*), for criminals condemned to long terms of imprisonment; and reformatories, for criminals under age and vagabonds. Certain types of dangerous individuals are relegated to special penal colonies known as *domicilii coatti*, or "forced residences." These establishments are, however, unsatisfactory, and a Bill for their abolition has already been promoted. On 31st December 1898 the number of prisons and cells was as follows:—

	Number of Prisons.	Number of Places.	Cells. For Continual Solitary Confinement.	Cells. For Nocturnal Solitary Confinement.
Judiciary Prisons	1456	65,401	5879	251
Penitentiaries	82	30,759	3589	2432
Reformatories, State	9	1,940	24	1262
Reformatories, Private	34	5,825	...	...
Totals	1581	103,925	9492	3945

Notwithstanding the construction of new prisons and the transformation of old ones, the number of cells for solitary confinement is still insufficient for a complete application of the penal system established by the code of 1890. The total number of prisoners, including minors and inhabitants of enforced residences, which from 76,066 (2·84 per 1000 inhabitants) on 31st December 1871 rose to a maximum of 80,792 on 31st December 1879 (2·87 per 1000), decreased gradually, notwithstanding some slight fluctuations, to a minimum of 60,621 in 1896 (1·94 per 1000), and on 31st December 1898 rose again to 75,470 (2·38 per 1000), of whom 75,470, less than one-tenth, or 7038, were women.

Army.—The organization of the Italian army has undergone no substantial change since the promulgation of the Army Bill of 7th June 1875, in virtue of which the military forces of the kingdom are divided into three categories:—(*a*) Standing army, (*b*) mobile militia, and (*c*) territorial militia. Nevertheless the number of men enrolled in these three categories has continually increased. Thus:—

Date.	Total. Officers.[1]	Total. Men.	Standing Army.	Mobile Militia.	Territorial Militia.
30th Sept. 1871	14,070	521,969	536,039	...	...
,, 1876	17,440	1,028,203	626,934	270,973	143,943
,, 1881	22,482	1,833,554	731,149	294,714	823,970
30th June 1886	31,193	2,464,680	898,505	283,437	1,302,709
,, 1891	36,739	2,821,367	843,160	445,315	1,553,784
,, 1898	35,765	3,221,726	828,543	465,361	1,946,418

[1] Including complementary officers on auxiliary service or in the reserve.

On 30th September 1871 the various categories of the army included only 2 per cent. of the population, but on 30th June 1898 they included 10 per cent. The increase is due to the effect of the Bill of 1875, which rendered all citizens liable to some form of military service until the completion of their 39th year. The above figures would undergo considerable reduction in case of mobilization, on account of deaths, illness, desertions, and foreign residence. Nor would the city guards, customs officers, prison guards, post office and railway employees be included in the mobilized army.

The standing army is divided into twelve army corps and twenty-five divisions. At present the army corps, with their respective divisions, are distributed as follows. The divisions are given in parentheses:—I., Turin (1st Turin, 2nd Novara); II., Alessandria (3rd Alessandria, 4th Cuneo); III., Milan (5th Milan, 6th Brescia); IV., Genoa (7th Piacenza, 8th Genoa); V., Verona (9th Verona, 10th Padua); VI., Bologna (11th Bologna, 12th Ravenna); VII., Ancona (13th Ancona, 14th Chieti); VIII., Florence (15th Florence, 16th Leghorn); IX., Rome (17th Rome, 18th Perugia, 25th Cagliari); X., Naples (19th Naples, 20th Salerno); XI., Bari (21st Bari, 22nd Catanzaro); XII., Palermo (23rd Palermo, 24th Messina).

Ordinary and extraordinary military expenditure for the financial year 1898–99 amounted to 246,647,646 lire, an increase of more than 97,000,000 lire as compared with 1871, when the expenditure was 149,584,632 lire. During the discussion of the military estimates for 1901–2, however, the Italian Chamber, in view of the tendency towards an increase of military expenditure, decided that for the following six years, *i.e.*, from 1st July 1901 until 30th June 1907, Italian military expenditure proper should not exceed the maximum of 239,000,000 lire fixed by the Army Bill of May 1897, and that the sum annually expended on military pensions should not exceed 36,000,000 lire. Thus, in the absence of unforeseen complications, Italian military expenditure may until 1907 be regarded as consolidated at 275,000,000 lire (£11,000,000) per annum, including £9,560,000 for the army proper and £1,440,000 for pensions.

Navy.—The conditions of service in the Italian navy were considerably modified by the Navy Bills of 28th August 1885, 12th July 1888, 30th June 1899, and 1st February 1900. Able-bodied men enrolled for naval service are divided into three categories:—(*a*) Men required for active service, whose number is fixed every year by law; (*b*) able-bodied supernumeraries not required for active service. These two categories are sorted by lot. (*c*) Able-bodied men exempt from active service for family reasons or other causes. Third category men belong to the naval reserve, into which men of the first and second categories pass after twelve years' liability to active service. For purposes of naval organization the Italian coast is divided into three maritime departments, with headquarters at Spezia, Naples, and Venice; and into two *comandi militari*, with headquarters at Taranto and at the island of Maddalena. The *personnel* of the navy consists of the following corps:—(1) General staff; (2) naval engineers, chiefly employed in building and repairing war vessels; (3) sanitary corps; (4) commissariat corps, for supplies and account-keeping; (5) crews. The following table shows the variations in the number of the *personnel* from 1872 to 1898, the increase noticeable from 1886 onwards being due to the circumstance that the Bill of 28th August 1885 abolished absolute exemption from naval service, and assigned certain duty to the third category men formerly exempt:—

Year.	Officers.	Men.	Total.
1872 . .	1173	10,766	11,939
1876 . .	1073	22,611	23,684
1881 . .	980	34,914	35,894
1886 . .	1066	40,884	41,950
1891 . .	2201	71,397	73,598
1896 . .	2322	94,851	97,173
1897 . .	2385	97,501	99,886
1898 . .	2359	100,513	102,872

The *matériel* of the Italian navy has been completely transformed, especially in virtue of the Bill of 31st March 1875. Old types of vessels have been sold or demolished, and replaced by newer types. The number and tonnage of the ships, with their crews, up to the end of 1899 are given in the following table:—

Year.	Total Number of Ships Built, in Course of Construction, or Fitting Out.			Ships in Service.							
				Ships in Service. Total.	Armoured.			Unarmoured.			
	Total.	Armoured.	Unarmoured.		No. of Ships.	Tonnage.	Crews.	No. of Ships.	Tonnage.	Crews.
31st December 1876 . .	73	18	55	65	14	59,330	5638	51	50,812	5,774
,, ,, 1881 . .	71	18	53	65	13	69,914	5330	52	58,842	6,101
,, ,, 1886 . .	215	21	194	140	14	82,955	5986	126	66,477	7,342
,, ,, 1891 . .	329	22	307	319	20	169,316	9077	299	134,663	13,811
,, ,, 1896 . .	325	24	301	313	18	161,172	9202	295	128,045	12,727
1st November 1899 . .	338	27	311	317	18	161,172	9012	299	142,288	13,983

The following classes of vessels were in active service on 1st November 1899:—

	Number of Vessels.			Hulls.				Displacement in Metric Tons.	Maximum I.H.P. of Engines.	No. of Principal Guns.
	Armoured.	Unarmoured.	Total.	Of Iron.	Of Steel.	Iron and Steel.	Of Wood.			
1st Class Battleships	10	...	10	...	8	2	...	129,710	128,036	502
2nd Class ,, ...	...	...	...	...	...	...	...	...	...	...
3rd Class ,, ...	6	...	6	5	1	...	...	25,950	23,853	205
4th, 5th, 6th, and 7th Class Battleships .	...	28	28	...	28	...	...	48,820	144,519	470
Destroyers	...	3	3	...	3	...	...	938	16,800	16
Torpedo boats	...	144	144	...	144	...	...	10,208·5	130,183	240
Auxiliary vessels	2	42	44	12	25	...	7	68,208	57,050	191
Local vessels for harbour use . . .	...	30	30	8	12	...	10	13,751	2,788	20
Tugs	...	25	25	16	4	...	5	1,649	2,557	11
Tenders	...	9	9	3	6	...	...	4,472	1,468	...
Lagoon gunboats	...	5	5	5	...	...	...	440	325	5
Steam torpedo launches	...	13	13	...	..	...	13	153·4	1,710	18
Total	18	299	317	49	231	2	35	304,299·9	509,289	1678

At the same date 21 new vessels were in course of construction or were being fitted out for active service; 9 of these were armoured and 12 unarmoured. Of the armoured vessels, 4 were first class and 5 second class battleships; of the unarmoured, 3 were battleships of the fifth and sixth classes, 8 destroyers, and 1 auxiliary vessel.

Naval expenditure has enormously increased since 1871, the total for 1871 having been 22,116,710 lire, and the total for 1898–99 105,438,874 lire, an increase of more than 83,000,000 lire. Violent fluctuations have, however, taken place from year to year, according to the state of Italian finances. In order to obviate this drawback, and to permit the steady execution of a normal programme of shipbuilding, the Italian Chamber, on 4th May 1901, adopted a resolution limiting naval expenditure, inclusive of naval pensions and of premiums on mercantile shipbuilding, to the sum of 121,000,000 lire (£4,840,000) for the following six years, *i.e.*, from 1st July 1901 until 30th June 1907. This sum consists of 106,000,000 lire (£4,240,000) of naval expenditure proper,

5,500,000 lire (£220,000) for naval pensions, and of 9,500,000 lire (£380,000) for premiums upon mercantile shipbuilding. During the financial year ending 30th June 1901 these figures were slightly exceeded, the total naval expenditure being 123,000,000 lire (£4,920,000), made up of 106,000,000 for the navy proper, 5,200,000 for naval pensions, and 11,800,000 for premiums to the mercantile marine.

Finances.—The volume of the Italian budget has considerably increased both as regards income and expenditure. The income of 1,518,535,464 lire in 1881 rose in 1899–1900 to 1,747,928,147 lire; while the expenditure increased from 1,467,648,226 lire in 1881 to 1,742,717,661 in 1899–1900, an increase of about 230,000,000 lire in income and 275,000,000 in expenditure. These figures include not only the categories of "income and expenditure" proper, but also those known as "movement of capital," "railway constructions," and "*partite di giro*," which, while they form part of the Italian budgetary system, do not constitute by themselves real income and expenditure.[1] Considering only income and expenditure proper, the totals from 1882 to 1889–1900 are:—

Financial Year.	Revenue (in Millions of Lire).	Expenditure (in Millions of Lire).	Surpluses or Deficits (in Millions of Lire).
1882	1301·62	1297·62	+4·00
1885–86	1409·10	1432·61	−23·51
1890–91	1540·00	1615·04	−75·04
1895–96	1633·60	1699·07	−65·47
1898–99	1658·82	1626·16	+32·66
1899-1900	1671·52	1633·09	+38·43
1900–1901	1720·73	1652·36	+68·37

The financial year 1862 closed with a deficit of more than 400,000,000 lire, which increased in 1866 to 721,000,000 lire on account of the preparations for the war against Austria. Excepting the increases of deficit in 1868 and 1870, the annual deficits tended thenceforward to decrease, until in 1875 equilibrium between expenditure and revenue was attained, and was maintained until 1881. Advantage was taken of the equilibrium to abolish certain imposts, amongst them the grist tax, which prior to its gradual repeal produced more than 80,000,000 lire a year. From 1885–86 onwards, outlay on public works, military and colonial expenditure, and especially the commercial and financial crises, contributed to produce annual deficits; but owing to drastic reforms introduced in 1894–95 and to careful management the year 1898–99 marked a return of surpluses (nearly 33,000,000 lire), and 1899–1900 gave a surplus of 38,000,000 lire.

The proportion of revenue derived from the various fiscal and other sources during 1899–1900 is shown by the following figures:—

[1] "Movement of capital" consists, as regards "income," of the proceeds of the sale of buildings, Church or Crown lands, old prisons, barracks, &c., or of moneys derived from sale of consolidated stock. Thus 'income" really signifies diminution of patrimony or increase of debt. In regard to "expenditure," "movement of capital" refers to extinction of debt by amortization or otherwise, to purchases of buildings, or to advances made by the State, as, for instance, the Italian instalment of the loan granted by the Powers to the provisional government of Crete. Thus "expenditure" really represents a patrimonial improvement, a creation of credit, or a decrease of indebtedness. The items referring to "railway construction" represent, on the one hand, repayments made to the exchequer by the communes and provinces of money disbursed on their account by the State Treasury; and, on the other, the cost of new railways incurred by the Treasury. The items of the "*partite di giro*" are inscribed both on the credit and debit sides of the budget, and have merely a figurative value, as, for instance, when the rent of a barracks belonging to the State is in the general estimates debited to the War Office and credited to the Treasury, while in the War Office estimate the rent of the same barracks would be debited to the Treasury and credited to the War Office.

	Millions of Lire.	Percentage of Total Revenue.
Crown lands and properties	102·40	6·1
Imposts, taxes, and trade monopolies	1409·71	84·7
Proceeds of public services (posts, telegraphs, &c.)	98·01	6·0
Repayments and contributions from provinces, communes, &c.	23·05	1·4
Sundry revenues	31·23	1·8

The State therefore draws its principal revenues from the imposts, the taxes, and the monopolies. According to the Italian tributary system, "imposts," properly so called, are those upon land, buildings, and personal estate. The impost upon land is based upon the cadastral survey independently of the vicissitudes of harvests, Italian territory being divided for this purpose into nine cadastral compartments. In 1869 the main quota of the impost was increased by one-tenth, in addition to the extra two-tenths previously imposed in 1866. Subsequently, however, it was decided to repeal these additional tenths, the first being abolished in 1886 and the rest in 1887. On account of the inequalities still existing in the cadastral survey, in spite of the law of 1886 (see *Agriculture*, above), great differences are to be found in the land tax assessments in various parts of Italy. Land is not so heavily burdened by the Government quota as by the additional centimes imposed by the provincial and communal authorities. It may be calculated that on an average Italian landowners pay nearly 25 per cent. of their revenues from land in the various forms of government and local land tax. The buildings impost has been assessed since 1866 upon the basis of 12·50 per cent. of "taxable revenue." Taxable revenue corresponds to two-thirds of actual income from factories and to three-fourths of actual income from houses; it is ascertained by the agents of the financial administration. In 1869, however, a third additional tenth was added to the previously existing additional two-tenths, and, unlike the tenths of the land tax, they have not since been abolished. At present the main quota with the additional three-tenths amounts to 16·25 per cent. of taxable income. The imposts on incomes from personal estate (*ricchezza mobile*) were introduced in 1866; it is not a general income tax, but applies to incomes derived from investments, industry, or personal enterprise, but not to landed revenues. It is proportional, and is collected by deduction from salaries and pensions paid to servants of the State, and from interest on consolidated stock; and by register in the cases of professional men, capitalists, or manufacturers. From 1871 to 1894 it was assessed at 13·20 per cent. of taxable income, this quota being formed of 12 per cent. main quota and 1·20 per cent. as an additional tenth. In 1894 the quota, including the additional tenth, was raised to the uniform level of 20 per cent.

Taxes proper are divided into (*a*) taxes on business transactions and (*b*) taxes on articles of consumption. The former apply principally to successions, stamps, registrations, mortgages, &c.; the latter to distilleries, breweries, explosives, native sugar, and matches, though the customs revenue and octrois upon articles of general consumption, such as corn, wine, spirits, meat, flour, petroleum, butter, tea, coffee, and sugar, may be considered as belonging to this class.

The monopolies are those of salt, tobacco, and the *lotto*.

In the financial year 1899–1900 the largest revenue was yielded by the income tax on personal estate or *ricchezza mobile* (289,000,000 lire), and by the customs and maritime dues (244,000,000 lire). The taxes on business transactions yielded 200,000,000 lire; the tobacco monopoly, 196,000,000; the land tax, 106,000,000; the buildings tax, 89,000,000; the salt monopoly, 74,000,000;

the lotto, 71,000,000; the octrois, 53,000,000; and the tax on manufactures, 64,000,000.

Since 1880, while income from the salt and lotto monopolies has remained almost stationary, and that from land tax and octroi has diminished, revenue derived from all other sources has notably increased, especially that from the income tax on personal estate, the customs, and the tobacco monopoly, the yield from which has been doubled as regards the first, and tripled as regards the two latter.

With regard to *expenditure*, the following table demonstrates the chief items which make up the total amount:—

	Millions of Lire.	Percentage.
Consolidated and redeemable debt, pensions, and royal civil list	728·35	44·60
Cost of general administration	45·10	2·76
Cost of collecting taxes, imposts, &c.	163·56	10·00
Cost of civil services (justice, education, agriculture, &c.)	267·56	15·77
Military and naval services	346·82	21·24
Civil and military services in Africa (Eritrea, Somaliland, &c.)	9·11	0·56
Other expenditure (railways, Church lands, &c.)	82·60	5·07
Total	1643·10	100·00

Nearly half the total expenditure is absorbed by interest on debt, which in the financial year 1899–1900 amounted to about 689,000,000 lire, exclusive of the 83,000,000 lire required for civil and military pensions. Debt has continually increased with the development of the State, especially as regards the military and civil services and the provision of railways and public works. The sum paid in interest on debt amounted to 441,000,000 lire in 1871, 486,000,000 in 1881, 640,000,000 in 1891–92, and 689,000,000 in 1899–1900. Next in order of importance comes naval and military expenditure, which in 1899–1900 amounted to 347,000,000 lire, or 243,000,000 for the army and 104,000,000 for the navy.[1] Of the 257,000,000 lire required for the various civil services, 61,000,000 are absorbed by posts and telegraphs, 48,000,000 by education, 32,000,000 by the administration of justice, 26,000,000 by prisons, 18,000,000 by police, while only 12,000,000 are allotted to agriculture, industry, and trade.

Since 1880 military expenditure has risen from 209,000,000 to 239,000,000, and the naval from little more than 40,000,000 to 104,000,000.

At the beginning of the financial year 1899–1900 the value of the patrimony of the State was calculated to be nearly eight milliards (7,974,901,559 lire). At the same time the indebtedness of the State was more than twice as much (16,435,941,523 lire). The credit side included railways, canals, salt, tobacco, telegraphs, &c., for 4,236 million lire; military and naval material, 1651 millions; land, buildings, furniture, and securities, 602 millions; Treasury balance, 655 millions; property of the State services, 632 millions; and scientific and artistic objects, 221 millions. The debit side included consolidated stock and redeemable debt, 14,669 millions; pensions (capitalized), 1634 millions; Treasury debt and State notes having forced currency, 11,482 millions.

Local Government.—Italian local government, or the provincial or communal administrative system, was modified by the law of 10th February 1889 and by posterior enactments. The elective principle has been extended in regard to the choice of syndics or mayors, who were previously royal nominees, but are now elected by a secret ballot of the communal council. In the provincial administrations the functions of the prefects have been curtailed. Whereas the prefect was formerly *ex officio* president of the provincial deputation or executive committee of the provincial council, his duties under the present law are reduced to mere participation in the management of provincial affairs, the president of the provincial deputation being chosen among and elected by the members of the deputation. The most important change introduced by the new law has been the creation in every province of a provincial administrative junta entrusted with the supervision of communal administrations, a function previously discharged by the provincial deputation. Each provincial administrative junta is composed, in part, of Government nominees (the prefect, acting as president, two councillors of the prefecture, and a supernumerary appointed at the beginning of every year by the Minister of the Interior), and in part of elective elements (four members and two supernumeraries), elected by the provincial council for four years, half of whom require to be elected every two years. The acts of communal administration requiring the sanction of the provincial administrative junta are chiefly financial (sale or purchase of property; investments, other than purchases of buildings; loans on mortgage security; leases for more than twelve years; expenditure affecting the communal budget for more than five years; modifications of the octroi and other communal imposts; or changes in police and building regulations). Both communal councils and prefects may appeal to the Government against the decision of the provincial administrative juntas, the Government being guided by the opinion of the Council of State. Besides possessing competence in regard to local government elections, which previously came within the jurisdiction of the provincial deputations, the provincial administrative juntas discharge magisterial functions in administrative affairs, and deal with appeals presented by private persons against acts of the communal and provincial administrations. The juntas are in this respect organs of the administrative jurisprudence created in Italy by the law of 1st May 1890, in order to provide juridical protection for those rights and interests outside the competence of the ordinary tribunals.[1]

The former qualifications for electorship in local government elections (to be an Italian citizen, to be able to read and write, and to have completed the twentieth year of age) have been modified, and it is now sufficient to pay five lire annually in direct taxes, five lire of certain communal taxes, or a certain rental (which varies according to the population of a commune), instead of being obliged to pay, as previously, at least five lire annually of direct taxes to the State. In consequence of this change the number of local electors increased by more than one-third between 1887–89; it decreased, however, as a result of an extraordinary revision of the registers in 1894.

Year.		Number of Qualified Local Electors.	
		Totals.	Per 100 Inhabitants.
1883	Before the Reform	1,849,304	6·43
1887		2,026,619	6·87
1889	After the Reform	3,343,875	11·19
1895		2,772,934	8·94
1898		2,894,592	9·17

[1] During the discussion of the estimates for the financial year 1901–1902 the Chamber and Senate adopted resolutions consolidating Italian military and naval expenditure for the following six years at a total of 396,000,000 lire annually, inclusive of naval and military pensions and of premiums on mercantile shipbuilding (see sections *Army* and *Navy*).

[1] In addition to the magisterial functions of the provincial administrative juntas, and with the same object of providing juridical protection for private interests, otherwise undefended, a fourth section of the Council of State was instituted in 1889, with competence to deal with the following matters: (*a*) To decide with regard to appeals based on pleas of incompetence, abuse of power, or infractions of law, which may be presented by individuals, or corporate personalities, against enactments of local authorities or administrative bodies; (*b*) to decide both as regards merit and form in cases of controversy between the State and its creditors, in matters relating to the interpretation of contracts, public loans, seizures of the temporalities of bishops and priests, and boundary disputes between communes and provinces.

The ratio of local electors to population varies greatly in the different provinces. In Piedmont it is 79 per cent., but in Sicily less than 45 per cent. The ratio of voters to qualified electors tends to increase; it is highest in Campania, Basilicata, and in the south generally; the lowest percentages are given by Emilia and Liguria:—

Year.	Number of Voters.	
	Totals.	Per 100 Qualified Voters.
1887	893,050	44·07
1889	2,002,630	59·89
1895	1,762,081	63·55

Local finance in Italy is regulated by the communal and provincial law of 4th May 1898, which, while retaining the fundamental characteristics of previous legislation, provided more efficacious control over the communes by instituting provincial administrative juntas, empowered to examine and sanction the acts of the communal financial administrations. As has been already explained, the sanction of the provincial administrative junta is necessary for sales or purchases of property, alterations of rates (although in case of increase the junta can only act upon request of ratepayers paying an aggregate of one-twentieth of the local direct taxation), and expenditure affecting the communal budget for more than five years. The provincial administrative junta is, moreover, empowered to order "obligatory" expenditure, such as the upkeep of roads, sanitary works, lighting, police, charities, education, &c., in case such expenditure is neglected by the communal authorities. The cost of fire brigades, infant asylums, evening and holiday schools, is classed as "optional" expenditure. Communal revenues are drawn from the proceeds of communal property, interest upon capital, taxes and local dues. The most important of the local dues is the gate tax, or *dazio di consumo*, which may be either a surtax upon commodities (such as alcoholic drinks or meat), having already paid customs duty at the frontier, in which case the local surtax may not exceed 50 per cent. of the frontier duty, or an exclusively communal duty limited to 10 per cent. on flour, bread, and farinaceous products,[1] and to 20 per cent. upon other commodities.

In addition, the communes have a right to levy a surtax not exceeding 50 per cent. of the quota levied by the State upon lands and buildings; a family tax, or *fuocatico*, upon the total incomes of families, which, for fiscal purposes, are divided into various categories; a tax based upon the rent-value of houses, and other taxes upon cattle, horses, carriages, and servants. Occasional sources of interest are found in the sale of communal property, the realization of communal credits, and the contraction of debt.

According to the statistics for 1897, the total revenue proper of the communes was 554,008,117 lire, of which 157,416,184 lire were yielded by gate tax, or octroi, and 132,961,697 by the surtax on lands and buildings; 21,000,000 lire were furnished by the family tax; 15,000,000 lire by the cattle tax, and 6,000,000 lire by the shop tax. Patrimonial revenues yielded 15,000,000 lire, while new debt was contracted for 81,000,000 lire. Including money raised by loan, revenue balanced expenditure, 97,000,000 being spent in administration; 86,000,000 for local and sanitary police; 77,000,000 for public works; 76,000,000 for education; 27,000,000 for public worship and charity; and 11,000 for general police and administration of justice. Interest on debt absorbed 53,000,000 lire out of a total of 170,000,000 lire of the expenditure classed as "patrimonial burdens," which, *inter alia*, included the cost of tax collection, &c. Since 1880 communal revenue has greatly increased. The chief increases in expenditure come under the heads of "patrimonial burdens," especially as regards interest on debt, local and sanitary police (from 52,000,000 to 86,000,000 lire), and for education (from 50,000,000 to 75,000,000 lire).

The provincial administrations, which act as links between the communes and the State, are entrusted with the management of the affairs of the provinces in general, as distinguished from those of the communes. Their expenditure is likewise classed as "obligatory" and "optional." The former category comprises the maintenance of provincial roads, bridges, and watercourse embankments; secondary education, whenever this is not provided for by private institutions or by the State (elementary education being maintained by the communes), and the maintenance of foundlings and pauper lunatics. "Optional" expenditure includes the cost of services of general public interest, though not strictly indispensable. Provincial revenues are drawn from provincial property, school taxes, tolls, and surtaxes on land and buildings. The provincial surtaxes may not exceed 50 per cent. of the quotas levied by the State. In 1897 the total provincial revenue was 93,306,335 lire, of which 86,500,000 lire were obtained from the surtax upon lands and buildings. Expenditure amounted to 94,222,208 lire, of which the principal items were 19,000,000 for roads and bridges, 13,000,000 for lunatic asylums, 6,000,000 for foundling hospitals, 8,000,000 for interest on debt, and 5,000,000 for police. Like communal revenue, provincial revenue has considerably increased since 1880, principally on account of the increase in the land and building surtax.

The Italian local authorities, communes and provinces alike, have considerably increased their indebtedness since 1882. The ratio of communal and provincial debt per inhabitant has grown from 30·79 lire to 43·70 lire, an increase due in great part to the need for improved buildings, hygienic reforms, and education, but also attributable in part to the manner in which the finances of many communes are administered.

AUTHORITIES. — *Annuario statistico italiano, 1900.* Rome, Bertero, 1900.—*Statistica dell' emigrazione italiana.* Published annually by the Direzione generale della Statistica.—*Emigrazione italiana all estero.* Published annually by the Direzione generale della Statistica.—*Emigrazione e colonie.* Diplomatic and consular reports published by Italian Foreign Office, 1893.—*L'Italia agricola alla fine del secolo XIX.* Rome, 1901.—*Notizie sull' agricoltura in Italia.* Rome, Bertero, 1900.—*L'industria della lana*, in the *Annali di Statistica*, serie iv., No. 84.—*L'industria della seta*, in the *Annali di Statistica*, serie iv., No. 55.—*L'industria della carta*, in the *Annali di Statistica*, serie iv., No. 91.—*Movimento della navigazione nei porti del Regno.* Published annually by the Ministry of Finance, 1862–99.—*Sulle condizioni della marina mercantile italiana.* Annual report from the Director-General of the Mercantile Marine to the Minister of Marine, 1881–99.—*Rivista del servizio minerario.* Published annually by the Inspectorship of Mines.—*Relaziones intorno al servizio postale e telegrafico ed al servizio delle Casse postali di risparmio.* Annual publication of the Ministry of Posts and Telegraphs.—*Movimenti commerciale del Regno d'Italia.* Published annually by the Ministry of Finance.—*Statistica degli scioperi avvenuti nell' industria e nell' agricoltura durante l'anno 1899.* Rome, Bertero, 1901.—*Statistica delle Societa cooperative di lavoro.* Published by the General Statistical Bureau, 1895.—*Statistica delle Societa cooperative di consumo*, 1897.—*Statistica delle Banche popolari*, 1900.—*Statistica dei Bilanci comunali.* Published annually by the General Statistical Bureau.—*Statistica dei Bilanci provinciali.*—*Statistica dei debiti comunali e provinciali.* Published periodically by the General Statistical Bureau.—*Il bilancio italiano del Regno d'Italia negli esercizio finanziari dal 1862 al 1899–1900.* Published by the Ragionerva generale dello Stato. Rome, 1901.

(A. Bo.)

RECENT HISTORY.

Few dates in modern European history equal in significance that of 20th September 1870, when the Italian troops under General Cadorna took possession of Rome in the name of the Italian nation, and completed at one stroke both the work of the Risorgimento and the destruction of the temporal power of the Roman pontiff. The adoption on 2nd October, by 133,681 votes against 1507, of the plebiscitary formula, "We desire our union to the kingdom of Italy under the constitutional monarchical government of King Victor Emmanuel II. and of his successors," merely conferred formal popular sanction upon the act of capitulation previously signed by the papal General Kanzler with the approval of the pope and his advisers.

The Roman Question.

For many years the destruction of the pope's temporal sovereignty had been recognized as a corollary to, if not a synonym for, the complete union of Italy. Dreamers or timorous politicians alone believed compromise possible. "Under the ægis of free institutions we leave to the wisdom of the Italian Government the task of assuring the independence of the spiritual authority of the pontiff"—declared the proclamation by which the provisional junta of Roman citizens called upon the people of the Papal States to accomplish the plebiscite. In the mind of the Italian Government and nation, and of a considerable proportion of the Italian clergy, no necessary connexion existed between the pope's temporal power and his spiritual

[1] At the beginning of 1902 the Italian Parliament sanctioned a Bill providing for the abolition of municipal duties on bread and farinaceous products within three years of the promulgation of the Bill on 1st July 1902.

independence. The Vatican and its supporters held, and hold, a contrary view. Their opposition, indeed, had proved a source of discord between Italy, France, and the Curia ever since Cavour, on 26th March 1861, had declared to the Subalpine parliament, "Only Rome can be the capital of Italy." Cavour's untimely death (6th June 1861) had interrupted his negotiations with Napoleon for the withdrawal of the French garrison from Rome, negotiations which Napoleon had declined to continue with Ricasoli, successor of Cavour, in spite of Ricasoli's declaration that Italy desired to go to Rome, "not with the help of inopportune, insurrectionary elements, but in full agreement with France, in order to restore to the Church that freedom and independence, that simplicity of discipline, whereby she had attained power and renown in the early centuries of her existence." The advent of the weak and tortuous Rattazzi administration (March 1862) had led to the ill-considered Garibaldian enterprise against Rome, which ended pitifully at Aspromonte (29th August 1862), and which increased, on the one hand, the diffidence of France, and on the other, the impatience of the Italian Radical "party of action." Not until 1864 was it possible for the Minghetti–Visconti Venosta cabinet to conclude with France, on the lines laid down by Cavour, a convention (15th September 1864) arranging for the evacuation of Rome by the French troops within two years, on condition that Italy should respect and enforce respect of papal territory, and should, as a pledge of abstention from immediate designs upon Rome, transport her capital from Turin to Florence. The "September convention" has been the subject of prolonged and bitter controversy; but it has not always been borne in mind that in 1864 the approaching downfall of the French empire could not be foreseen, nor that the solution of the Roman question must then have appeared strictly contingent upon the will of Napoleon. As long as France remained directly responsible for the integrity of the papal domain, any attempt to complete Italian unity could but arouse her hostility. The imperial troops once withdrawn, Italy might trust to "moral means," *i.e.*, to the strength of unitary sentiment, and to the efforts of patriotic committees in the papal states, to hasten the consummation of her Risorgimento. If, by guaranteeing papal territory against attack, Minghetti and his colleagues undertook an ungrateful task, and seemed to forego, or indefinitely to postpone, the realization of unitary aspirations, their error was remedied by their successor, La Marmora, who in a note addressed to the French Government on 7th November 1864 formally reserved for Italy freedom in regard to those national aspirations, "which, by their very nature, belonged to the national conscience, and could not be discussed between two Governments." Judged in the light of subsequent events, the September convention is seen to have marked the first stage on the road to Rome, and to have secured for Italy, by the withdrawal of the French garrison, a diplomatic advantage which even Clerical trickery in connexion with the Legion of Antibes failed substantially to affect.

Any expectation that the transfer of the Italian capital to Florence (February 1865) and the evacuation of Rome by the French (December 1866) would have convinced the Vatican of the wisdom of conciliation with Italy was upset by the failure of two Italian missions to Rome, conducted by Vegezzi (April–June 1865) and by Tonello (December 1866). Moreover, the question of a *modus vivendi* between Italy and the papacy was complicated in 1867 by the return of Rattazzi to power. While explicitly accepting and promising loyally to execute the September convention, Rattazzi connived at Garibaldi's ill-starred adventure, which afforded a pretext for the reoccupation of Rome by the French (30th October 1867), and ended in the catastrophe of Mentana (3rd November 1867). Though Rome was again evacuated in the following month, a French garrison, 5000 strong, at Civitavecchia, lent point to Rouher's famous declaration (5th December 1867), that Italy would "never" be allowed to take possession of Rome. In Italy this declaration was met two days later by a resolution in which the Senate reaffirmed the Italian claim to Rome as capital. Anxious to settle the Roman question, or to cast its burden upon other shoulders than his own, Napoleon resorted to the time-worn suggestion of a European conference, a suggestion sterilized in this instance by Bismarck's desire to maintain the French occupation of Civitavecchia as a chronic source of discord between Italy and France. Foiled in this attempt, the French emperor next sought to profit by a proposal from Victor Emmanuel for a return pure and simple to the convention of September, by making such return conditional upon the conclusion of a Franco-Italian offensive and defensive alliance. Austria, already approached by Napoleon on the subject of an anti-Prussian league, had insisted that Italy should be a party to the scheme if only to preclude the renewal of the Prusso-Italian alliance of 1866. In June 1869 negotiations were opened directly between Napoleon and Victor Emmanuel, General Menabrea, in his double capacity as premier and aide-de-camp to the king, being the only Italian minister fully cognizant of the scheme. He, however, insisted that eventual war should not destroy the North German Confederation, and demanded, as a *sine quâ non*, both the recall of the French troops from Civitavecchia and permission for Italy to occupy all the papal states except Rome, and even, under certain conditions, Rome itself. The Italian demands were supported by the Austrian chancellor, Count von Beust, who, in his fervour for the alliance, declared himself ready to guarantee Italy a rectification of her frontier on the eastern Alps; but Napoleon, though at first inclined to accept the Italian conditions, gave way to the adverse influence of M. de la Vallette, who, encouraged by the empress, refused to countenance the clauses relative to Rome. Thus the projected alliance remained in abeyance until pressure of impending hostilities induced Napoleon to reopen negotiations on 16th July 1870.

Mentana.

In the meantime political conditions in Italy underwent considerable change. The Mentana episode and the prolonged French occupation of Civitavecchia profoundly irritated public feeling, while, after a crisis of unprecedented length, the Menabrea cabinet was succeeded (12th December 1869) by a strong administration, in which Giovanni Lanza, Quintino Sella, and Visconti Venosta held the chief portfolios. Sella, strong-willed and clear-headed, was heartily averse from all idea of a French alliance. Better acquainted than his sovereign or his colleagues with the respective conditions of Prussia and France, and consequently less persuaded than they of the certainty of a French victory in an eventual war, he was anxious that Italy should not be entangled by a pact which might prove ruinous, nor be compelled to incur outlay which might endanger the success of his herculean efforts to reorganize Italian finance. He was, moreover, convinced that the moment was approaching for a definitive settlement of the Roman question. When renewed in July 1870, the French proposal for an anti-Prussian league again suffered shipwreck upon the Italian demand for the withdrawal of the garrison from Civitavecchia and for permission to go to Rome. A strong despatch from Beust to the Austrian representative in Paris in support of the Italian demand irritated M. Émile Ollivier, who declared that the French garrison would "never" be withdrawn

from Civitavecchia, and on 25th July, in a letter to the emperor, characterized Beust's proposal to deliver Rome to the Italians as "pitiful and impracticable."

Relations with France. According to M. Ollivier, the only possible basis of alliance with Italy would be a return to the September convention. Without recognizing the sufficiency of such a basis, Visconti Venosta, Italian foreign minister, notified the Duc de Gramont on 29th July that Italy was prepared to execute the convention. On 5th August the French garrison evacuated Civitavecchia. Italy, convinced that France would not sanction her occupation of Rome, set about organizing with Great Britain and Austria a league of neutral Powers, after King Victor Emmanuel, by means of a special envoy, Count Vimercati, had made, on 2nd and 3rd August, a last vain attempt to induce Napoleon at Metz to agree to the Italian condition with regard to Rome. Italian neutrality was, moreover, soon imposed by the *débâcle* of the French army and by the action of the Tsar, who had warned Austria that any breach of neutrality on her part in favour of France would be followed by Russian intervention in support of Germany. Victor Emmanuel's chivalrous desire to render Napoleon a military equivalent for Magenta and Solferino, and the appeals of France for help, failed to shake the attitude of the Italian cabinet, which, apart from other considerations, knew only too well that the condition of the Italian army precluded rapid mobilization of any considerable force. Pressed by his colleague Sella and by the agitation of the Radical "party of action" for an immediate advance upon Rome, Visconti Venosta, on 29th August, addressed a circular note to the Powers, setting forth the reasons which compelled Italy to avail herself of the reserves formulated by La Marmora on 7th November 1864 in regard to the fulfilment of national aspirations.

Even if the fall of the French empire on 4th September 1870 had not released Italy *de facto et de jure* from the September convention, the Italian Government would have been compelled to occupy the papal states. Armed bands were preparing to make an onslaught upon Rome, a mutiny had broken out among the pontifical Zouaves, and in Rome itself signs of incipient revolution were apparent. Before advancing upon Rome King Victor Emmanuel sent Count Ponza di San Martino to the pope with a letter containing protestations of solicitude for the welfare of the Church, and an appeal for a peaceful occupation of Rome upon terms guaranteeing the pontiff's spiritual independence. Pius IX. indignantly rejected the proposal, and the Italian envoy, on 11th September, returned empty-handed to Florence. On the morrow the general forward movement began, Viterbo being occupied the same day, Civitavecchia on 16th September, and Rome on the morning of 20th September. Attempts made by Count von Arnim, Prussian minister to the Holy See, to promote a peaceful occupation of Rome were unavailing to shake the determination of the pope, who instructed General Kanzler, papal commander-in-chief, only to yield to force. As soon as a breach, battered in the wall near Porta Pia, had been stormed by the Italian troops, General Kanzler yielded and signed a formal capitulation. Some 200 men had been killed and wounded on both sides. On 21st September the whole of Rome was occupied except the Leonine City, the occupation being, however, extended to the Leonine City on 22nd September at the special request of the pope for reasons of public order.

The downfall of the temporal power was hailed throughout Italy with unbounded enthusiasm. Abroad, Catholic countries at first received the tidings with resignation, and Protestant countries with joy. In France, where the Government of National Defence had replaced the Empire, M. Crémieux, as president of the Government delegation at Tours, hastened to offer his congratulations to Italy; while M. Senard, French minister at Florence, wrote to Victor Emmanuel: "I desire not to lose a single instant in addressing to your Majesty, on behalf of my Government and in my own name, my sincere congratulations on this happy event."

Italian occupation of Rome. The occupation of Rome caused no surprise to the French Government, which had been forewarned on 11th September of the Italian intentions. On that occasion M. Jules Favre had recognized the September convention to be dead, and, while refusing explicitly to denounce it, had admitted that unless Italy went to Rome the city would become a prey to dangerous agitators. At the same time he made it clear that Italy would occupy Rome upon her own responsibility, though he subsequently telegraphed to M. Senard: "France cannot directly meddle in the Roman question. The temporal power has been a scourge to the world; it has fallen, and we shall not raise it again, but we feel too unfortunate to trample upon it. We shall see the Italian Government go to Rome with pleasure. It is necessary that it should go. Order and peace in Italy are at this price." Agreeably surprised by this attitude on the part of France, Visconti Venosta lost no time in conveying officially the thanks of Italy to the French Government. He doubtless foresaw that the language of MM. Favre, Crémieux, and Senard would not be endorsed by the French Clericals. Prussia, while satisfied at the fall of the temporal power, seemed to fear lest Italy might recompense the absence of French opposition to the occupation of Rome by armed intervention in favour of France. Bismarck, moreover, was indignant at the connivance of the Italian Government in the Garibaldian expedition to Dijon, and was irritated by Visconti Venosta's plea in the Italian parliament for the integrity of French territory. On 10th March 1873 Bismarck, indeed, confessed to the Prussian Herrenhaus that, towards the end of the Franco-German war, he had been disposed to make an arrangement with the Holy See detrimental to Italy. Negotiations for some such arrangement took place between him and Cardinal Ledochowski, but failed through Bismarck's fear of falling a victim to ecclesiastical duplicity. The course of events in France, however, soon calmed German apprehensions. The advent of M. Thiers, his attitude towards the petition of French bishops on behalf of the pope, the recall of M. Senard and the instructions given to his successor, the count of Choiseul, to absent himself from Italy at the moment of Victor Emmanuel's official entry into Rome (2nd July 1871), and the haste displayed in appointing a French ambassador to the Holy See, rapidly cooled the cordiality of Franco-Italian relations and reassured Bismarck on the score of any dangerous intimacy between the two Governments.

The friendly attitude of France towards Italy during the period immediately subsequent to the occupation of Rome seemed to cow and to dishearten the Vatican. For a few weeks the relations between the Curia and the Italian authorities were marked by a conciliatory spirit. The secretary-general of the Italian Foreign Office, Baron Blanc, who had accompanied General Cadorna to Rome, was received almost daily by Cardinal Antonelli, papal secretary of state, in order to settle innumerable questions arising out of the Italian occupation.

Attitude of the Vatican. The royal commissioner for finance, Signor Giacomelli, had, as a precautionary measure, seized the pontifical treasury; but upon being informed by Cardinal Antonelli that among the funds deposited

in the treasury were 1,000,000 crowns of Peter's Pence offered by the faithful to the pope in person, the commissioner was authorized by the Italian council of state not only to restore this sum, but also to indemnify the Holy See for moneys expended for the service of the October coupon of the pontifical debt, that debt having been taken over by the Italian state. On 29th September Cardinal Antonelli further apprised Baron Blanc that he was about to issue drafts for the monthly payment of the 50,000 crowns inscribed in the pontifical budget for the maintenance of the pope, the Sacred College, the apostolic palaces, and the papal guards. The Italian treasury at once honoured all the papal drafts, and thus contributed a first instalment of the 3,225,000 lire per annum afterwards placed by Article 4 of the Law of Guarantees at the disposal of the Holy See. Payments would have been regularly continued had not pressure from the French Clerical party coerced the Vatican into refusing any further instalment.

Once in possession of Rome, and guarantor to the Catholic world of the spiritual independence of the pope, the Italian Government prepared juridically to regulate its relations to the Holy See. A Bill known as the Law of Guarantees was therefore framed and laid before parliament. The measure was an amalgam of Cavour's scheme for a "free Church in a free State," of Ricasoli's Free Church Bill, rejected by parliament four years previously, and of the proposals presented to Pius IX. by Count Ponza di San Martino in September 1870. After a debate lasting nearly two months the Law of Guarantees was adopted in secret ballot on 21st March 1871 by 185 votes against 106. It consisted of two parts. The first, containing thirteen Articles, recognized (Articles 1 and 2) the person of the pontiff as sacred and intangible, and while providing for free discussion of religious questions, punished insults and outrages against the pope in the same way as insults and outrages against the king. Royal honours were attributed to the pope (Article 3), who was further guaranteed the same precedence as that accorded to him by other Catholic sovereigns, and the right to maintain his Noble and Swiss guards. Article 4 allotted the pontiff an annuity of 3,225,000 lire (£129,000) for the maintenance of the Sacred College, the sacred palaces, the congregations, the Vatican chancery, and the diplomatic service. The sacred palaces, museums, and libraries were, by Article 5, exempted from all taxation, and the pope was assured perpetual enjoyment of the Vatican and Lateran buildings and gardens, and of the papal villa at Castel Gandolfo. Articles 6 and 7 forbade access of any Italian official or agent to the above-mentioned palaces or to any eventual conclave or œcumenical council without special authorization from the pope, conclave, or council. Article 8 prohibited the seizure or examination of any ecclesiastical papers, documents, books, or registers of purely spiritual character. Article 9 guaranteed to the pope full freedom for the exercise of his spiritual ministry, and provided for the publication of pontifical announcements on the doors of the Roman churches and basilicas. Article 10 extended immunity to ecclesiastics employed by the Holy See, and bestowed upon foreign ecclesiastics in Rome the rights of Italian citizens. By Article 11, diplomatists accredited to the Holy See, and papal diplomatists while in Italy, were placed on the same footing as diplomatists accredited to the Quirinal. Article 12 provided for the transmission free of cost in Italy of all papal telegrams and correspondence both with bishops and foreign governments, and sanctioned the establishment, at the expense of the Italian state, of a papal telegraph office served by papal officials in communication with the Italian postal and telegraph system. Article 13 exempted all ecclesiastical seminaries, academies, colleges, and schools for the education of priests in the city of Rome, from all interference on the part of the Italian Government.

The Law of Guarantees.

This portion of the law, designed to reassure foreign Catholics, met with little opposition; but the second portion, regulating the relations between State and Church in Italy, was sharply criticized by deputies who, like Sella, recognized the ideal of a "free Church in a free State" to be an impracticable dream. The second division of the law abolished (Article 14) all restrictions upon the right of meeting of members of the clergy. By Article 15 the Government relinquished its rights to apostolic legation in Sicily, and to the appointment of its own nominees to the chief benefices throughout the kingdom. Bishops were further dispensed from swearing fealty to the king, though, except in Rome and suburbs, the choice of bishops was limited to ecclesiastics of Italian nationality. Article 16 abolished the need for royal *exequatur* and *placet* for ecclesiastical publications, but subordinated the enjoyment of temporalities by bishops and priests to the concession of state *exequatur* and *placet*. Article 17 maintained the independence of the ecclesiastical jurisdiction in spiritual and disciplinary matters, but reserved for the state the exclusive right to carry out coercive measures. On 12th July 1871, Articles 268, 269, and 270 of the Italian Penal Code were so modified as to make ecclesiastics liable to imprisonment for periods varying from six months to five years, and to fines from 1000 to 3000 lire, for spoken or written attacks against the laws of the state, or for the fomentation of disorder. An encyclical of Pius IX. to the bishops of the Catholic Church on 15th May 1871 repudiated the Law of Guarantees, and summoned Catholic princes to co-operate in restoring the temporal power. Practically, therefore, the law has remained a one-sided enactment, by which Italy considers herself bound, and of which she has always observed the spirit, even though the exigencies of self-defence may have led in some minor respects to non-observance of the letter. The annuity payable to the pope has, for instance, been made subject to quinquennial prescription, so that in the event of tardy recognition of the law the Vatican could at no time claim payment of more than five years' annuity with interest.

For a few months after the occupation of Rome pressing questions incidental to a new change of capital and to the administration of a new domain distracted public attention from the real condition of Italian affairs. The rise of the Tiber and the flooding of Rome in December 1870 (tactfully used by Victor Emmanuel as an opportunity for a first visit to the new capital) illustrated the imperative necessity of reorganizing the drainage of the city and of constructing the Tiber embankment. In spite of pressure from the French Government, which desired Italy to maintain Florence as the political and to regard Rome merely as the moral capital of the realm, the Government offices and both legislative chambers were transferred in 1871 to the Eternal City. Early in the year the Crown Prince Humbert with the Princess Margherita took up their residence in the Quirinal Palace, which, in view of the Vatican refusal to deliver up the keys, had to be opened by force. Eight monasteries were expropriated to make room for the chief state departments, pending the construction of more suitable edifices. The growth of Clerical influence in France engendered a belief that Italy would soon have to defend with the sword her newly-won unity, while the tremendous lesson of the Franco-Prussian war convinced the military authorities of the need for thorough military reform. General

Ricotti, minister of war, therefore framed an Army Reform Bill designed to bring the Italian army as nearly as possible up to the Prussian standard. Sella, minister of finance, notwithstanding the sorry plight of the Italian exchequer, readily granted the means for the reform. "We must arm," he said, "since we have overturned the papal throne," and he pointed to France as the quarter from which attack was most likely to come.

Though perhaps less desperate than during the previous decade, the condition of Italian finance was precarious indeed. With taxation screwed up to breaking point on personal and real estate, on all forms of commercial and industrial activity, and on salt, flour, and other necessaries of life; with a deficit of £8,500,000 for the current year, and the prospect of a further aggregate deficit of £12,000,000 during the next quinquennium, Sella's heroic struggle against national bankruptcy was still far from a successful termination. He chiefly had borne the brunt and won the laurels of the unprecedented fight against deficit in which Italy had been involved since 1862. As finance minister in the Rattazzi cabinet of that year he had been confronted with a public debt of nearly £120,000,000, and with an immediate deficit of nearly £18,000,000. In 1864, as minister in the La Marmora cabinet, he had again to face an excess of expenditure over income amounting to more than £14,600,000. By the seizure and sale of Church lands, by the sale of state railways, by "economy to the bone," and on one supreme occasion by an appeal to taxpayers to advance a year's quota of the land-tax, he had met the most pressing engagements of that troublous period. The king was persuaded to forego one-fifth of his civil list, ministers and the higher civil servants were required to relinquish a portion of their meagre salaries, but, in spite of all, Sella had found himself in 1865 compelled to propose the most hated of fiscal burdens—a grist tax on cereals. This tax (*macinato*) had long been known in Italy. Vexatious methods of assessment and collection had made it so unpopular that the Italian Government in 1859–60 had thought it expedient to abolish it throughout the realm. Sella hoped by the application of a mechanical meter both to obviate the odium attaching to former methods of collection and to avoid the maintenance of an army of inspectors and tax-gatherers, whose stipends had formerly eaten up most of the proceeds of the impost. Before proposing the reintroduction of the tax, Sella and his friend Ferrara improved and made exhaustive experiments with the meter. The result of their efforts was laid before parliament in one of the most monumental and most painstaking preambles ever prefixed to a Bill. Sella, nevertheless, fell before the storm of opposition which his scheme aroused. Scialoja, who succeeded him, was obliged to adopt a similar proposal, but parliament again proved refractory. Ferrara, successor of Scialoja, met a like fate; but Count Cambray-Digny, finance minister in the Menabrea cabinet of 1868–69, driven to find means to cover a deficit aggravated by the interest on the Venetian debt, succeeded, with Sella's help, in forcing a Grist Tax Bill through parliament, though in a form of which Sella could not entirely approve. When, on 1st January 1869, the new tax came into force, nearly half the flour-mills in Italy ceased work. In many districts the Government was obliged to open mills on its own account. Inspectors and tax-gatherers did their work under police protection, and in several parts of the country riots had to be suppressed *manu militari*. At first the net revenue from the impost was less than £1,100,000; but under Sella's firm administration (1869–73), and in consequence of improvements gradually introduced by him, the net return ultimately exceeded £3,200,000. The parliamentary opposition to the impost, which the Left denounced as "the tax on hunger," was largely factitious. Few, except the open partisans of national bankruptcy, doubted its necessity; yet so strong was the current of feeling worked up for party purposes by opponents of the measure, that Sella's achievement in having by its means saved the financial situation of Italy deserves to rank among the most noteworthy performances of modern parliamentary statesmanship.

Finance.

Under the stress of the appalling financial conditions, represented by chronic deficit, crushing taxation, the heavy expenditure necessary for the consolidation of the kingdom, the reform of the army, and the interest on the pontifical debt, Sella, on 11th December 1871, exposed to parliament the financial situation in all its nakedness. He recognized that considerable improvement had already taken place. Revenue from taxation had risen in a decade from £7,000,000 to £20,200,000; profit on state monopolies had increased from £7,000,000 to £9,400,000; exports had grown to exceed imports; income from the working of telegraphs had tripled itself; railways had been extended from 2200 to 6200 kilometres, and the annual travelling public had augmented from 15,000,000 to 25,000,000 persons. The serious feature of the situation lay less in the income than in the "intangible" expenditure, namely, the vast sums required for interest on the various forms of public debt and for pensions. Within ten years this category of outlay had increased from £8,000,000 to £28,800,000. During the same period the assumption of the Venetian and Roman debts, losses on the issue of loans, and the accumulation of annual deficits, had caused public indebtedness to rise from £92,000,000 to £328,000,000, no less than £100,000,000 of the latter sum having been sacrificed in premiums and commissions to bankers and underwriters of loans. By economies and new taxes Sella had reduced the deficit to less than £2,000,000 in 1871, but for 1872 he found himself confronted with a total expenditure £8,000,000 in excess of revenue. He therefore proposed to make over the treasury service to the state banks, to increase the forced currency, to raise the stamp and registration duties, and to impose a new tax on textile fabrics. An optional conversion of sundry internal loans into consolidated stock at a lower rate of interest was calculated to effect considerable saving. The battle over these proposals was long and fierce. But for the tactics of Rattazzi, leader of the Left, who, by basing his opposition on party considerations, impeded the secession of Minghetti and a part of the Right from the ministerial majority, Sella would have been defeated. On 23rd March 1872, however, he succeeded in carrying his programme, which not only provided for the pressing needs of the moment, but laid the foundation of the much-needed equilibrium between expenditure and revenue.

In the spring of 1873 it became evident that the days of the Lanza–Sella cabinet were numbered. Fear of the advent of a Radical administration under Rattazzi alone prevented the Minghettian Right from revolting against the Government. The Left, conscious of its strength, impatiently awaited the moment of accession to power. Sella, the real head of the Lanza cabinet, was worn out by four years' continuous work, and disheartened by the perfidious misrepresentation in which Italian politicians, particularly those of the Left, have ever excelled. By sheer force of will he compelled the Chamber early in 1873 to adopt some minor financial reforms, but, on 29th April, found himself in a minority on the question

of a credit for a proposed state arsenal at Taranto. Pressure from all sides of the House, however, induced the ministry to retain office until after the debate on the application to Rome and the Papal States of the Religious Orders Bill (originally passed in 1866)—a measure which, with the help of Ricasoli, was carried at the end of May. While leaving intact the general houses of the various confraternities (except that of the Jesuits), the Bill abolished the corporate personality of religious orders, handed over their schools and hospitals to civil administrators, placed their churches at the disposal of the secular clergy, and provided pensions for nuns and monks, those who had families being sent to reside with their relatives, and those who by reason of age or bereavement had no home but their monasteries being allowed to end their days in religious houses specially set apart for the purpose. The proceeds of the sale of the suppressed convents and monasteries were partly converted into pensions for monks and nuns, and partly allotted to the municipal charity boards which had undertaken the educational and charitable functions formerly exercised by the religious orders. To the pope was made over £16,000 per annum as a contribution to the expense of maintaining in Rome representatives of foreign orders; the Sacred College, however, rejected this endowment, and summoned all the suppressed confraternities to reconstitute themselves under the ordinary Italian law of association. A few days after the passage of the Religious Orders Bill, the death of Rattazzi (5th June 1873) removed all probability of the immediate advent of the Left. Sella, uncertain of the loyalty of the Right, challenged a vote on the immediate discussion of further financial reforms, and on 23rd June was overthrown by a coalition of the Left under Depretis with a part of the Right under Minghetti and the Tuscan Centre under Correnti. The Administration which thus fell was unquestionably the most important since the death of Cavour. It had completed national unity, transferred the capital to Rome, overcome the chief obstacles to financial equilibrium, initiated military reform, and laid the foundation of the relations between State and Church.

Religious Orders Bill.

The succeeding Minghetti–Visconti Venosta cabinet—which held office from 10th July 1873 to 18th March 1876—continued in essential points the work of the preceding Administration. Minghetti's finance, though less clear-sighted and less resolute than that of Sella, was on the whole prudent and beneficial. With the aid of Sella he concluded conventions for the redemption of the chief Italian railways from their French and Austrian proprietors. By dint of expedients he gradually overcame the chronic deficit, and, owing to the normal increase of revenue, ended his term of office with the announcement of a surplus of some £720,000. The question whether this surplus was real or only apparent has been much debated, but there is no reason to doubt its substantial reality. It left out of account a sum of £1,000,000 for railway construction which was covered by credit, but, on the other hand, took no note of £360,000 expended in the redemption of debt. Practically, therefore, the Right, of which the Minghetti cabinet was the last representative administration, left Italian finance with a surplus of £80,000. Outside the all-important domain of finance, the attention of Minghetti and his colleagues was principally absorbed by strife between Church and State, army reform, and railway redemption. For some time after the occupation of Rome the pope, in order to substantiate the pretence that his spiritual freedom had been diminished, avoided the creation of cardinals and the nomination of bishops. On 22nd December 1873, however, he unexpectedly created twelve cardinals, and subsequently proceeded to nominate a number of bishops. Visconti Venosta, who had retained the portfolio for foreign affairs in the Minghetti cabinet, at once drew the attention of the European Powers to this proof of the pope's spiritual freedom and of the imaginary nature of his "imprisonment" in the Vatican. At the same time he assured them that absolute liberty would be guaranteed to the deliberations of a conclave. In relation to the Church in Italy, Minghetti's policy was less perspicacious. He let it be understood that the announcement of the appointment of bishops and the request for the royal *exequatur* might be made to the Government impersonally by the congregation of bishops and regulars, by a municipal council or by any other corporate body—a concession of which the bishops were quick to take advantage, but which so irritated Italian political opinion that, in July 1875, the Government was compelled to withdraw the temporalities of ecclesiastics who had neglected to apply for the *exequatur*, and to evict sundry bishops who had taken possession of their palaces without authorization from the state. Parliamentary pressure further obliged Bonghi, minister of public instruction, to compel clerical seminaries either to forego the instruction of lay pupils or to conform to the laws of the state in regard to inspection and examination, an ordinance which gave rise to conflicts between ecclesiastical and lay authorities, and led to the forcible dissolution of the Mantua seminary and to the suppression of the Catholic university in Rome.

Minghetti.

More noteworthy than its management of internal affairs were the efforts of the Minghetti cabinet to strengthen and consolidate national defence. Appalled by the weakness or, rather, the non-existence of the navy, Admiral Saint-Bon, with his coadjutor, Signor Brin, addressed himself earnestly to the task of recreating the fleet, which had never recovered from the effects of the disaster of Lissa. During his three years of office he laid the foundation upon which Brin was afterwards to build up a new Italian navy. Simultaneously General Ricotti matured the army reform scheme which he had elaborated under the preceding Administration. His Bill, adopted by parliament on 7th June 1875, still forms the ground plan of the Italian army. Besides providing for an extensive system of fortification and territorial defence, it fixed the period of military liability for able-bodied men at nineteen years, beginning on the completion of the twentieth and ending with the thirty-ninth year of their age. Recruits were divided into three categories. Infantry, artillery, and engineer recruits of the first category were made liable to serve from two to three years with the colours, cavalry recruits four years, and carabineer recruits five. After discharge from active service, men belonging to the infantry, artillery, and engineers pass into the standing army reserve until completion of their twenty-eighth year, and cavalrymen and carabineers until completion of their twenty-ninth year. From the beginning of their twenty-ninth to the end of their thirty-second year first-category men of the infantry, artillery, and engineers are placed in the *milizia mobile* (a formation corresponding to the first levy of the German *Landwehr*), and for the last seven years of their military liability pass into the territorial or local militia (approximately equivalent to the second levy of the *Landwehr*). First-category cavalrymen and carabineers, after completing their twenty-ninth year, are placed immediately in the territorial militia, since the *milizia mobile* possesses no cavalry or carabineer cadres. The second category

Military and naval reform.

consists of supernumerary recruits for whom no place exists in the standing army. These belong for eight years to the standing army reserve, whence they pass for four years into the *milizia mobile*, and finally for seven years into the territorial militia. The third category is made up of men legally exempt from military service with the colours (*i.e.*, only sons, eldest sons of widows, eldest brothers of families of orphans, brothers of soldiers killed or wounded on active service, &c.), who belong for nineteen years to the territorial militia. This category represents at least 30 per cent. of the total annual levy. Voluntary, or one year's service with the colours, is admitted in the case of those who have successfully completed five years' instruction in the elementary schools and who pay the War Office a sum varying from £48 to £64, according to the arm in which they serve. The number of recruits annually incorporated in the active army is fixed every year by parliament on proposal of the war minister. At the time of the application of the Ricotti law, the annual levy was approximately 65,000, but has since grown to exceed 95,000. Theoretically, the army now comprises 784,424 men, including 14,414 officers and 216,723 men in active service and 6294 officers and 546,771 men of the standing army reserve. The *milizia mobile* consists approximately of 500,000 officers and men, and the territorial or local militia approximately of 2,100,000 officers and men. Considerations of economy, however, preclude the effectual training of anything like these totals. The outlay necessitated by the adoption of the Ricotti Bill amounted to £6,600,000 ordinary and £800,000 extraordinary expenditure per annum, a total which has by degrees been increased to and consolidated at the present level of £9,560,000.

Foreign policy under the Right.

It may be accounted as a piece of rare fortune for Italy that during the whole period 1869–76 the direction of her foreign policy remained in the experienced hands of Visconti Venosta, a statesman whose trustworthiness, dignity, and moderation even political opponents have been compelled to recognize. Diplomatic records fail to substantiate the accusations of lack of initiative and instability of political criterion currently brought against him by contemporaries. As foreign minister of a young state which had attained unity in defiance of the most formidable religious organization in the world and in opposition to the traditional policy of France, it could but be Visconti Venosta's aim to uphold the dignity of his country while convincing European diplomacy that United Italy was an element of order and progress, and that the spiritual independence of the Roman pontiff had suffered no diminution. Prudence, moreover, counselled avoidance of all action likely to serve the predominant anti-Italian party in France as a pretext for violent intervention in favour of the pope. On the occasion of the Metrical Congress, which met in Paris in 1872, he, however, successfully protested against the recognition of the Vatican delegate, Father Secchi, as a representative of a "state," and obtained from Count de Rémusat, French foreign minister, a formal declaration that the presence of Father Secchi on that occasion could not constitute a diplomatic precedent. The irritation displayed by Bismarck at the Francophil attitude of Italy towards the end of the Franco-German war gave place to a certain show of goodwill when the great chancellor found himself in his turn involved in a struggle against the Vatican and when the policy of M. Thiers began to strain Franco-Italian relations. M. Thiers had consistently opposed the Emperor Napoleon's pro-Italian policy. In the case of Italy, as in that of Germany, he frankly regretted the constitution of powerful homogeneous states upon the borders of France. Personal pique accentuated this feeling in regard to Italy. The refusal of Victor Emmanuel II. to meet M. Thiers at the opening of the Mont Cenis tunnel (a refusal not unconnected with offensive language employed at Florence in October 1870 by M. Thiers during his European tour, and with his instructions to the French minister to remain absent from Victor Emmanuel's official entry into Rome) had wounded the *amour propre* of the French statesman, and had decreased whatever inclination he might otherwise have felt to oppose the French Clerical agitation for the restoration of the temporal power, and for French interference with the Italian Religious Orders Bill. Consequently relations between France and Italy became so strained that in 1873 both the French minister to the Quirinal and the Italian minister to the Republic remained for several months absent from their posts. At this juncture the emperor of Austria invited Victor Emmanuel to visit the Vienna Exhibition, and the Italian Government received a confidential intimation that acceptance of the invitation to Vienna would be followed by a further invitation from Berlin. Perceiving the advantage of a visit to the imperial and apostolic court after the Italian occupation of Rome and the suppression of the religious orders, and convinced of the value of more cordial intercourse with the German empire, Visconti Venosta and Minghetti advised their sovereign to accept both the Austrian and the subsequent German invitations. The visit to Vienna took place on 17th to 22nd September, and that to Berlin on 22nd to 26th September 1873, the Italian monarch being accorded in both capitals a most cordial reception, although the contemporaneous publication of La Marmora's famous pamphlet, *More Light on the Events of 1866*, prevented intercourse between the Italian ministers and Bismarck from being entirely confidential. Visconti Venosta and Minghetti, moreover, wisely resisted the chancellor's pressure to override the Law of Guarantees and to engage in an Italian *Kulturkampf*. Nevertheless the royal journey contributed notably to the establishment of cordial relations between Italy and the central Powers, relations which were further strengthened by the visit of the Emperor Francis Joseph to Victor Emmanuel at Venice in April 1875, and by that of the German emperor to Milan in October of the same year. Meanwhile M. Thiers had given place to Marshal MacMahon, who effected a decided improvement in Franco-Italian relations by recalling from Civitavecchia the cruiser *Orénoque*, which since 1870 had been stationed in that port at the disposal of the pope in case he should desire to quit Rome. The foreign policy of Visconti Venosta may be said to have reinforced the international position of Italy without sacrifice of dignity, and without the vacillation and short-sightedness which was to characterize the ensuing administrations of the Left.

The fall of the Right on 18th March 1876 was an event destined profoundly and in many respects adversely to affect the course of Italian history. Theoretically, it may be argued that the advent of the new men, and the ultra-democratic ideas associated with the historic Left, was not only inevitable, but beneficial, since the concentration of power for a long period in the hands of the representatives of any one class or region of a country could not fail to be detrimental; practically, however, it is essential that new men should equal those whom they replace in personal integrity and aptitude for government. Except at rare and not auspicious intervals, the Right had held office from 1849 to 1876. Its rule was associated in the popular mind with severe administration; hostility to the democratic elements represented by Garibaldi, Crispi,

Depretis, and Bertani; ruthless imposition and collection of taxes in order to meet the financial engagements forced upon Italy by the vicissitudes of her Risorgimento; strong predilection for Piedmontese, Lombards, and Tuscans, and a steady determination, not always scrupulous in its choice of means, to retain executive power and the most important administrative offices of the state for the *consorteria*, or close corporation, of its own adherents. For years the men of the Left had worked to inoculate the electorate with suspicion of Conservative methods and with hatred of the imposts which they nevertheless knew to be indispensable to sound finance. In regard to the grist tax especially, the agitators of the Left had placed their party in a radically false position. Moreover, the redemption of the railways by the state—contracts for which had been signed by Sella in 1875 on behalf of the Minghetti cabinet with Rothschild at Basel and with the Austrian Government at Vienna—had been fiercely opposed by the Left, although its members were for the most part convinced of the utility of the operation. When, at the beginning of March 1876, these contracts were submitted to parliament, a group of Tuscan deputies, under Cesare Correnti, joined the opposition, and on 18th March took advantage of a chance motion concerning the date of discussion of an interpellation on the grist tax to place the Minghetti cabinet in a minority. Depretis, ex-pro-dictator of Sicily, and successor of Rattazzi in the leadership of the Left, was entrusted by the king with the formation of a Liberal ministry.

First Depretis Cabinet.

Besides the premiership, Depretis assumed the portfolio of finance; Nicotera, an ex-Garibaldian of somewhat tarnished reputation, but a man of energetic and conservative temperament, was placed at the ministry of the interior; public works were entrusted to Zanardelli, a Radical doctrinaire of considerable juridical attainments; General Mezzacapo and Signor Brin replaced General Ricotti and Admiral Saint-Bon at the War Office and Ministry of Marine; while to Mancini and Coppino, prominent members of the Left, were allotted the portfolios of justice and public instruction. Great difficulty was experienced in finding a foreign minister willing to challenge comparison with Visconti Venosta. Several diplomatists in active service were approached, but, partly on account of their refusal, and partly from the desire of the Left to avoid giving so important a post to a diplomatist bound by ties of friendship or of interest to the Right, the choice fell upon Melegari, Italian minister at Bern.

The new ministers had long since made monarchical professions of faith, but, up to the moment of taking office, were nevertheless considered to be tinged with an almost revolutionary hue. The king alone appeared to feel no misgiving. His shrewd sense of political expediency and his loyalty to constitutional principles saved him from the error of obstructing the advent and driving into an anti-dynastic attitude politicians who had succeeded in winning popular favour. Indeed, the patriotism and loyalty of the new ministers were above suspicion. Danger lay rather in entrusting men schooled in political conspiracy and in unscrupulous parliamentary opposition with the government of a young state still beset by enemies at home and abroad. As an opposition party the Left had lived upon the facile credit of political promises, but had no well-considered programme nor other discipline nor unity of purpose than that born of the common eagerness of its leaders for office and their common hostility to the Right. Neither Depretis, Nicotera, Crispi, Cairoli, nor Zanardelli was disposed permanently to recognize the superiority of any one chief. The dissensions which broke out among them within a few months of the accession of their party to power never afterwards disappeared, except at rare moments when it became necessary to unite in preventing the return of the Conservatives. Considerations such as these could not be expected to appeal to the nation at large, which hailed the advent of the Left as the dawn of an era of unlimited popular sovereignty, diminished administrative pressure, reduction of taxation, and general prosperity. The programme of Depretis corresponded only in part to these expectations. Its chief points were extension of the franchise, incompatibility of a parliamentary mandate with an official position, strict enforcement of the rights of the State in regard to the Church, protection of freedom of conscience, maintenance of the military and naval policy inaugurated by the Conservatives, acceptance of the railway redemption contracts, consolidation of the financial equilibrium, abolition of the forced currency, and, eventually, fiscal reform. The long-promised abolition of the grist tax was not explicitly mentioned, opposition to the railway redemption contracts was transformed into approval, and the vaunted reduction of taxation replaced by lip-service to the Conservative deity of financial equilibrium. The railway redemption contracts were in fact immediately voted by Parliament, with a clause pledging the Government to legislate in favour of farming out the railways to private companies.

Programme of the Left.

Nicotera, minister of the interior, began his administration of home affairs by a sweeping change in the *personnel* of the prefects, sub-prefects, and public prosecutors, but found himself obliged to incur the wrath of his supporters by prohibiting Radical meetings likely to endanger public order, and by enunciating administrative principles which would have befitted an inveterate Conservative. In regard to the Church, he instructed the prefects strictly to prevent infraction of the law against religious orders. At the same time the cabinet, as a whole, brought in a Clerical Abuses Bill, threatening with severe punishment priests guilty of disturbing the peace of families, of opposing the laws of the state, or of fomenting disorder. Depretis, for his part, was compelled to declare impracticable the immediate abolition of the grist tax, and to frame a Bill for the increase of revenue, acts which caused the secession of some sixty Radicals and Republicans from the ministerial majority, and gave the signal for an agitation against the premier similar to that which he himself had formerly undertaken against the Right. The first general election under the Left (November 1876) had yielded the cabinet the overwhelming majority of 421 Ministerialists against 87 Conservatives, but the very size of the majority rendered it unmanageable. The Clerical Abuses Bill provoked further dissensions: Nicotera was severely affected by revelations concerning his political past; Zanardelli refused to sanction the construction of a railway in Calabria in which Nicotera was interested; and Depretis saw fit to compensate the supporters of his Bill for the increase of revenue by decorating at one stroke sixty ministerial deputies with the Order of the Crown of Italy. A further derogation from the ideal of democratic austerity was committed by adding £80,000 per annum to the king's civil list (14th May 1877) and by burdening the state exchequer with royal household pensions amounting to £20,000 a year. The civil list, which the law of 10th August 1862 had fixed at £650,000 a year, but which had been voluntarily reduced by the king to £530,000 in 1864, and to £490,000 in 1867, was thus raised to £570,000 a year. Almost the only respect in which the Left could boast a decided improvement over the administration of the Right was the energy displayed by Nicotera in combating brigandage and the maffia in Calabria and Sicily. Successes achieved in

those provinces failed, however, to save Nicotera from the wrath of the Chamber, and on 14th December 1877 a cabinet crisis arose over a question concerning the secrecy of telegraphic correspondence. Depretis thereupon reconstructed his administration, excluding Nicotera, Melegari, and Zanardelli, placing Crispi at the home office, entrusting Magliani with finance, and himself assuming the direction of foreign affairs.

In regard to foreign affairs, the *début* of the Left as a governing party was scarcely more satisfactory than its home policy. Since the war of 1866 the Left had advocated an Italo-Prussian alliance in opposition to the Francophil tendencies of the Right. On more than one occasion Bismarck had maintained direct relations with the chiefs of the Left, and had in 1870 worked to prevent a Franco-Italian alliance by encouraging the "party of action" to press for the occupation of Rome. Besides, the Left stood for anticlericalism and for the retention by the State of means of coercing the Church, in opposition to the men of the Right, who, with the exception of Sella, favoured Cavour's ideal of "a free Church in a free State," and the consequent abandonment of state control over ecclesiastical government. Upon the outbreak of the Prussian *Kulturkampf* the Left had pressed the Right to introduce an Italian counterpart to the Prussian May laws, especially as the attitude of Thiers and the hostility of the French Clericals obviated the need for sparing French susceptibilities. Visconti Venosta and Minghetti, partly from aversion to a Jacobin policy, and partly from a conviction that Bismark sooner or later would undertake his *Gang nach Canossa*, regardless of any tacit engagement he might have assumed towards Italy, had wisely declined to be drawn into any infraction of the Law of Guarantees. It was, however, expected that the chiefs of the Left, upon attaining office, would turn resolutely towards Prussia in search of a guarantee against the Clerical menace embodied in the *régime* of Marshal Macmahon. On the contrary, Depretis and Melegari, both of whom were imbued with French Liberal doctrines, adopted towards the Republic an attitude so deferential as to arouse suspicion in Vienna and Berlin. Depretis recalled Nigra from Paris and replaced him by General Cialdini, whose ardent plea for Italian intervention in favour of France in 1870, and whose comradeship with Marshal Macmahon in 1859, would, it was supposed, render him *persona gratissima* to the French Government. This calculation was falsified by events. Incensed by the elevation to the rank of embassies of the Italian legation in Paris and the French legation to the Quirinal, and by the introduction of the Italian Bill against clerical abuses, the French Clerical party not only attacked Italy and her representative, General Cialdini, in the Chamber of Deputies, but promoted a monster petition against the Italian Bill. Even the *coup d'État* of 16th May 1877 (when Macmahon dismissed the Jules Simon cabinet for opposing the Clerical petition) hardly availed to change the attitude of Depretis. As a precaution against an eventual French attempt to restore the temporal power, orders were hurriedly given to complete the defences of Rome, but in other respects the Italian Government maintained its subservient attitude. Yet at that moment the adoption of a clear line of policy, in accord with the central Powers, might have saved Italy from the loss of prestige entailed by her bearing in regard to the Russo-Turkish war and the Austrian acquisition of Bosnia, and might have prevented the disappointment subsequently occasioned by the outcome of the Congress of Berlin. In the hope of inducing the European Powers to "compensate" Italy for the increase of Austrian influence on the Adriatic, Crispi undertook in the autumn of 1877, with the approval of the king, and in spite of the half-disguised opposition of Depretis, a semi-official mission to Paris, Berlin, London, and Vienna. The mission appears not to have been an unqualified success, though Crispi afterwards affirmed in the Chamber (4th March 1886) that Depretis might in 1877 "have harnessed fortune to the Italian chariot." Depretis, anxious only to avoid "a policy of adventure," let slip whatever opportunity may have presented itself, and neglected even to deal energetically with the impotent but mischievous Italian agitation for a "rectification" of the Italo-Austrian frontier. He greeted the treaty of San Stefano (3rd March 1878) with undisguised relief, and, by the mouth of the king, congratulated Italy (7th March 1878) on having maintained with the Powers friendly and cordial relations "free from suspicious precautions," and upon having secured for herself "that most precious of alliances, the alliance of the future"—a phrase of which the empty rhetoric was to be bitterly demonstrated by the Berlin Congress and the French occupation of Tunis.

Foreign policy of the Left.

The entry of Crispi into the Depretis cabinet (December 1877) placed at the ministry of the interior a strong hand and sure eye at a moment when they were about to become imperatively necessary. Crispi was the only man of truly statesmanlike calibre in the ranks of the Left. Formerly a friend and disciple of Mazzini, with whom he had broken on the question of the monarchical form of government which Crispi believed indispensable to the unification of Italy, he had afterwards been one of Garibaldi's most efficient coadjutors and an active member of the "party of action." Passionate, not always scrupulous in his choice and use of political weapons, intensely patriotic, loyal with a loyalty based rather on reason than sentiment, quick-witted, prompt in action, determined and pertinacious, he possessed in eminent degree many qualities lacking in other Liberal chieftains. Hardly had he assumed office when the unexpected death of Victor Emmanuel II. (9th January 1878) stirred national feeling to an unprecedented depth and placed the continuity of monarchical institutions in Italy upon trial before Europe. For thirty years Victor Emmanuel had been the centre point of national hopes, the token and embodiment of the struggle for national redemption. He had led the country out of the despondency which followed the defeat of Novara and the abdication of Charles Albert, through all the vicissitudes of national unification to the final triumph at Rome. His disappearance snapped the chief link with the heroic period and removed from the helm of state a ruler of large heart, great experience, and civil courage, at a moment when elements of continuity were needed and vital problems of internal reorganization had still to be faced. Crispi adopted the measures necessary to ensure the tranquil accession of King Humbert with a quick energy which precluded any Radical or Republican demonstrations. His influence decided the choice of the Roman Pantheon as the late monarch's burial-place, in spite of formidable pressure from the Piedmontese, who wished Victor Emmanuel II. to rest with the Sardinian kings at Superga. He also persuaded the new ruler to inaugurate, as King Humbert I., the new dynastical epoch of the kings of Italy, instead of continuing as Humbert IV. the succession of the kings of Sardinia. Before the commotion caused by the death of Victor Emmanuel had passed away, the decease of Pius IX. (7th February 1878) placed further demands upon Crispi's sagacity and promptitude. Like Victor Emmanuel, Pius IX. had been bound up with the history of the Risorgimento, but, unlike him, had

Crispi.

Deaths of Victor Emmanuel II. and Pius IX.

represented and embodied the anti-national, reactionary spirit. Having once let slip the opportunity which presented itself in 1846–48, of placing the papacy at the head of the unitary movement, he had seen himself driven from Rome, despoiled piecemeal of papal territory, reduced to an attitude of perpetual protest, and finally confined, voluntarily, but still confined, within the walls of the Vatican. Ecclesiastically, he had become the instrument of the triumph of Jesuit influence, and had in turn set his seal upon the dogma of the Immaculate Conception, the Syllabus, and Papal Infallibility. Yet, in spite of all, his jovial disposition and good-humoured cynicism saved him from unpopularity, and rendered his death an occasion of mourning. Notwithstanding the pontiff's bestowal of the apostolic benediction *in articulo mortis* upon Victor Emmanuel, the attitude of the Vatican had remained so inimical as to make it doubtful whether the conclave would be held in Rome. Crispi, whose strong anti-clerical convictions did not prevent him from regarding the papacy as pre-eminently an Italian institution, was determined both to prove to the Catholic world the practical independence of the government of the Church and to retain for Rome so potent a centre of universal attraction as the presence of the future pope. The Sacred College of cardinals having decided to hold the conclave abroad, Crispi assured them of absolute freedom if they remained in Rome, or of protection to the frontier should they migrate, but warned them that, once evacuated, the Vatican would be occupied in the name of the Italian Government and be lost to the Church as headquarters of the papacy. The cardinals thereupon overruled their former decision, and the conclave was held in Rome, the new pope, Cardinal Pecci, being elected on 20th February 1878 without let or hindrance. The Italian Government not only prorogued the Chamber during the conclave to prevent unseemly inquiries or demonstrations on the part of deputies, but by means of Mancini, minister of justice, and Cardinal di Pietro, assured the new pope protection during the settlement of his outstanding personal affairs, an assurance of which Leo XIII., on the evening after his election, took full advantage. At the same time the duke of Aosta, commander of the Rome army corps, ordered the troops to render royal honours to the pontiff should be officially appear in the capital. King Humbert addressed to the pope a letter of congratulation upon his election, and received a courteous reply. The improvement thus signalized in the relations between Quirinal and Vatican was further exemplified on 18th October 1878, when the Italian Government accepted a papal formula with regard to the granting of the royal *exequatur* for bishops, whereby they, upon nomination by the Holy See, recognized state control over, and made application for, the payment of their temporalities.

Leo XIII.

The Depretis–Crispi cabinet did not long survive the opening of the new reign. Crispi's position was shaken by a morally plausible but juridically untenable charge of bigamy, while on 8th March the election of Cairoli, an opponent of the ministry and head of the extremer section of the Left, to the presidency of the Chamber, induced Depretis to tender his resignation to the new king.

Cairoli.

Cairoli succeeded in forming an administration, in which his friend Count Corti, Italian ambassador at Constantinople, accepted the portfolio of foreign affairs, Zanardelli the ministry of the interior, and Seismit Doda the ministry of finance. Though the cabinet had no stable majority, it induced the Chamber to sanction a commercial treaty which had been negotiated with France and a general "autonomous" customs tariff. The commercial treaty was, however, rejected by the French Chamber in June 1878, a circumstance necessitating the application of the Italian general tariff, which implied a 10 to 20 per cent. increase in the duties on the principal French exports. A highly imaginative financial exposition by Seismit Doda, who announced a surplus of £2,400,000, paved the way for a Grist Tax Reduction Bill, which Cairoli had taken over from the Depretis programme. The Chamber, though convinced of the danger of this reform, the perils of which were incisively demonstrated by Sella, voted by an overwhelming majority for an immediate reduction of the impost by one-fourth, and its complete abolition within four years. Cairoli's premiership was, however, destined to be cut short by an attempt made upon the king's life in November 1878, during a royal visit to Naples, by a miscreant named Passanante. In spite of the courage and presence of mind of Cairoli, who received the dagger thrust intended for the king, public and parliamentary indignation found expression in a vote which compelled the ministry to resign.

Though brief, Cairoli's term of office was momentous in regard to foreign affairs. The treaty of San Stefano had led to the convocation of the Berlin Congress, and though Count Corti was by no means ignorant of the rumours concerning secret agreements between Germany, Austria, and Russia, and Germany, Austria, and Great Britain, he scarcely seemed alive to the possible effect of such agreements upon Italy. Replying on 9th April 1878 to interpellations by Visconti Venosta and other deputies on the impending Congress of Berlin, he appeared free from apprehension lest Italy, isolated, might find herself face to face with a change of the balance of power in the Mediterranean, and declared that in the event of serious complications Italy would be "too much sought after rather than too much forgotten." The policy of Italy in the congress, he added, would be to support the interests of the young Balkan nations. Wrapped in this optimism, Count Corti proceeded, as first Italian delegate, to Berlin, where he found himself obliged, on 28th May, to join reluctantly in sanctioning the Austrian occupation of Bosnia and Herzegovina. On 8th July the revelation of the Anglo-Ottoman treaty for the British occupation of Cyprus took the congress by surprise. Italy, who had made the integrity of the Ottoman Empire a cardinal point of her Eastern policy, felt this change of the Mediterranean *status quo* the more severely inasmuch as, in order not to strain her relations with France, she had turned a deaf ear to Austrian, Russian, and German advice to prepare to occupy Tunis in agreement with Great Britain. Count Corti had no suspicion that France had adopted a less disinterested attitude towards similar suggestions from Bismarck and Lord Salisbury. He therefore returned from the German capital with "clean" but empty hands, a plight which found marked disfavour in Italian eyes, and stimulated anti-Austrian Irredentism. Ever since Venetia had been ceded by Austria to the Emperor Napoleon, and by him to Italy, after the war of 1866, secret revolutionary committees had been formed in the northern Italian provinces to prepare for the "redemption" of Trent and Trieste. For twelve years these committees had remained comparatively inactive, but in 1878 the presence of the ex-Garibaldian Cairoli at the head of the Government, and popular dissatisfaction at the spread of Austrian sway on the Adriatic, encouraged them to begin a series of noisy demonstrations. On the evening of the signature at Berlin of the clause sanctioning the Austrian occupation of Bosnia and Herzegovina, an Irredentist riot took place before the Austrian consulate at Venice. The

Italy and the Berlin Congress.

Irredentism.

Italian Government attached little importance to the occurrence, and believed that a diplomatic expression of regret would suffice to allay Austrian irritation. Austria, indeed, might easily have been persuaded to ignore the Irredentist agitation, had not the equivocal attitude of Cairoli and Zanardelli cast doubt upon the sincerity of their regret. The former at Pavia (15th October 1878), and the latter at Arco (3rd November), declared publicly that Irredentist manifestations could not be prevented under existing laws, but gave no hint of introducing any law to sanction their prevention. "Repression, not prevention," became the official formula, the enunciation of which by Cairoli at Pavia caused Count Corti and two other ministers to resign.

The fall of Cairoli, and the formation of a second Depretis cabinet in 1878, brought no substantial change in the attitude of the Government towards Irredentism, nor was the position improved by the return of Cairoli to power in the following July. Though aware of Bismarck's hostility towards Italy, of the conclusion of the Austro-German alliance of 1879, and of the undisguised ill-will of France, Italy not only made no attempt to crush an agitation as mischievous as it was futile, but granted a state funeral to General Avezzana, president of the Irredentist League. In Bonghi's mordant phrase, the foreign policy of Italy during this period may be said to have been characterized by "enormous intellectual impotence counterbalanced by equal moral feebleness." Home affairs were scarcely better managed. Parliament had degenerated into a congeries of personal groups, whose members were eager only to overturn cabinets in order to secure power for the leaders and official favours for themselves. Depretis, who had succeeded Cairoli in December 1878, fell in July 1879, after a vote in which Cairoli and Nicotera joined the Conservative opposition. On 12th July Cairoli formed a new Administration, only to resign on 24th November, and to reconstruct his cabinet with the help of Depretis. The administration of finance was as chaotic as the condition of parliament. The £2,400,000 surplus announced by Seismit Doda proved to be a myth. Nevertheless Magliani, who succeeded Seismit Doda, had neither the perspicacity nor the courage to resist the abolition of the grist tax. The first vote of the Chamber for the immediate diminution of the tax, and for its total abolition on 1st January 1883, had been opposed by the Senate. A second Bill was passed by the Chamber on 18th July 1879, providing for the immediate repeal of the grist tax on minor cereals, and for its total abolition on 1st January 1884. While approving the repeal in regard to minor cereals, the Senate (24th January 1880) again rejected the repeal of the tax on grinding wheat as prejudicial to national finance. After the general election of 1880, however, the Ministeralists, aided by a number of factious Conservatives, passed a third Bill repealing the grist tax on wheat (10th July 1880), the repeal to take effect from 1st January 1884 onwards. The Senate, in which the partizans of the ministry had been increased by numerous appointments *ad hoc*, finally set the seal of its approval upon the measure. Notwithstanding this prospective loss of revenue, parliament showed great reluctance to vote any new impost, although hardly a year previously it had sanctioned (30th June 1879) Depretis's scheme for spending during the next eighteen years £43,200,000 in building 5000 kilometres of railway, an expenditure not wholly justified by the importance of the lines, and useful principally as a source of electoral sops for the constituents of ministerial deputies. The unsatisfactory financial condition of the Florence, Rome, and Naples municipalities necessitated state help, but the Chamber nevertheless proceeded with a light heart (23rd February 1881) to sanction the issue of a foreign loan for £26,000,000, with a view to the abolition of the forced currency, thus adding to the burdens of the exchequer a load which three years later again dragged Italy into the gulf of chronic deficit.

Finance.

In no modern country is error or incompetence on the part of administrators more swiftly followed by retribution than in Italy; both at home and abroad she is hemmed in by political and economic conditions which leave little margin for folly, and still less for "mental and moral insufficiency" such as had been displayed by the Left. Nemesis came in the spring of 1881, in the form of the French invasion of Tunis. Guiccioli, the biographer of Sella, observes that Italian politicians find it especially hard to resist "the temptation of appearing crafty." The men of the Left believed themselves subtle enough to retain the confidence and esteem of all foreign Powers while coquetting at home with elements which some of these Powers had reason to regard with suspicion. Italy, in constant danger from France, needed good relations with Austria and Germany, but could only attain the goodwill of the former by firm treatment of the revolutionary Irredentist agitation, and of the latter by clear demonstration of Italian will and ability to cope with all anti-monarchical forces. Depretis and Cairoli did neither the one nor the other. Hence, when opportunity offered firmly to establish Italian predominance in the central Mediterranean by an occupation of Tunis, they found themselves deprived of those confidential relations with the central Powers, and even with Great Britain, which might have enabled them to use the opportunity to full advantage. The conduct of Italy in declining the suggestions received from Count Andrassy and General Ignatieff on the eve of the Russo-Turkish war—that Italy should seek compensation in Tunis for the extension of Austrian sway in the Balkans—and in subsequently rejecting the German suggestion to come to an arrangement with Great Britain for the occupation of Tunis as compensation for the British occupation of Cyprus, was certainly due to fear lest an attempt on Tunis should lead to a war with France, for which Italy knew herself to be totally unprepared. This very unpreparedness, however, rendered still less excusable her treatment of the Irredentist agitation, which brought her within a hair's-breadth of a conflict with Austria. Although Cairoli, upon learning of the Anglo-Ottoman convention in regard to Cyprus, had advised Count Corti of the possibility that Great Britain might seek to placate France by conniving at a French occupation of Tunis, neither he nor Count Corti had any inkling of the verbal arrangement made between Lord Salisbury and M. Waddington at the instance of Bismarck, that, when convenient, France should occupy Tunis, an agreement afterwards confirmed (with a reserve as to the eventual attitude of Italy) in despatches exchanged in July and August 1878 between the Quai d'Orsay and Downing Street. Almost up to the moment of the French occupation of Tunis the Italian Government believed that Great Britain, if only out of gratitude for the bearing of Italy in connexion with the Dulcigno demonstration in the autumn of 1880, would prevent French acquisition of the Regency. Ignorant of the assurance conveyed to France by Lord Granville that the Gladstone cabinet would respect the engagements of the Beaconsfield–Salisbury administration, Cairoli, in deference to Italian public opinion, endeavoured to neutralize the activity of the French consul Roustan by the appointment of an equally energetic Italian consul, Signor Macciò. The rivalry between these two officials in Tunis contributed not a little to strain

Tunis.

Franco-Italian relations, but it is doubtful whether France would have precipitated her action had not General Menabrea, Italian ambassador in London, urged his Government to purchase the Tunis–Goletta railway from the English company by which it had been constructed. A French attempt to purchase the line was upset in the English courts, and the railway was finally secured by Italy at a price more than eight times its real value. This pertinacity engendered a belief in France that Italy was about to undertake in Tunis a more aggressive policy than necessary for the protection of her commercial interests. M. Roustan therefore hastened to extort from the bey concessions calculated to neutralize the advantages which Italy had hoped to secure by the possession of the Tunis–Goletta line, and at the same time the French Government prepared at Toulon an expeditionary corps for the occupation of the Regency. In the spring of 1881 the Kroumir tribe was reported to have attacked a French force on the Algerian border, and on 9th April M. Roustan informed the bey of Tunis that France would chastise the assailants. The bey issued futile protests to the Powers. On 26th April the island of Tabarca was occupied by the French, Biserta was seized on 2nd May, and on 12th May the bey signed the treaty of Bardo accepting the French protectorate. France undertook the maintenance of order in the Regency, and assumed the representation of Tunis in all dealings with other countries.

Italian indignation at the French *coup de main* was the deeper on account of the apparent duplicity of the Government of the Republic. On 11th May the French foreign minister, M. Barthélémy de Saint Hilaire, had officially assured the Italian ambassador in Paris that France "had no thought of occupying Tunis or any part of Tunisian territory, beyond some points of the Kroumir country." This assurance, dictated by M. Jules Ferry to M. de Saint Hilaire in the presence of the Italian ambassador, and by him telegraphed *en clair* to Rome, was considered a binding pledge that France would not materially alter the *status quo* in Tunis. Documents subsequently published have somewhat attenuated the responsibility of M. Ferry and M. de Saint Hilaire for this breach of faith, and have shown that the French forces in Tunis acted upon secret instructions from General Farre, minister of war in the Ferry cabinet, who pursued a policy diametrically opposed to the official declarations made by the premier and the foreign minister. Even had this circumstance been known at the time, it could scarcely have mitigated the intense resentment of the whole Italian nation at an event which was considered tantamount not only to the destruction of Italian aspirations to Tunis, but to the ruin of the interests of the numerous Italian colony and to a constant menace against the security of the Sicilian and south Italian coasts.

Had the blow thus struck at Italian influence in the Mediterranean induced politicians to sink for a while their personal differences and to unite in presenting a firm front to foreign nations, the crisis in regard to Tunis might not have been wholly unproductive of good. Unfortunately, on this, as on other critical occasions, deputies proved themselves incapable of common effort to promote general welfare. While excitement over Tunis was at its height, but before the situation was irretrievably compromised to the disadvantage of Italy, Cairoli had been compelled to resign by a vote of want of confidence in the Chamber. The only politician capable of dealing adequately with the situation was Sella, leader of the Right, and to him the crown appealed. The faction leaders of the Left, though divided by personal jealousies and mutually incompatible ambitions, agreed that the worst evil which could befall Italy would be the return of the Right to power, and conspired to preclude the possibility of a Sella cabinet. An attempt by Depretis to recompose the Cairoli ministry proved fruitless, and after eleven precious days had been lost, King Humbert was obliged, on 19th April 1881, to refuse Cairoli's resignation. The conclusion of the treaty of Bardo on 12th May, however, compelled Cairoli to sacrifice himself to popular indignation. Again Sella was called upon, but again the dog-in-the-manger policy of Depretis, Cairoli, Nicotera, and Baccarini, in conjunction with the intolerant attitude of some extreme Conservatives, proved fatal to his endeavours. Depretis then succeeded in recomposing the Cairoli cabinet without Cairoli, Mancini being placed at the Foreign Office. Except in regard to an increase of the army estimates, urgently demanded by public opinion, the new ministry had practically no programme. Public opinion was further irritated against France by the massacre of some Italian workmen at Marseilles on the occasion of the return of the French expedition from Tunis, and Depretis, in response to public feeling, found himself obliged to mobilize a part of the militia for military exercises. In this condition of home and foreign affairs occurred disorders at Rome in connexion with the transfer of the remains of Pius IX. from St Peter's to the basilica of San Lorenzo. Most of the responsibility lay with the Vatican, which had arranged the procession in the way best calculated to irritate Italian feeling, but little excuse can be offered for the failure of the Italian authorities to maintain public order. In conjunction with the occupation of Tunis, the effect of these disorders was to exhibit Italy as a country powerless to defend its interests abroad or to keep peace at home. The scandal and the pressure of foreign Catholic opinion compelled Depretis to pursue a more energetic policy, and to publish a formal declaration of the intangibility of the Law of Guarantees.

Growth of the Triple Alliance.

Meanwhile a conviction was spreading that the only way of escape from the dangerous isolation of Italy lay in closer agreement with Austria and Germany. Depretis tardily recognized the need for such agreement, if only to remove the "coldness and invincible diffidence" which, by subsequent confession of Mancini, then characterized the attitude of the central Powers; but he was opposed to any formal alliance, lest it might arouse French resentment, while the new Franco-Italian treaty was still unconcluded, and the foreign loan for the abolition of the forced currency had still to be floated. He, indeed, was not disposed to concede to public opinion anything beyond an increase of the army, a measure insistently demanded by Garibaldi and the Left. The Right likewise desired to strengthen both army and navy, but advocated cordial relations with Berlin and Vienna as a guarantee against French domineering, and as a pledge that Italy would be vouchsafed time to effect her armaments without disturbing financial equilibrium. The Right also hoped that closer accord with Germany and Austria would compel Italy to conform her home policy more nearly to the principles of order prevailing in those empires. More resolute than Right or Left was the Centre, a small group led by Sidney Sonnino, a young politician of unusual fibre, which sought in the press and in parliament to spread a conviction that the only sound basis for Italian policy would be close alliance with the central Powers and a friendly understanding with Great Britain in regard to Mediterranean affairs. The principal Italian public men were divided in opinion on the subject of an alliance. Peruzzi, Lanza, and Bonghi pleaded for equal friendship with all Powers, and especially with France; Crispi, Minghetti, Cadorna, and others, including Blanc, secretary-general to the Foreign

Office, openly favoured a pro-Austrian policy. Austria and Germany, however, scarcely reciprocated these dispositions. The Irredentist agitation had left profound traces at Berlin as well as at Vienna, and had given rise to a distrust of Depretis which nothing had yet occurred to allay. Nor, in view of the comparative weakness of Italian armaments, could eagerness to find an ally be deemed conclusive proof of the value of Italian friendship. Count di Robilant, Italian ambassador at Vienna, warned his Government not to yield too readily to pro-Austrian pressure, lest the dignity of Italy be compromised or her desire for an alliance be granted on onerous terms. Mancini, foreign minister, who was as anxious as Depretis for the conclusion of the Franco-Italian commercial treaty, gladly followed this advice, and limited his efforts to the maintenance of correct diplomatic relations with the central Powers. Except in regard to the Roman question, the advantages and disadvantages of an Italian alliance with Austria and Germany counterbalanced each other. A *rapprochement* with France and a continuance of the Irredentist movement could not fail to arouse Austro-German hostility; but, on the other hand, to draw near to the central Powers would inevitably accentuate the diffidence of France. In the one hypothesis, as in the other, Italy could count upon the moral support of Great Britain, but could not make of British friendship the keystone of a Continental policy. Apart from resentment against France on account of Tunis, there remained the question of the temporal power of the pope to turn the scale in favour of Austria and Germany. Danger of foreign interference in the relations between Italy and the papacy had never been so great since the Italian occupation of Rome as when, in the summer of 1881, the disorders during the transfer of the remains of Pius IX. had lent an unwonted ring of plausibility to the papal complaint concerning the "miserable" position of the Holy See. Bismarck at that moment had entered upon his pilgrimage to Canossa, and was anxious to obtain from the Vatican the support of German Catholics. What resistance could Italy have offered had the German chancellor, seconded by Austria, and assuredly supported by France, called upon Italy to revise the Law of Guarantees in conformity with Catholic exigencies, or had he taken the initiative of making papal independence the subject of an international conference? Friendship and alliance with Catholic Austria and powerful Germany could alone lay this spectre. This was the only immediate advantage Italy could hope to obtain by drawing nearer the central Powers.

The political conditions of Europe favoured the realization of Italian desires. Growing rivalry between Austria and Russia in the Balkans rendered the continuance of the "League of the Three Emperors" a practical impossibility. The Austro-German alliance of 1879 formally guaranteed the territory of the contracting parties, but Austria could not count upon effectual help from Germany in case of war, since Russian attack upon Austria would certainly have been followed by French attack upon Germany. As in 1869–70, it therefore became a matter of the highest importance for Austria to retain full disposal of all her troops by assuring herself against Italian aggression. The Tsar, Alexander III., under the impression of the assassination of his father, desired, however, the renewal of the *Dreikaiserbund*, both as a guarantee of European peace and as a conservative league against revolutionary parties. The German emperor shared this desire, but Bismarck and the Austrian emperor wished to substitute for the imperial league some more advantageous combination. Hence a tacit understanding between Bismarck and Austria that the latter should profit by Italian resentment against France to draw Italy into the orbit of the Austro-German alliance. For the moment Germany was to hold aloof lest any active initiative on her part should displease the Vatican, of whose help Bismarck stood in need.

At the beginning of August 1881 the Austrian press mooted the idea of a visit from King Humbert to the Emperor Francis Joseph. Count di Robilant, anxious that Italy should not seem to beg a smile from the central Powers, advised Mancini to receive with caution the suggestions of the Austrian press. Depretis took occasion to deny, in a form scarcely courteous, the probability of the visit. Robilant's opposition to a precipitate acceptance of the Austrian hint was founded upon fear lest King Humbert at Vienna might be pressed to disavow Irredentist aspirations, and upon a desire to arrange for a visit of the Emperor Francis Joseph to Rome in return for King Humbert's visit to Vienna. Seeing the hesitation of the Italian Government, the Austrian and German semi-official press redoubled their efforts to bring about the visit. By the end of September the idea had gained such ground in Italy that the visit was practically settled, and on 7th October Mancini informed Robilant (who was then in Italy) of the fact. Though he considered such precipitation impolitic, Robilant, finding that confidential information of Italian intentions had already been conveyed to the Austrian Government, sought an interview with King Humbert, and on 17th October started for Vienna to settle the conditions of the visit. Depretis, fearing to jeopardize the impending conclusion of the Franco-Italian commercial treaty, would have preferred the visit to take the form of an act of personal courtesy between sovereigns. The Austrian Government, for its part, desired that the king should be accompanied by Depretis, though not by Mancini, lest the presence of the Italian foreign minister should lend to the occasion too marked a political character. Mancini, unable to brook exclusion, insisted, however, upon accompanying the king. King Humbert with Queen Margherita reached Vienna on the morning of 27th October, and stayed at the Hofburg until 31st October. The visit was marked by the greatest cordiality, Count Robilant's fears of inopportune pressure with regard to Irredentism proving groundless. Both in Germany and Austria the visit was construed as a preliminary to the adhesion of Italy to the Austro-German alliance. Count Hatzfeldt, on behalf of the German Foreign Office, informed the Italian ambassador in Berlin that whatever was done at Vienna would be regarded as having been done in the German capital. Nor did nascent irritation in France prevent the conclusion of the Franco-Italian commercial treaty, which was signed at Paris on 3rd November.

In Italy public opinion as a whole was favourable to the visit, especially as it was not considered an obstacle to the projected increase of the army and navy. Doubts, however, soon sprang up as to its effect upon the minds of Austrian statesmen, since on 8th November the language employed by Baron de Kallay and Count Andrassy to the Hungarian delegations on the subject of Irredentism was scarcely calculated to soothe Italian susceptibilities. But on 9th November the European situation was suddenly modified by the formation of the Gambetta cabinet, and, in view of the policy of revenge with which Gambetta was supposed to be identified, it became imperative for Bismarck to assure himself that Italy would not be enticed into a Francophil attitude by any concession Gambetta might offer. As usual when dealing with weaker nations, the German chancellor resorted to intimidation. He not only re-established the Prussian legation to the Vatican, suppressed since 1874, and omitted from the imperial

message to the Reichstag (17th November 1881) all reference to King Humbert's visit to Vienna, but took occasion on 29th November to refer to Italy as a country tottering on the verge of revolution, and opened in the German semi-official press a campaign in favour of an international guarantee for the independence of the papacy. These manœuvres produced their effect upon Italian public opinion. In the long and important debate upon foreign policy in the Italian Chamber of Deputies (6th to 9th December) the fear was repeatedly expressed lest Bismarck should seek to purchase the support of German Catholics by raising the Roman question. Mancini, still unwilling frankly to adhere to the Austro-German alliance, found his policy of "friendship all round" impeded by Gambetta's uncompromising attitude in regard to Tunis. Bismarck nevertheless continued his press campaign in favour of the temporal power until, reassured by Gambetta's decision to send M. Roustan back to Tunis to complete as minister the anti-Italian programme begun as consul, he finally instructed his organs to emphasize the common interests of Germany and Italy on the occasion of the opening of the St Gothard tunnel. But the effect of the German press campaign could not be effaced in a day. At the new year's reception of deputies King Humbert aroused enthusiasm by a significant remark that Italy intended to remain "mistress in her own house"; while Mancini addressed to Count de Launay, Italian ambassador in Berlin, a haughty despatch, repudiating the supposition that the pope might (as Bismarckian emissaries had suggested to the Vatican) obtain abroad greater spiritual liberty than in Rome, or that closer relations between Italy and Germany, such as were required by the interests and aspirations of the two countries, could be made in any way contingent upon a modification of Italian freedom of action in regard to home affairs.

The sudden fall of Gambetta (26th January 1882) having removed the fear of immediate European complications, the cabinets of Berlin and Vienna again displayed diffidence towards Italy. So great was Bismarck's distrust of Italian parliamentary instability, his doubts of Italian capacity for offensive warfare, and his fear of the Francophil tendencies of Depretis, that for many weeks the Italian ambassador at Berlin was unable to obtain audience of the chancellor. But for the Tunisian question Italy might again have been drawn into the wake of France. Mancini tried to impede the organization of French rule in the Regency by refusing to recognize the treaty of Bardo, yet so careless was Bismarck of Italian susceptibilities, that he instructed the German consul at Tunis to recognize French decrees. Partly under the influence of these circumstances, and partly in response to persuasion by Baron Blanc, secretary-general for foreign affairs, Mancini instructed Count di Robilant to open negotiations for an Italo-Austrian alliance—instructions which Robilant neglected until questioned by Count Kalnoky on the subject. The first exchange of ideas between the two Governments proved fruitless, since Kalnoky, somewhat Clerically-minded, was averse from guaranteeing the integrity of all Italian territory, and Mancini was equally unwilling to guarantee to Austria permanent possession of Trent and Trieste. Mancini, moreover, wished the treaty of alliance to provide for reciprocal protection of the chief interests of the contracting Powers, Italy undertaking to second Austria-Hungary in the Balkans, and Austria and Germany pledging themselves to support Italy in Mediterranean questions. Without some such proviso Italy would, in Mancini's opinion, be exposed single-handed to French resentment. At the request of Kalnoky, Mancini defined his proposal in a memorandum, but the illness of himself and Depretis, combined with an untoward discussion in the Italian press on the failure of the Austrian emperor to return in Rome King Humbert's visit to Vienna, caused negotiations to drag. The pope, it transpired, had refused to receive the emperor if he came to Rome on a visit to the Quirinal, and Francis Joseph, though anxious to return King Humbert's visit, was unable to offend the feelings of his Catholic subjects. Meanwhile (11th May 1882) the Italian parliament adopted the new Army Bill, involving a special credit of £5,100,000 for the creation of two new army corps, by which the war footing of the regular army was raised to nearly 850,000 men and the ordinary military estimates to £8,000,000 per annum. Garibaldi, who, since the French occupation of Tunis, had ardently worked for the increase of the army, had thus the satisfaction of seeing his desire realized before his death at Caprera, on 2nd June 1882. "In spirit a child, in character a man of classic mould," Garibaldi had remained the nation's idol, an almost legendary hero whose place none could aspire to fill. Gratitude for his achievements and sorrow for his death found expression in universal mourning wherein king and peasant equally joined. Before his death, and almost contemporaneously with the passing of the Army Bill, negotiations for the alliance were renewed. Encouraged from Berlin, Kalnoky agreed to the reciprocal territorial guarantee, but declined reciprocity in support of special interests. Mancini had therefore to be content with a declaration that the allies would act in mutually friendly intelligence. Depretis made some opposition, but finally acquiesced, and the treaty of triple alliance was signed on 20th May 1882, five days after the promulgation of the Franco-Italian commercial treaty in Paris. Though partial revelations have been made, the exact tenor of the treaty of triple alliance has never been divulged. It is known to have been concluded for a period of five years, to have pledged the contracting parties to join in resisting attack upon the territory of any one of them, and to have specified the military disposition to be adopted by each in case attack should come either from France, or from Russia, or from both simultaneously. The Italian General Staff is said to have undertaken, in the event of war against France, to operate with two armies on the north-western frontier against the French armée des Alpes, of which the war strength is about 250,000 men. A third Italian army would, if expedient, pass into Germany, to operate against either France or Russia. Austria undertook to guard the Adriatic on land and sea, and to help Germany by checkmating Russia on land. Germany would be sufficiently employed in carrying on war against two fronts. Kalnoky desired that both the terms of the treaty and the fact of its conclusion should remain secret, but Bismarck and Mancini hastened to hint at its existence, the former in the Reichstag on 12th June 1882, and the latter in the Italian semi-official press. A revival of Irredentism in connexion with the execution of an Austrian deserter named Oberdank, who after escaping into Italy endeavoured to return to Austria with explosive bombs in his possession, and the cordial references to France made by Depretis at Stradella (8th October 1882), prevented the French Government from suspecting the existence of the alliance, or from ceasing to strive after a Franco-Italian understanding. Suspicion was not aroused until March 1883, when Mancini, in defending himself against strictures upon his refusal to co-operate with Great Britain in Egypt, practically revealed the existence of the treaty, thereby irritating France and destroying Depretis's secret hope of finding in the triple alliance the advantage of an Austro-German guarantee without the disadvantage of French enmity. In Italy the revelation

Death of Garibaldi.

Signature of the Treaty, 1882.

of the treaty was hailed with satisfaction except by the Clericals, who were enraged at the blow thus struck at the restoration of the pope's temporal power, and by the Radicals, who feared both the inevitable breach with republican France and the reinforcement of Italian constitutional parties by intimacy with strong monarchical states such as Germany and Austria. These very considerations naturally combined to recommend the fact to constitutionalists, who saw in it, besides the territorial guarantee, the elimination of the danger of foreign interference in the relations between Italy and the Vatican, such as Bismarck had recently threatened and such as France was believed ready to propose.

Nevertheless, during its first period (1882–87) the triple alliance failed to ensure cordiality between the contracting Powers. Mancini exerted himself in a hundred ways to soothe French resentment. He not only refused to join Great Britain in the Egyptian expedition, but agreed to suspend Italian consular jurisdiction in Tunis, and deprecated suspicion of French designs upon Morocco. His efforts were worse than futile. France remained cold, while Bismarck and Kalnoky, distrustful of the Radicalism of Depretis and Mancini, assumed towards their ally an attitude almost hostile. Possibly Germany and Austria may have been influenced by the secret treaty signed between Austria, Germany, and Russia on 21st March 1884, and ratified during the meeting of the three emperors at Skiernewice in September of that year, by which Bismarck, in return for "honest brokerage" in the Balkans, is understood to have obtained from Austria and Russia a promise of benevolent neutrality in case Germany should be "forced" to make war upon a fourth Power—France. Guaranteed thus against Russian attack, Italy became in the eyes of the central Powers a negligible quantity, and was treated accordingly. Though kept in the dark as to the Skiernewice arrangement, the Italian Government soon discovered from the course of events that the triple alliance had practically lost its object, European peace having been assured without Italian cooperation. Meanwhile France provided Italy with fresh cause for uneasiness by abating her hostility to Germany. Italy in consequence drew nearer to Great Britain, and at the London conference on the Egyptian financial question sided with Great Britain against Austria and Germany. At the same time negotiations took place with Great Britain for an Italian occupation of Massawa, and Mancini, dreaming of a vast Anglo-Italian enterprise against the Mahdi, expatiated in the spring of 1885 upon the glories of an Anglo-Italian alliance, an indiscretion which drew upon him a scarcely-veiled *démenti* from London. Again speaking in the Chamber, Mancini claimed for Italy the principal merit in the conclusion of the triple alliance, but declared that the alliance left Italy full liberty of action in regard to interests outside its scope, "especially as there was no possibility of obtaining protection for such interests from those who by the alliance had not undertaken to protect them." These words, which revealed the absence of any stipulation in regard to the protection of Italian interests in the Mediterranean, created lively dissatisfaction in Italy and corresponding satisfaction in France. They hastened Mancini's downfall (17th June 1885), and prepared the advent of Count di Robilant, who three months later succeeded Mancini at the Italian Foreign Office. Robilant, for whom the Skiernewice pact was no secret, followed a firmly independent policy throughout the Bulgarian crisis of 1885–86, declining to be drawn into any action beyond that required by the treaty of Berlin and the protection of Italian interests in the Balkans. Italy, indeed, came out of the Eastern crisis with enhanced prestige and with her relations to Austria greatly improved. Towards Prince Bismarck Robilant maintained an attitude of dignified independence, and as, in the spring of 1886, the moment for the renewal of the triple alliance drew near, he profited by the development of the Bulgarian crisis and the threatened Franco-Russian understanding to secure from the central Powers "something more" than the bare territorial guarantee of the original treaty. This "something more" consisted, at least in part, of the arrangement, with the help of Austria and Germany, of an Anglo-Italian naval understanding having special reference to the Eastern question, but providing for common action by the British and Italian fleets in the Mediterranean in case of war. A vote of the Italian Chamber on 4th February 1887, in connexion with the disaster to Italian troops at Dogali, in Abyssinia, brought about the resignation of the Depretis–Robilant cabinet. The crisis dragged for three months, and before its definitive solution by the formation of a Depretis–Crispi ministry, Robilant succeeded (17th March 1887) in renewing the triple alliance on terms more favourable to Italy than those obtained in 1882. Not only did he secure concessions from Austria and Germany corresponding in some degree to the improved state of the Italian army and navy, but, in virtue of the Anglo-Italian understanding, assured the practical adhesion of Great Britain to the European policy of the central Powers, a triumph probably greater than any registered by Italian diplomacy since the completion of national unity.

First renewal of the Triple Alliance.

The period between May 1881 and July 1887 occupied, in the region of foreign affairs, by the negotiation, conclusion, and renewal of the triple alliance, by the Bulgarian crisis, and by the dawn of an Italian colonial policy, was marked at home by urgent political and economic problems, and by the parliamentary phenomena known as *trasformismo*. On 29th June 1881 the Chamber adopted a Franchise Reform Bill, which increased the electorate from 600,000 to 2,000,000 by lowering the fiscal qualification from 40 to 19·80 lire in direct taxation, and by extending the suffrage to all persons who had passed through the two lower standards of the elementary schools, and practically to all persons able to read and write. The immediate result of the reform was to increase the political influence of large cities where the proportion of illiterate workmen was lower than in the country districts, and to exclude from the franchise numbers of peasants and small proprietors who, though of more conservative temperament and of better economic position than the artizan population of the large towns, were often unable to fulfil the scholarship qualification. On 12th April 1883 the forced currency was formally abolished by the resumption of treasury payments in gold with funds obtained through a loan of £14,500,000 issued in London on 5th May 1882. Owing to the hostility of the French market, the loan was covered with difficulty, and, though the gold premium fell and commercial exchanges were temporarily facilitated by the resumption of cash payments, it is doubtful whether these advantages made up for the burden of £640,000 additional annual interest thrown upon the exchequer. On 6th March 1885 parliament finally sanctioned the conventions by which state railways were farmed out to three private companies—the Mediterranean, Adriatic, and Sicilian. The railways redeemed in 1875–76 had been worked in the interval by the Government at a heavy loss. A commission of inquiry reported in favour of private management. The conventions, concluded for a period of sixty years, but terminable by either party

Internal reforms.

after twenty or forty years, retained for the state the possession of the lines, but sold rolling stock to the companies, arranged various schedules of state subsidy for lines projected or in course of construction, guaranteed interest on the bonds of the companies, and arranged for the division of revenue between the companies, the reserve fund, and the state. National control of the railways was secured by a proviso that the directors must be of Italian nationality. Depretis and his colleague Genala, minister of public works, experienced great difficulty in securing parliamentary sanction for the conventions, not so much on account of their defective character, as from the opposition of local interests anxious to extort new lines from the Government. In fact, the conventions were only voted by a majority of twenty-three votes after the Government had undertaken to increase the length of new state-built lines from 1500 to 2500 kilometres. Unfortunately, the calculation of probable railway revenue on which the conventions had been based proved to be enormously exaggerated. For many years the 37½ per cent. of the gross revenue (less the cost of maintaining the rolling stock, incumbent on the state) scarcely sufficed to pay the interest on debts incurred for railway construction and on the guaranteed bonds. A competent German authority has calculated that, on the whole, railways have cost Italian taxpayers £8,000,000 a year. Gradually the increase of traffic consequent upon the industrial development of Italy has decreased the annual losses of the state, but the position of the Government in regard to the railways still remains so unsatisfactory that the basis of the conventions will probably be radically altered on the expiration of the first period of twenty years in 1905.

The railway conventions.

Intimately bound up with the forced currency, the railway conventions, and public works was the financial question in general. From 1876, when equilibrium between expenditure and revenue had first been attained, taxation yielded steady annual surpluses, which in 1881 reached the satisfactory level of £2,120,000. The gradual abolition of the grist tax on minor cereals diminished the surplus in 1882 to £236,000, and in 1883 to £110,000, while the total repeal of the grist tax on wheat, which took effect on 1st January 1884, coincided with the opening of a new and disastrous period of deficit. True, the repeal of the grist tax was not the only, nor possibly even the principal, cause of the deficit. The policy of "fiscal transformation" inaugurated by the Left increased revenue from indirect taxation from £17,000,000 in 1876 to more than £24,000,000 in 1887, by substituting heavy corn duties for the grist tax, and by raising the sugar and petroleum duties to unprecedented levels. But partly from lack of firm financial administration, partly through the increase of military and naval expenditure (which in 1887 amounted to £9,000,000 for the army, while special efforts were made to strengthen the navy), and principally through the constant drain of railway construction and public works, the demands upon the exchequer grew largely to exceed the normal increase of revenue, and necessitated the contraction of new debts. In their anxiety to remain in office Depretis and the Finance Minister, Magliani, never hesitated to mortgage the financial future of their country. No concession could be denied to deputies, or groups of deputies, whose support was indispensable to the life of the cabinet, nor, under such conditions, was it possible to place any effective check upon administrative abuses in which politicians or their electors were interested. Railways, roads, and harbours which contractors had undertaken to construct for reasonable amounts were frequently made to cost thrice the original estimates. Minghetti, in a trenchant exposure of the parliamentary condition of Italy during this period, cites a case in which a credit for certain public works was, during a debate in the Chamber, increased by the Government from £6,600,000 to £9,000,000 in order to conciliate local political interests. In the spring of 1887 Genala, minister of public works, was taken to task for having sanctioned expenditure of £80,000,000 on railway construction while only £40,000,000 had been included in the estimates. As most of these credits were spread over a series of years, succeeding Administrations found their financial liberty of action destroyed, and were obliged to cover deficit by constant issues of consolidated stock. Thus the deficit of £940,000 for the financial year 1885–86 rose to nearly £2,920,000 in 1887–88, and in 1888–89 attained the terrible level of £9,400,000.

Finance.

Nevertheless, in spite of many and serious shortcomings, the long series of Depretis administrations was marked by the adoption of some useful measures. Besides the realization of the formal programme of the Left, consisting of the repeal of the grist tax, the abolition of the forced currency, the extension of the suffrage, and the development of the railway system, Depretis laid the foundation for land tax re-assessment by introducing a new cadastral survey. Unfortunately, the new survey was made largely optional, so that provinces which had reason to hope for a diminution of land tax under a revised assessment hastened to complete their survey, while others, in which the average of the land tax was, and is, below a normal assessment, have neglected to comply with the provisions of the scheme. Hence, pending compulsory completion of the survey, the Land Tax Equalization Bill has resulted in loss to the exchequer. An important undertaking, known as the Agricultural Inquiry, brought to light vast quantities of information valuable for future agrarian legislation. The year 1885 saw the introduction and adoption of a measure embodying the principle of employers' liability for accidents to workmen, a principle subsequently extended and more equitably defined in the spring of 1899. An effort to encourage the development of the mercantile marine was made in the same year, and a convention was concluded with the chief lines of passenger steamers to retain their fastest vessels as auxiliaries to the fleet in case of war. Sanitation and public hygiene received a potent impulse from the cholera epidemic of 1884, many of the unhealthiest quarters in Naples and other cities being demolished and rebuilt, with funds chiefly furnished by the state. The movement was strongly supported by King Humbert, whose intrepidity in visiting the most dangerous spots at Busca and Naples while the epidemic was at its height, reassuring the panic-stricken inhabitants by his presence, excited the enthusiasm of his people and the admiration of Europe.

During the accomplishment of these and other reforms the condition of parliament underwent profound change. By degrees the Administrations of the Left had ceased to rely solely upon the Liberal sections of the Chamber, and had carried their most important Bills with the help of the Right. This process of transformation was not exclusively the work of Depretis, but had been initiated as early as 1873, when a portion of the Right under Minghetti had, by joining the Left, overturned the Lanza–Sella cabinet. In 1876 Minghetti himself had fallen a victim to a similar defection of Conservative deputies. The practical annihilation of the old Right in the elections of 1876 opened a new parliamentary era. Reduced in number to less than one hundred, and radically changed in spirit and composition, the Right gave way, if not to despair, at least to a despondency unsuited to an

"Trasformismo."

opposition party. Though on more than one occasion personal rancour against the men of the Moderate Left prevented the Right from following Sella's advice and regaining, by timely coalition with cognate parliamentary elements, a portion of its former influence, the bulk of the party, with singular inconsistency, drew nearer and nearer to the Liberal cabinets. The process was accelerated by Sella's illness and death (14th March 1884), an event which cast profound discouragement over the more thoughtful of the Conservatives and Moderate Liberals, by whom Sella had been regarded as a supreme political reserve, as a statesman whose experienced vigour and patriotic sagacity might have been trusted to lift Italy from any depth of folly or misfortune. By a strange anomaly the Radical measures brought forward by the Left diminished instead of increasing the distance between it and the Conservatives. Numerically insufficient to reject such measures, and lacking the fibre and the cohesion necessary for the pursuance of a far-sighted policy, the Right thought prudent not to employ its strength in uncompromising opposition, but rather, by supporting the Government, to endeavour to modify Radical legislation in a Conservative sense. In every case the calculation proved fallacious. Radical measures were passed unmodified, and the Right was compelled sadly to accept the accomplished fact. Thus it was with the abolition of the grist tax, the reform of the suffrage, the railway conventions, and many other Bills. When, in course of time, the extended suffrage increased the Republican and Extreme Radical elements in the Chamber, and the Liberal "Pentarchy" (composed of Crispi, Cairoli, Nicotera, Zanardelli, and Baccarini) assumed an attitude of bitter hostility to Depretis, the Right, obeying the impulse of Minghetti, rallied openly to Depretis, lending him aid without which his prolonged term of office would have been impossible. The result was parliamentary chaos, baptized *trasformismo*. In May 1883 this process received official recognition by the elimination of the Radicals Zanardelli and Baccarini from the Depretis cabinet, while in the course of 1884 a Conservative, Signor Biancheri, was elected to the presidency of the Chamber, and another Conservative, General Ricotti, appointed to the War Office. Though Depretis, at the end of his life in 1887, showed signs of repenting of the confusion thus created, he had established a parliamentary system destined largely to sterilize and vitiate the political life of Italy.

Colonial policy.

Contemporaneously with the vicissitudes of home and foreign policy under the Left there grew up in Italy a marked tendency towards colonial enterprise. The tendency itself dated from 1869, when a congress of the Italian chambers of commerce at Genoa had urged the Lanza cabinet to establish a commercial depôt on the Red Sea. On 11th March 1870 an Italian shipper, Signor Rubattino, had bought the bay of Assab, with the neighbouring island of Darmakieh, from the local Sultan Berehan for £1880, the funds being furnished by the Government. In consequence of this purchase an exchange of despatches had taken place in 1871 between the Italian foreign minister, Visconti Venosta, and the Egyptian Government, the latter being unwilling to recognize the sovereignty of Berehan over Assab or his right to sell territory to a foreign Power. So decided was Egyptian opposition that Visconti Venosta thought it opportune not to occupy Assab, but to allow the question to slumber. No further step was taken until, at the end of 1879, Rubattino prepared to establish a commercial station at Assab. The British Government made inquiry as to his intentions, and on 19th April 1880 received a formal undertaking from Cairoli that Assab would never be fortified nor be made a military establishment. Meanwhile (January 1880) stores and materials were landed, and Assab was permanently occupied. Eighteen months later a party of Italian sailors and explorers under Lieutenant Biglieri and Signor Giulietti were massacred in Egyptian territory. Egypt, however, refused to make thorough inquiry into the massacre, and was only prevented from occupying Raheita and coming into conflict with Italy by the good offices of Lord Granville, who dissuaded the Egyptian Government from enforcing its sovereignty. On 20th September 1881 Berehan formally accepted Italian protection, and in the following February an Anglo-Italian convention established the Italian title to Assab on condition that Italy should formally recognize the suzerainty of the Porte and of the khedive over the Red Sea coast, and should prevent the transport of arms and munitions of war through the territory of Assab. This convention was never recognized by the Porte nor by the Egyptian Government. A month later (10th March 1882) Rubattino made over his establishment to the Italian Government, and on 12th June the Chamber adopted a Bill constituting Assab an Italian crown colony.

The Egyptian Question.

Within four weeks of the adoption of this Bill the bombardment of Alexandria by the British fleet (11th July 1882) opened an era destined profoundly to affect the colonial position of Italy. The revolt of Arabi Pasha (September 1881) had led to the meeting of an ambassadorial conference at Constantinople under the presidency of the Italian ambassador, Count Corti. The conference had been promoted by Mancini, Italian minister for foreign affairs, in the hope of preventing European intervention in Egypt and the permanent establishment of an Anglo-French condominium to the detriment of Italian influence. Prior to the meeting of the conference Italy had proposed to the Powers that a mandate be conferred upon Turkey to intervene in the Egyptian crisis, and the Porte hastened to despatch to Cairo a high commissioner, Dervish Pasha, whose arrival at Cairo led to the sanguinary riots of 11th June 1882. At the opening of the conference (23rd June 1882) Italy secured the signature of a self-denying protocol whereby all the great Powers undertook to avoid isolated action in their own individual interests; but the rapid development of the crisis in Egypt, and the refusal of France to co-operate with Great Britain in the restoration of order, necessitated vigorous action by the latter alone. In view of the French refusal, Lord Granville on 27th July invited Italy to join in restoring order in Egypt; but Mancini and Depretis, in spite of the efforts of Crispi, then in London, declined the offer. Financial considerations, lack of proper transports for an expeditionary corps, fear of displeasing France, dislike of a "policy of adventure," misplaced deference towards the ambassadorial conference in Constantinople, and unwillingness to thwart the current of Italian sentiment in favour of the Egyptian "nationalists," were the chief motives of the Italian refusal, which had the effect of somewhat estranging Great Britain and Italy. Anglo-Italian relations, however, regained their normal cordiality two years later, and found expression in the support lent by Italy to the British proposal at the London conference on the Egyptian question (July 1884), for which Great Britain officially returned thanks. About the same time Mancini was informed by the Italian agent in Cairo that Great Britain would be well disposed towards an Italian occupation of a part of the Red Sea coast. Having sounded Lord Granville, Mancini received encouragement to seize Beilul and Massawa, in view of the projected restriction of the Egyptian zone of military occupation. Lord Granville

further inquired whether Italy would co-operate in pacifying the Sudan, and received an affirmative reply. Italian action was hastened by news that, in December 1884, an exploring party under Signor Bianchi, royal commissioner for Assab, had been massacred in the Haussa country, an event which aroused in Italy a desire to punish the assassins and to obtain satisfaction for the still unpunished massacre of Signor Giulietti and his companions. Partly to satisfy public opinion, partly in order to profit by the favourable disposition of the British Government, and partly in the hope of remedying the error committed in 1882 by refusal to co-operate with Great Britain in Egypt, the Italian Government in January 1885 despatched an expedition under Admiral Caimi and Colonel Saletta to occupy Massawa and Beilul. The occupation, effected on 5th February, was accelerated by fear lest Italy might be forestalled by France or Russia, both of which Powers were suspected of desiring to establish themselves firmly on the Red Sea and to exercise a protectorate over Abyssinia. News of the occupation reached Europe simultaneously with the tidings of the fall of Khartum, an event which disappointed Italian hopes of military co-operation with Great Britain in the Sudan. The resignation of the Gladstone–Granville cabinet further precluded the projected Italian occupation of Suakin, and the Italians, wisely refraining from an independent attempt to succour Kassala, then besieged by the Mahdists, bent their efforts to the increase of their zone of occupation around Massawa. Arafali, 50 miles south, and Arkiko, 9 miles south-east, of Massawa were occupied during the month of April. The extension of the Italian zone excited the suspicions of Johannes, negus of Abyssinia, whose apprehensions were assiduously fomented by Alula, ras of Tigré, and by French and Greek adventurers. In order to reassure the negus, Captain Ferrari and Dr Nerazzini were despatched on a mission to Abyssinia. The mission was apparently successful, and arrangements were made with the negus for the ratification of undertakings entered into by Ferrari and Nerazzini by means of a second mission under General Pozzolini. Protection inopportunely accorded by Italy to enemies of Ras Alula, however, induced the Abyssinians to assume an attitude so hostile that the Pozzolini mission had to be abandoned. In January 1886 Ras Alula raided the village of Wa, to the west of Zula, but towards the end of the year (23rd November) Wa was occupied by the irregular troops of General Gené, who had superseded Colonel Saletta at Massawa. Angered by this step, Ras Alula took prisoners the members of an Italian exploring party commanded by Count Salimbeni, and held them as hostages for the evacuation of Wa. General Gené nevertheless reinforced Wa and pushed forward to Saati a detachment from Arkiko. On 25th January 1887 Ras Alula attacked Saati, but was repulsed with loss. On the following day, however, the Abyssinians succeeded in surprising, near the village of Dogali, an Italian force of 524 officers and men under Colonel De Cristoforis, who were convoying provisions to the garrison of Saati. The Abyssinians, 20,000 strong, speedily overwhelmed the small Italian force, which, after exhausting its ammunition, was destroyed where it stood. One man only escaped. Four hundred and seven men and twenty-three officers were killed outright, and one officer and eighty-one men wounded. Dead and wounded alike were horribly mutilated by order of Alula. Fearing a new attack, General Gené withdrew his forces from Saati, Wa, and Arafali; but the losses of the Abyssinians at Saati and Dogali had been so heavy as to dissuade Alula from further hostilities.

Disaster of Dogali.

In Italy the disaster of Dogali produced consternation, and caused the fall of the Depretis–Robilant cabinet. The Chamber, eager for revenge, voted a credit of £200,000, and sanctioned the despatch of reinforcements. General Gené was reprimanded, and superseded by General Saletta, who fortified Massawa and prepared to resist further attack. Meanwhile Signor Crispi, who, though averse from colonial adventure, desired to vindicate Italian honour, entered the Depretis cabinet as minister of the interior, and obtained from parliament a new credit of £800,000. In November 1887 a strong expedition under General di San Marzano raised the strength of the Massawa garrison to nearly 20,000 men. The British Government, desirous of preventing an Italo-Abyssinian conflict, which could but strengthen the position of the Mahdists, despatched Sir Gerald Portal from Massawa on 29th October to mediate with the negus. The mission proved fruitless. Sir Gerald Portal returned to Massawa on 25th December 1887, and warned the Italians that Johannes was preparing to attack them in the following spring with an army of 100,000 men. On 28th March 1888 the negus indeed descended from the Abyssinian high plateau in the direction of Saati, but finding the Italian position too strong to be carried by assault, temporized and opened negotiations for peace. His tactics failed to entice the Italians from their position, and on 3rd April sickness among his men compelled Johannes to withdraw the whole Abyssinian army to Ghinda. Danger being past, General di San Marzano was recalled from Massawa and the colonial garrison considerably reduced. The negus next marched against Menelek, king of Shoa, whose neutrality Italy had purchased with 5000 Remington rifles and a supply of ammunition, but found him with 80,000 men too strongly entrenched to be successfully attacked. Tidings of a new Mahdist incursion into Abyssinian territory reached the negus at that moment, and induced him to postpone the settlement of his quarrel with Menelek until the dervishes had been chastised. Marching towards the Nile, he joined battle with the Mahdists, but on 10th March 1889 was defeated and killed near Metammeh. His death gave rise to an Abyssinian war of succession between Mangashà, natural son of Johannes, and Menelek, grandson of the Negus Sella-Sellassié. Menelek, by means of Count Antonelli, resident in the Shoa country, requested Italy to execute a diversion in his favour by occupying Asmarà and other points on the high plateau. Antonelli profited by the situation to obtain Menelek's signature to a treaty fixing the frontiers of the Italian colony and defining Italo-Abyssinian relations. The treaty, signed at Ucciali on 2nd May 1889, arranged for regular intercourse between Italy and Abyssinia; conceded to Italy a portion of the high plateau, with the positions of Halai, Saganeiti, and Asmarà; fixed an import and export duty of 8 per cent. *ad valorem* on caravans entering and leaving Ethiopia for Massawa; reserved to Menelek the exclusive right to import firearms; arranged for reciprocal extradition of criminals; prohibited the slave trade, and accorded to Italy special commercial privileges. The main point of the treaty, however, lay in clause 17: "His Majesty the King of Kings of Ethiopia *consents* to make use of the Government of His Majesty the King of Italy for the treatment of all questions concerning other Powers and Governments." Upon this clause Italy founded her claim to a protectorate over Abyssinia. In September 1889 the treaty of Ucciali was ratified in Italy by Menelek's lieutenant, the Degiacc Makonnen, who was received by the Italian Government with great pomp and ceremony. Makonnen further concluded with the Italian premier, Crispi, a convention whereby Italy recognized

Abyssinia.

Treaty of Ucciali.

Menelek as emperor of Ethiopia, Menelek recognized the Italian colony, and arranged for a special Italo-Abyssinian currency and for a loan. On 11th October Italy communicated article 17 of the treaty of Ucciali to the European Powers, interpreting it as a valid title to an Italian protectorate over Abyssinia. Russia alone neglected to take note of the communication, and persisted in the hostile attitude she had assumed at the moment of the occupation of Massawa. Meanwhile the Italian mint coined thalers bearing the portrait of King Humbert, with an inscription referring to the Italian protectorate, and on 1st January 1890 a royal decree conferred upon the colony the name of "Eritrea."

Operations in Abyssinia.

In the colony itself General Baldissera, who had replaced General Saletta, delayed the movement against Mangashà desired by Menelek. The Italian general would have preferred to wait until his intervention was requested by both pretenders to the Abyssinian throne. Pressed by the home Government, he, however, instructed a native ally to occupy the important positions of Keren and Asmarà, and prepared himself to take the offensive against Mangashà and Ras Alula. The latter retreated south of the river Mareb, leaving the whole of the cis-Mareb territory, including the provinces of Hamasen, Agameh, Seraè, and Okulè-Kusai, in Italian hands. General Orero, successor of Baldissera, pushed offensive action more vigorously, and on 26th January 1890 entered Adowa, a city considerably to the south of the Mareb—an imprudent step which aroused Menelek's suspicions, and had hurriedly to be retraced. Mangashà, seeing further resistance to be useless, submitted to Menelek, who at the end of February ratified at Makallé the additional convention to the treaty of Ucciali, but refused to recognize the Italian occupation of the Mareb. The negus, however, conformed to article 17 of the treaty of Ucciali by requesting Italy to represent Abyssinia at the Brussels anti-slavery conference, an act which strengthened Italian illusions as to Menelek's readiness to submit to their protectorate. Menelek had previously notified the chief European Powers of his coronation at Entotto (14th December 1889), but Germany and Great Britain replied that such notification should have been made through the Italian Government. Germany, moreover, wounded Menelek's pride by employing merely the title of "highness." The negus took advantage of the incident to protest against the Italian text of article 17, and to contend that the Amharic text contained no equivalent for the word "*consent*," but merely stipulated that Abyssinia "*might*" make use of Italy in her relations with foreign Powers. On 28th October 1890 Count Antonelli, negotiator of the treaty, was despatched to settle the controversy, but on arriving at Addis Abbaba, the new residence of the negus, found agreement impossible either with regard to the frontier or the protectorate. After protracted negotiations, during which Antonelli was induced to sign a draft treaty apparently arranging for the delimitation of the Italo-Abyssinian boundary and for the maintenance of article 17 with the original discrepancy between the Italian and Amharic texts, the Italian plenipotentiary, finding that he had again been duped, repudiated his signature and left Addis Abbaba in haste (February 1891). On 10th April Menelek communicated to the Powers his views with regard to the Italian frontier, and announced his intention of re-establishing the ancient boundaries of Ethiopia as far as Khartum to the north-west and Victoria Nyanza to the south. Meanwhile the Marquis di Rudini, who had succeeded Crispi as Italian premier, had authorized the abandonment of article 17 even before he had heard of the failure of Antonelli's negotiations. Rudini was glad to leave the whole dispute in abeyance and to make with the local ras, or chieftains, of the high plateau an arrangement securing for Italy the cis-Mareb provinces of Seraè and Okulè-Kusai under the rule of an allied native chief named Bath-Agos.

First Crispi Cabinet.

The period 1887–90 was marked in Italy by great political activity. The entry of Crispi into the Depretis cabinet as minister of the interior (4th April 1887) introduced into the Government an element of vigour which had long been lacking. Though sixty-eight years of age, Crispi possessed an activity, a rapidity of decision, and an energy in execution with which none of his contemporaries could vie. Within four months the death of Depretis (29th July 1887) opened for Crispi the way to the premiership. Besides assuming the presidency of the council of ministers and retaining the ministry of the interior, Crispi took over the portfolio of foreign affairs which Depretis had held since the resignation of Count di Robilant. One of the first questions with which he had to deal was that of conciliation between Italy and the Vatican. At the end of May the pope, in an allocution to the cardinals, had spoken of Italy in terms of unusual cordiality, and had expressed a wish for peace. A few days later Signor Bonghi, one of the framers of the Law of Guarantees, published in the *Nuova Antologia* a plea for reconciliation on the basis of an amendment to the Law of Guarantees and recognition by the pope of the Italian title to Rome. The chief incident of the movement towards conciliation consisted, however, in the publication of a pamphlet entitled *La Conciliazione* by Father Tosti, a close friend and confidant of the pope, extolling the advantages of peace between Vatican and Quirinal. Tosti's pamphlet was known to represent papal ideas, and Tosti himself was *persona grata* to the Italian Government. Reconciliation seemed within sight when suddenly Tosti's pamphlet was placed on the Index, ostensibly on account of a phrase, "The whole of Italy entered Rome by the breach of Porta Pia; the king cannot restore Rome to the pope, since Rome belongs to the Italian people." On 4th June 1887 the official Vatican organ, the *Osservatore Romano*, published a letter written by Tosti to the pope conditionally retracting the views expressed in the pamphlet. The letter had been written at the pope's request, on the understanding that it should not be published. On 15th June the pope addressed to Cardinal Rampolla del Tindaro, secretary of state, a letter reiterating in uncompromising terms the papal claim to the temporal power, and at the end of July Cardinal Rampolla reformulated the same claim in a circular to the papal nuncios abroad. The dream of conciliation was at an end, but the Tosti incident had served once more to illustrate the true position of the Vatican in regard to Italy. It became clear that neither the influence of the regular clergy, of which the Society of Jesus is the most powerful embodiment, nor that of foreign clerical parties, which largely control the Peter's Pence fund, would ever permit renunciation of the papal claim to temporal power. France, and the French Catholics especially, feared lest conciliation should diminish the reliance of the Vatican upon France, and consequently French hold over the Vatican. The Vatican, for its part, felt its claim to temporal power to be too valuable a pecuniary asset and too efficacious an instrument of Church discipline lightly to be thrown away. The legend of an "imprisoned pope," subject to every whim of his gaolers, had never failed to arouse the pity and loosen the purse-strings of the faithful;

Tosti and conciliation.

Terms of the "Roman Question."

dangerous innovators and would-be reformers within the Church could be compelled to bow before the symbol of the temporal power, and their spirit of submission tested by their readiness to forego the realization of their aims until the head of the Church should be restored to his rightful domain. More important than all was the interest of the Roman Curia, composed almost exclusively of Italians, to retain in its own hands the choice of the pontiff and to maintain the predominance of the Italian element and the Italian spirit in the ecclesiastical hierarchy. Conciliation with Italy would expose the pope and his Italian *entourage* to suspicion of being unduly subject to Italian political influence—of being, in a word, more Italian than Catholic. Such a suspicion would inevitably lead to a movement in favour of the internationalization of the Curia and of the papacy. In order to avoid this danger it was therefore necessary to refuse all compromise, and, by perpetual reiteration of a claim incompatible with Italian territorial unity, to prove to the Church at large that the pope and the Curia were more Catholic than Italian. Such rigidity of principle need not be extended to the affairs of everyday contact between the Vatican and the Italian authorities, with regard to which, indeed, a tacit *modus vivendi* was easily attainable. Italy, for her part, could not go back upon the achievements of the Risorgimento by restoring Rome or any portion of Italian territory to the pope. She had hoped by conciliation to arrive at an understanding which should have ranged the Church among the conservative and not among the disruptive forces of the country, but she was keenly desirous to retain the papacy as a preponderatingly Italian institution, and was ready to make whatever formal concessions might have appeared necessary to reassure foreign Catholics concerning the reality of the pope's spiritual independence. The failure of the conciliation movement left profound irritation between Vatican and Quirinal, an irritation which, on the Vatican side, found expression in vivacious protests and in threats of leaving Rome; and, on the Italian side, in the deposition of the syndic of Rome for having visited the cardinal-vicar, in the anti-clerical provisions of the new Penal Code, and in the inauguration (9th June 1889) of a monument to Giordano Bruno on the very site of his martyrdom.

The internal situation inherited by Crispi from Depretis was no sinecure. Extravagant expenditure on railways and public works, loose administration of finance, the cost of colonial enterprise, the growing demands for the army and navy, the impending tariff war with France, and the over-speculation in building and in industrial ventures, which had absorbed all the floating capital of the country, had combined to produce a state of affairs calling for firm and radical treatment. Crispi, burdened by the premiership and by the two most important portfolios in the cabinet, was, however, unable to exercise efficient control over all departments of state. Nevertheless his administration was by no means unfruitful. Zanardelli, minister of justice, secured in June 1888 the adoption of a new Penal Code; state surveillance was extended to the *opere pie*, or charitable institutions; municipal franchise was reformed by granting what was practically manhood suffrage, with residential qualification, provision being made for minority representation; and the central state administration was reformed by a Bill fixing the number and functions of the various ministries. The management of finance was scarcely satisfactory, for though Giolitti, who had succeeded Magliani and Perazzi at the treasury, suppressed the former's illusory "pension fund," he lacked the fibre necessary to deal with the enormous deficit of nearly £10,000,000 in 1888–89, the existence of which both Perazzi and he had recognized. The most successful feature of Crispi's term of office was his strict maintenance of order and the suppression of Radical and Irredentist agitation. So vigorous was his treatment of Irredentism that he dismissed without warning his colleague Seismit Doda, minister of finance, for having failed to protest against Irredentist speeches delivered in his presence at Udine. Firmness such as this secured for him the support of all constitutional elements, and after three years' premiership his position was infinitely stronger than at the outset. The general election of 1890 gave the cabinet an almost unwieldy majority, comprising four-fifths of the Chamber. A lengthy term of office seemed to be opening out before him when, on 31st January 1891, Crispi, speaking in a debate upon an unimportant Bill, angrily rebuked the Right for its noisy interruptions. The rebuke infuriated the Conservative deputies, who, protesting against Crispi's words in the name of the "sacred memories" of their party, precipitated a division and placed the cabinet in a minority. The incident, whether due to chance or guile, brought about the resignation of Crispi. A few days later he was succeeded in the premiership by the Marquis di Rudini, leader of the Right, who formed a coalition cabinet with Nicotera and a part of the Left.

The sudden fall of Crispi wrought a great change in the character of Italian relations with foreign Powers. His policy had been characterized by extreme cordiality towards Austria and Germany, by a close understanding with Great Britain in regard to Mediterranean questions, and by an apparent animosity towards France, which at one moment seemed likely to lead to war. Shortly before the fall of the Depretis–Robilant cabinet Count Robilant had announced the intention of Italy to denounce the commercial treaties with France and Austria, which would lapse on 31st December 1887, and had intimated his readiness to negotiate new treaties. On 24th June 1887, in view of a possible rupture of commercial relations with France, the Depretis–Crispi cabinet introduced a new general tariff. The probability of the conclusion of a new Franco-Italian treaty was small, both on account of the protectionist spirit of France and of French resentment at the renewal of the triple alliance, but even such slight probability vanished after a visit paid to Bismarck by Crispi (October 1887) within three months of his appointment to the premiership. Crispi entertained no *à priori* animosity towards France, but was strongly convinced that Italy must emancipate herself from the position of political dependence on her powerful neighbour which had vitiated the foreign policy of the Left. So far was he from desiring a rupture with France, that he had subordinated acceptance of the portfolio of the interior in the Depretis cabinet to an assurance that the triple alliance contained no provision for offensive warfare. But his ostentatious visit to Friedrichsruh, and a subsequent speech at Turin, in which, while professing sentiments of friendship and esteem for France, he eulogized the personality of Bismarck, aroused against him a hostility on the part of the French which he was never afterwards able to allay. France was equally careless of Italian susceptibilities, and in April 1888 M. Goblet made a futile but irritating attempt to enforce at Massawa the Ottoman *régime* of the capitulations in regard to non-Italian residents. In such circumstances the negotiations for the new commercial treaty could but fail, and though the old treaty was prolonged by special arrangement for two months, differential tariffs were put in force on both sides of the frontier on 29th February 1888. The value of French exports into Italy decreased immediately by one-half, while Italian

Rudini.

exports to France decreased by nearly two-thirds. At the end of 1889 Signor Crispi abolished the differential duties against French imports and returned to the general Italian tariff, but France declined to follow his lead, and maintained her prohibitive dues. Meanwhile the enthusiastic reception accorded to the young German emperor on the occasion of his visit to Rome in October 1888, and the cordiality shown towards King Humbert and Crispi at Berlin in May 1889, increased the tension of Franco-Italian relations; nor was it until after the fall of Prince Bismarck in March 1890 that Crispi adopted towards the Republic a more friendly attitude by sending an Italian squadron to salute President Carnot at Toulon. The chief advantage derived by Italy from Crispi's foreign policy was the increase of confidence in her Government on the part of her allies and of Great Britain. On the occasion of the incident raised by M. Goblet with regard to Massawa, Bismarck made it clear to France that, in case of complications, Italy would not stand alone; and when in February 1888 a strong French fleet appeared to menace the Italian coast, the British Mediterranean squadron demonstrated its readiness to support Italian naval dispositions. Moreover, under Crispi's hand Italy awoke from the apathy of former years and gained consciousness of her place in the world. The conflict with France, the operations in Eritrea, the vigorous interpretation of the triple alliance, the questions of Morocco and Bulgaria, were all used by him as means to stimulate national sentiment. With the instinct of a true statesman, he felt the pulse of the people, divined their need for prestige, and their preference for a Government heavy-handed rather than lax. How great had been Crispi's power was seen by contrast with the policy of the Rudini cabinet which succeeded him in February 1891. Crispi's so-called "megalomania" gave place to retrenchment in home affairs and to a deferential attitude towards all foreign Powers. The premiership of Rudini was hailed by the Radical leader, Cavallotti, as a pledge of the non-renewal of the triple alliance, against which the Radicals began a vociferous campaign. Their tactics, however, produced a contrary effect, for Rudini, accepting proposals from Berlin, renewed the alliance in June 1891 for a period of twelve years. None of Rudini's public utterances justify the supposition that he assumed office with the intention of allowing the alliance to lapse on its expiry in May 1892; indeed, he frankly declared it to form the basis of his foreign policy. The attitude of several of his colleagues was more equivocal, but though they coquetted with French financiers in the hope of obtaining the support of the Paris Bourse for Italian securities, the precipitate renewal of the alliance destroyed all probability of a close understanding with France. The desire of Rudini to live on the best possible terms with all Powers was further evinced in the course of a visit paid to Monza by M. de Giers in October 1891, when the Russian statesman was apprised of the entirely defensive nature of Italian engagements under the triple alliance. At the same time he carried to a successful conclusion negotiations begun by Crispi for the renewal of commercial treaties with Austria and Germany upon terms which to some extent compensated Italy for the reduction of her commerce with France, and concluded with Great Britain conventions for the delimitation of British and Italian spheres of influence in north-east Africa. In home affairs his Administration was weak and vacillating, nor did the economies effected in naval and military expenditure and in other departments suffice to strengthen the position of a cabinet which had disappointed the hopes of its supporters. On 14th April 1892 dissensions between ministers concerning the financial programme led to a cabinet crisis, and though Rudini succeeded in reconstructing his administration, he was defeated in the Chamber on 5th May and obliged to resign. King Humbert, who, from lack of confidence in Rudini, had declined to allow him to dissolve parliament, entrusted Signor Giolitti, a Piedmontese deputy, sometime treasury minister in the Crispi cabinet, with the formation of a ministry of the Left, which contrived to obtain six months' supply on account, and dissolved the Chamber.

Second renewal of the Triple Alliance.

Giolitti.

The ensuing general election (November 1892), marked by unprecedented violence and abuse of official pressure upon the electorate, fitly ushered in what proved to be the most unfortunate period of Italian history since the completion of national unity. The influence of Giolitti was based largely upon the favour of a court clique, and especially of Rattazzi, minister of the royal household. Early in 1893 a scandal arose in connexion with the management of state banks, and particularly of the Banca Romana, whose managing director, Signor Tanlongo, had issued £2,500,000 of duplicate bank-notes. Giolitti scarcely improved matters by creating Tanlongo a member of the Senate, and by denying in parliament the existence of any mismanagement. The Senate, however, manifested the utmost hostility to Tanlongo, whom Giolitti, in consequence of an interpellation in the Chamber, was compelled to arrest. Arrests of other prominent persons followed, and on 3rd February the Chamber authorized the prosecution of De Zerbi, a Neapolitan deputy accused of corruption. On 20th February De Zerbi suddenly expired. For a time Giolitti successfully opposed inquiry into the conditions of the state banks, but on 21st March was compelled to sanction an official investigation by a parliamentary commission composed of seven members. On 23rd November the report of the commission was read to the Chamber amid intense excitement. It established that all Italian cabinets since 1880 had grossly neglected the state banks; that the two preceding cabinets had been aware of the irregularities committed by Tanlongo; that Tanlongo had heavily subsidized the press, paying as much as £20,000 for that purpose in 1888 alone; that a number of deputies, including several ex-ministers, had received from him loans of a considerable amount, which they had apparently made no effort to refund; that Giolitti had deceived the Chamber with regard to the state banks, and was open to suspicion of having, after the arrest of Tanlongo, abstracted a number of documents from the latter's papers before placing the remainder in the hands of the judicial authorities. In spite of the gravity of the charges formulated against many prominent men, the report merely "deplored" and "disapproved" of their conduct, without proposing penal proceedings. Fear of extending still farther a scandal which had already attained huge dimensions, and the desire to avoid any further shock to national credit, convinced the commissioners of the expediency of avoiding a long series of prosecutions. The report, however, sealed the fate of the Giolitti cabinet, and on 24th November it resigned amid general execration.

Bank scandals.

Apart from the lack of scruple manifested by Giolitti in the bank scandals, he exhibited incompetence in the conduct of foreign and home affairs. On 16th and 18th August 1893 a number of Italian workmen were massacred at Aigues-Mortes. The French authorities, under whose eyes the massacre was perpetrated, did nothing to prevent or repress it, and the mayor of Marseilles even refused to admit the wounded Italian workmen to the municipal

Aigues-Mortes massacre.

hospital. These occurrences provoked anti-French demonstrations in many parts of Italy, and revived the chronic Italian rancour against France. The Italian foreign minister, Signor Brin, began by demanding the punishment of the persons guilty of the massacre, but hastened to accept as satisfactory the anodyne measures adopted by the French Government. Giolitti removed the prefect of Rome for not having prevented an expression of popular anger, and presented formal excuses to the French consul at Messina for a demonstration against that consulate. In the following December the French tribunal at Angoulême acquitted all the authors of the massacre. At home Signor Giolitti displayed the same weakness. Riots at Naples in August 1893 and symptoms of unrest in Sicily found him, as usual, unprepared and vacillating. The closing of the French market to Sicilian produce, the devastation wrought by the phylloxera, and the decrease of the sulphur trade had combined to produce in Sicily a discontent of which Socialist agitators took advantage to organize the workmen of the towns and the peasants of the country into groups known as *fasci*. The movement had no well-defined object. Here and there it was based upon a bastard Socialism, in other places it was made a means of municipal party warfare under the guidance of the local maffia, and in some districts it was simply popular effervescence against the local octrois on bread and flour. As early as January 1893 a conflict had occurred between the police and the populace, in which several men, women, and children were killed, an occurrence used by the agitators further to inflame the populace. Instead of maintaining a firm policy, Giolitti allowed the movement to spread until, towards the autumn of 1893, he became alarmed and drafted troops into the island, though in numbers insufficient to restore order. At the moment of his fall the movement assumed the aspect of an insurrection, and during the interval between his resignation (24th November) and the formation of a new Crispi cabinet (10th December) conflicts between the public forces and the rioters were frequent. The return of Crispi to power—a return imposed by public opinion as that of the only man capable of dealing with the desperate situation—marked the turning-point of the crisis. Intimately acquainted with the conditions of his native island, Crispi adopted efficacious remedies. The *fasci* were suppressed, Sicily was filled with troops, the reserves were called out, a state of siege proclaimed, military courts instituted, and the whole movement crushed in a few weeks. The chief agitators were either sentenced to heavy terms of imprisonment or were compelled to flee the country. A simultaneous insurrection at Massa-Carrara was crushed with similar vigour. Crispi's methods aroused great outcry in the Radical press, but the severe sentences of the military courts were in time tempered by the royal prerogative of amnesty.

Insurrection in Sicily.

But it was not alone in regard to public order that heroic measures were necessary. The financial situation inspired serious misgivings. While engagements contracted by Depretis in regard to public works had more than neutralized the normal increase of revenue from taxation, the whole credit of the state had been affected by the severe economic and financial crises of the years 1889–93. The state banks, already hampered by maladministration, were encumbered by huge quantities of real estate which had been taken over as compensation for unredeemed mortgages. Baron Sidney Sonnino, minister of finance in the Crispi cabinet, found a prospective deficit of £7,080,000, and in spite of economies was obliged to face an actual deficit of more than £6,000,000. Drastic measures were necessary to limit expenditure and to provide new sources of revenue. Sonnino applied, and subsequently amended, the Bank Reform Bill passed by the previous Administration (10th August 1893) for the creation of a supreme state bank, the Bank of Italy, which was entrusted with the liquidation of the insolvent Banca Romana. The new law forbade the state banks to lend money on real estate, limited their powers of discounting bills and securities, and reduced the maximum of their paper currency. In order to diminish the gold premium, which under Giolitti had risen to 16 per cent., forced currency was given to the existing notes of the banks of Italy, Naples, and Sicily, while special state notes were issued to meet immediate currency needs. Measures were enforced to prevent Italian holders of consols from sending their coupons abroad to be paid in gold, with the result that, whereas in 1893 £3,240,000 had been paid abroad in gold for the service of the January coupons and only £680,000 in paper in Italy, the same coupon was paid a year later with only £1,360,000 abroad and £2,540,000 at home. Economies for more than £1,000,000 were immediately effected, taxes, calculated to produce £2,440,000, were proposed to be placed upon land, incomes, salt, and corn, while the existing income-tax upon consols (fixed at 8 per cent. by Cambray-Digny in 1868, and raised to 13·20 per cent. by Sella in 1870) was increased to 20 per cent. irrespectively of the stockholders' nationality. These proposals met with opposition so fierce as to cause a cabinet crisis, but Sonnino, who resigned office as minister of finance, returned to power as minister of the treasury, promulgated some of his proposals by royal decree, and in spite of vehement opposition secured their ratification by the Chamber. The tax upon consols, which, in conjunction with the other severe fiscal measures, was regarded abroad as a pledge that Italy intended at all costs to avoid bankruptcy, caused a rise in Italian stocks. When the Crispi cabinet fell in March 1896 Sonnino had the satisfaction of seeing revenue increased by £3,400,000, expenditure diminished by £2,800,000, the gold premium reduced from 16 to 5 per cent., consolidated stock at 95 instead of 72, and, notwithstanding the expenditure necessitated by the Abyssinian war, financial equilibrium practically restored.

Financial crisis.

While engaged in restoring order and in supporting Sonnino's courageous struggle against bankruptcy, Crispi became the object of fierce attacks from the Radicals, Socialists, and Anarchists. On 16th June an attempt by an anarchist named Lega was made on Crispi's life; on 24th June President Carnot was assassinated by the anarchist Caserio; and on 30th June an Italian journalist was murdered at Leghorn for a newspaper attack upon anarchism—a series of outrages which led the Government to frame and parliament to adopt (11th July) a Public Safety Bill for the prevention of anarchist propaganda and crime. At the end of July the trial of the persons implicated in the Banca Romana scandal revealed the fact that among the documents abstracted by Giolitti from the papers of the bank manager, Tanlongo, were several bearing upon Crispi's political and private life. On 11th December Giolitti laid these and other papers before the Chamber, in the hope of ruining Crispi, but upon examination most of them were found to be worthless, and the rest of so private a nature as to be unfit for publication. The effect of the incident was rather to increase detestation of Giolitti than to damage Crispi. The latter, indeed, prosecuted the former for libel and for abuse of his position when premier, but after many vicissitudes, including the flight of Giolitti to Berlin in order to avoid arrest, the Chamber refused authorization for the

Attacks on Crispi.

prosecution, and the matter dropped. A fresh attempt of the same kind was then made against Crispi by the Radical leader Cavallotti, who advanced unproven charges of corruption and embezzlement. These attacks were, however, unavailing to shake Crispi's position, and in the general election of May 1895 his Government obtained a majority of nearly 200 votes. Nevertheless public confidence in the efficacy of the parliamentary system and in the honesty of politicians was seriously diminished by these unsavoury occurrences, which, in combination with the acquittal of all the defendants in the Banca Romana trial and the abandonment of the proceedings against Giolitti, reinforced to an alarming degree the propaganda of the revolutionary parties.

The foreign policy of the second Crispi Administration, in which the portfolio of foreign affairs was held by Baron Blanc, was, as before, marked by a cordial interpretation of the triple alliance and by close accord with Great Britain. A strong Italian squadron took part in the opening of the North Sea Canal at Kiel, and in the Armenian question Italy seconded with energy the diplomacy of Austria and Germany, while the Italian fleet joined the British Mediterranean squadron in a demonstration off the Syrian coast. Graver than any foreign question were the complications in Eritrea. Under the arrangement concluded in 1891 by Rudini with native chiefs in regard to the Italo-Abyssinian frontier districts, relations with Abyssinia had remained comparatively satisfactory. Towards the Sudan, however, the Mahdists, who had recovered from a defeat inflicted by an Italian force at Agordat in 1890, resumed operations in December 1893. Colonel Arimondi, commander of the colonial forces in the absence of the military governor, General Baratieri, attacked and routed a dervish force 10,000 strong on 21st December. The Italian troops, mostly native levies, numbered only 2200 men. The dervish loss was more than 1000 killed, while the total Italian casualties amounted to less than 250. General Baratieri, upon returning to the colony, decided to execute a *coup de main* against the dervish base at Kassala, both in order to relieve pressure from that quarter and to preclude a combined Abyssinian and dervish attack upon the colony at the end of 1894. An agreement had been concluded with Great Britain on 15th April 1891, to the effect that, were Kassala occupied by the Italians, the place should be transferred to the Egyptian Government as soon as the latter should be in a position to restore order in the Sudan. Concentrating a little army of 2600 men, Baratieri surprised and captured Kassala on 17th July 1894, and garrisoned the place with native levies under Italian officers. Meanwhile Menelek, jealous of the extension of Italian influence to a part of Somaliland and to the Benadir coast, had, with the support of France and Russia, completed his preparations for asserting his authority as independent suzerain of Ethiopia. On 11th May 1893 he denounced the treaty of Ucciali, but the Giolitti cabinet, absorbed by the bank scandals, paid no heed to his action. Possibly an adroit repetition in favour of Mangashà and against Menelek of the policy formerly followed in favour of Menelek against the negus Johannes might have consolidated Italian influence in Abyssinia by preventing the ascendency of any single chieftain. The Italian Government, however, neglected this opening, and Mangashà came to terms with Menelek. Consequently the efforts of Crispi and his envoy, Colonel Piano, to conclude a new treaty with Menelek in June 1894 not only proved unsuccessful, but formed a prelude to troubles on the Italo-Abyssinian frontier. Bath-Agos, the native chieftain who ruled the Okulé-Kusai and the cis-Mareb provinces on behalf of Italy, intrigued with Mangashà, ras of the trans-Mareb province of Tigré, and with Menelek, to raise a revolt against Italian rule on the high plateau. In December 1894 the revolt broke out, but Major Toselli with a small force marched rapidly against Bath-Agos, whom he routed and killed at Halai. General Baratieri, governor of Eritrea, having reason to suspect the complicity of Mangashà in the revolt, called upon him to furnish troops for a projected Italo-Abyssinian campaign against the Mahdists. Mangashà made no reply, and Baratieri crossed the Mareb and advanced to Adowa. This movement, intended to overawe the Tigrins, failed in its effect, since Baratieri four days later was obliged to evacuate Adowa and return northwards. Mangashà thereupon took the offensive and attempted to occupy the village of Coatit in Okulé-Kusai, but was forestalled and defeated by Baratieri on 13th January 1895. Hurriedly retreating to Senafé, hard pressed by the Italians, who shelled Senafé on the evening of 15th January, Mangashà was obliged to abandon his camp and provisions to Baratieri, who also secured a quantity of correspondence establishing the complicity of Menelek and Mangashà in the revolt of Bath-Agos.

Complications in Eritrea.

The comparatively facile success achieved by Baratieri against Mangashà seems to have led him to undervalue his enemy, and to forget that Menelek, negus and king of Shoa, had an interest in allowing Mangashà to be crushed, in order that the imperial authority and the superiority of Shoan over Tigrin arms might be the more strikingly asserted. After obtaining the establishment of an apostolic prefecture in Eritrea under the charge of Italian Franciscans, Baratieri expelled from the colony the French Lazarist missionaries for their alleged complicity in the Bath-Agos insurrection, and in March 1895 undertook the conquest of Tigré. Occupying Adigrat and Makallè, he reached Adowa on 1st April, and thence pushed forward to Axum, the holy city of Abyssinia. These places were garrisoned, and during the rainy season Baratieri returned to Italy, where he was received with unbounded enthusiasm. Whether he or the Crispi cabinet had any inkling of the enterprise to which they were committed by the occupation of Tigré is more than doubtful. Certainly Baratieri made no adequate preparations to repel an Abyssinian attempt to reconquer the province. Early in September both Mangashà and Menelek showed signs of activity, and on 20th September Makonnen, ras of Harrar, who up till then had been regarded as a friend and quasi-ally by Italy, expelled all Italians from his territory and marched with 30,000 men to join the negus. On returning to Eritrea, Baratieri mobilized his native reserves and pushed forward columns under Major Toselli and General Arimondi as far south as Amba Alagi. Mangashà fell back before the Italians, who obtained several minor successes; but on 6th December Toselli's column, 2000 strong, which through a misunderstanding continued to hold Amba Alagi, was almost annihilated by the Abyssinian vanguard of 40,000 men. Toselli and all but three officers and 300 men fell at their posts after a desperate resistance. Arimondi, collecting the survivors of the Toselli column, retreated to Makallè and Adigrat. At Makallè, however, he left a small garrison in the fort, which on 7th January was invested by the Abyssinian army. Repeated attempts to capture the fort having failed, Menelek and Makonnen opened negotiations with Baratieri for its capitulation, and on 21st January the garrison, under Major Galliano, who had heroically defended the position, were permitted to march out with the honours of war. Meanwhile Baratieri received reinforcements from Italy, but remained

Conquest of Tigré.

undecided as to the best plan of campaign. Thus a month was lost, during which the Abyssinian army advanced to Hausen, a position slightly south of Adowa. The Italian commander attempted to treat with Menelek, but his negotiations merely enabled the Italian envoy, Major Salsa, to ascertain that the Abyssinians were nearly 100,000 strong, mostly armed with rifles and well supplied with artillery. The Italians, including camp-followers, numbered less than 25,000 men, a force too small for effective action, but too large to be easily provisioned at 200 miles from its base, in a roadless, mountainous country, almost devoid of water. For a moment Baratieri thought of retreat, especially as the hope of creating a diversion from Zeila towards Harrar had failed in consequence of the British refusal to permit the landing of an Italian force without the consent of France. The defection of a number of native allies (who, however, were attacked and defeated by Colonel Stevani on 18th February) rendered the Italian position still more precarious, but Baratieri, unable to make up his mind, continued to manœuvre in the hope of drawing an Abyssinian attack. These futile tactics exasperated the home Government, which on 22nd February despatched General Baldissera, with strong reinforcements, to supersede Baratieri. On 25th February Crispi telegraphed to Baratieri, denouncing his operations as "military phthisis," and urging him to decide upon some strategic plan. Baratieri, anxious probably to obtain some success before the arrival of Baldissera, and alarmed by the rapid diminution of his stores, which precluded further immobility, called a council of war (29th February) and obtained the approval of the divisional commanders for a plan of attack. During the night the army advanced towards Adowa in three divisions, under Generals Dabormida, Arimondi, and Albertone, each division being between 4000 and 5000 strong, and a brigade 5300 strong, under General Ellena, remaining in reserve. All the divisions, save that of Albertone, consisted chiefly of Italian troops. During the march Albertone's native division mistook the road, and found itself obliged to delay the Arimondi column by retracing its steps. Marching rapidly, however, Albertone outdistanced the other columns, but, in consequence of allowing his men an hour's rest, arrived upon the scene of action when the Abyssinians, whom it had been hoped to surprise at dawn, were ready to receive the attack. Pressed by overwhelming forces, the Italians, after a violent combat, began to give way. The Dabormida division, unsupported by Albertone, found itself likewise engaged in a separate combat against superior numbers. Similarly the Arimondi brigade was attacked by 30,000 Shoans, and encumbered by the *débris* of Albertone's troops. Baratieri vainly attempted to push forward the reserve, but the Italians were already overwhelmed, and the battle—or rather, series of distinct engagements—ended in a general rout. The Italian loss is estimated to have been more than 6000, of whom 3125 were whites. Between 3000 and 4000 prisoners were taken by the Abyssinians, including General Albertone, while Generals Arimondi and Dabormida were killed and General Ellena wounded. The Abyssinians lost more than 5000 killed and 8000 wounded. Baratieri, after a futile attempt to direct the retreat, fled in haste and reached Adi-Cajè before the *débris* of his army. Thence he despatched telegrams to Italy throwing blame for the defeat upon his troops, a proceeding which subsequent evidence proved to be as unjustifiable as it was unsoldierlike. Placed under court-martial for his conduct, Baratieri was acquitted of the charge of having been led to give battle by other than military considerations, but the sentence "deplored that in such difficult circumstances the command should have been given to a general so inferior to the exigencies of the situation."

Battle of Adowa.

In Italy the news of the defeat of Adowa caused deep discouragement and dismay. On 5th March the Crispi cabinet resigned before an outburst of indignation which the Opposition had assiduously fomented, and five days later a new cabinet was formed by General Ricotti, who, however, made over the premiership to the Marquis di Rudini. The latter, though leader of the Right, had long been intriguing with Cavallotti, leader of the Extreme Left, to overthrow Crispi, but without the disaster of Adowa his plan would scarcely have succeeded. The first act of the new cabinet was to confirm instructions given by its predecessor to General Baldissera (who had succeeded General Baratieri on 2nd March) to treat for peace with Menelek if he thought desirable. Baldissera opened negotiations with the negus through Major Salsa, and simultaneously reorganized the Italian army. The negotiations having failed, he marched to relieve the beleaguered garrison of Adigrat; but Menelek, discouraged by the heavy losses at Adowa, broke up his camp and returned southwards to Shoa. At the same time Baldissera detached Colonel Stevani with four native battalions to relieve Kassala, then hard pressed by the Mahdists. Kassala was relieved on 1st April, and Stevani a few days later severely defeated the dervishes at Mount Mokram and Tucruff. Returning from Kassala (which Italy decided to hold until it could be transferred to the Anglo-Egyptian forces then moving towards Dongola), Colonel Stevani rejoined Baldissera, who on 4th May relieved Adigrat after a well-executed march. By adroit negotiations with Mangashà the Italian general obtained the release of all the Italian prisoners in Tigré, and towards the end of May withdrew his whole force north of the Mareb. Active hostilities over, most of the Italian troops were ordered home; and after a fruitless attempt by the pope to induce Menelek to release the Italian prisoners in the Shoa province, Major Nerazzini was despatched as special envoy to the negus to arrange terms of peace. On 26th October Nerazzini succeeded in concluding, at Addis Abbaba, a provisional treaty abolishing the treaty of Ucciali; recognizing the absolute independence of Eritrea; postponing for one year the definitive delimitation of the Italo-Abyssinian boundary, but allowing the Italians meanwhile to hold the strong Mareb–Belesa–Muna line; and arranging for the release of the Italian prisoners after ratification of the treaty in exchange for an indemnity of which the amount was to be fixed by the Italian Government. The treaty having been duly ratified, and an indemnity of £400,000 paid to Menelek, the Shoan prisoners were released, and Major Nerazzini once more returned to Abyssinia with instructions to secure, if possible, Menelek's assent to the definitive retention of the Mareb–Belesa–Muna line by Italy. Before Nerazzini could reach Addis Abbaba, Rudini, in order partially to satisfy the demands of his Radical supporters for the abandonment of the colony, announced in the Chamber the intention of Italy to limit her occupation to the triangular zone between the points Asmarà, Keren, and Massawa, and, possibly, to withdraw to Massawa alone. This declaration, of which Menelek was swiftly apprised by French agents, rendered it impossible for Nerazzini to obtain more than a boundary leaving to Italy but a small portion of the high plateau and ceding to Abyssinia the fertile provinces of Seraè and Okulé-Kusai. The fall of the Rudini cabinet in June 1898, however, enabled Signor Ferdinando Martini and Captain Cicco di Cola, who had been appointed respectively civil

Abyssinian settlement.

governor of Eritrea and minister resident at Addis Abbaba, to prevent the cession of Seraè and Okulé-Kusai, and to secure the assent of Menelek to Italian retention of the Mareb–Belesa–Muna frontier. Eritrea has now approximately the same extent as before the revolt of Bath-Agos, except in regard (1) to Kassala, which was transferred to the Anglo-Egyptian authorities on 25th December 1897, in pursuance of the above-mentioned Anglo-Italian convention; and (2) to slight rectifications of its northern and eastern boundaries by conventions recently concluded between the Eritrean and the Anglo-Egyptian authorities. Under Signor Ferdinando Martini's able administration the cost of the colony to Italy has been reduced to £260,000 per annum, its trade and agriculture have vastly improved, and the discovery of gold in the neighbourhood of Asmarà now justifies the hope that it may ere long become a source of profit to Italy.

While marked in regard to Eritrea by vacillation and undignified readiness to yield to Radical clamour, the policy of the Marquis di Rudini was in other respects chiefly characterized by a desire to demolish Crispi and his supporters. Actuated by rancour against Crispi, he on 29th April 1896 authorized the publication of a Green Book on Abyssinian affairs, in which, without the consent of Great Britain, the confidential Anglo-Italian negotiations in regard to the Abyssinian war were disclosed. This publication, which amounted to a gross breach of diplomatic confidence, might have endangered the cordiality of Anglo-Italian relations, had not the esteem of the British Government for General Ferrero, Italian ambassador in London, induced it to overlook the incident. Fortunately for Italy, the Marquis Visconti Venosta shortly afterwards consented to assume the portfolio of foreign affairs, which had been resigned by Duke Caetani di Sermoneta, and again to place, after an interval of twenty years, his unrivalled experience at the service of his country. In September 1896 he succeeded in concluding with France a treaty with regard to Tunis in place of the old Italo-Tunisian treaty, denounced by the French Government a year previously. During the Greco-Turkish war of 1897 Visconti Venosta laboured to maintain the European concert, joined Great Britain in preserving Greece from the worst consequences of her folly, and lent moral and material aid in establishing an autonomous government in Crete. At the same time he mitigated the Francophil tendencies of some of his colleagues, accompanied King Humbert and Queen Margherita on their visit to Homburg in September 1897, and, by loyal observance of the spirit of the triple alliance, retained for Italy the confidence of her allies without forfeiting the goodwill of France.

The home administration of the Rudini cabinet compared unfavourably with that of foreign affairs. Bound by a secret understanding with the Radical leader Cavallotti, an able but unscrupulous demagogue, Rudini was compelled to bow to Radical exigencies. He threw all the influence of the Government against Crispi, who was charged with complicity in embezzlements perpetrated by Favilla, managing director of the Bologna branch of the Bank of Naples. After being subjected to persecution for nearly two years, Crispi's character was substantially vindicated by the report of a parliamentary commission appointed to inquire into his relations with Favilla. True, the commission proposed and the Chamber adopted a vote of censure upon Crispi's conduct in 1894, when, as premier and minister of the interior, he had borrowed £12,000 from Favilla to replenish the secret service fund, and had subsequently repaid the money as instalments for secret service were in due course furnished by the treasury. Though irregular, his action was to some extent justified by the depletion of the secret service fund under Giolitti and by the abnormal circumstances prevailing in 1893–94, when he had been obliged to quell the insurrections in Sicily and Massa-Carrara. But the Rudini–Cavallotti alliance was destined to produce other results than those of the campaign against Crispi. Pressed by Cavallotti, Rudini in March 1897 dissolved the Chamber and conducted the general election in such a way as to crush by Government pressure the partisans of Crispi, and greatly to strengthen the (Socialist, Republican, and Radical) revolutionary parties. More than ever at the mercy of the Radicals and of their revolutionary allies, Rudini continued so to administer public affairs that subversive propaganda and associations obtained unprecedented extension. The effect was seen in May 1898, when, in consequence of a rise in the price of bread, disturbances occurred in southern Italy. The corn duty was reduced to meet the emergency, but the disturbed area extended to Naples, Foggia, Bari, Minervino-Murge, Molfetta, and thence along the line of railway which skirts the Adriatic coast. At Faenza, Piacenza, Cremona, Pavia, and Milan, where subversive associations were stronger, it assumed the complexion of a political revolt. From 7th to 9th May Milan remained practically in the hands of the mob. A palace was sacked, barricades were erected, and for forty-eight hours the troops under General Bava-Beccaris, notwithstanding the employment of artillery, were unable to restore order. In view of these occurrences, Rudini authorized the proclamation of a state of siege at Milan, Florence, Leghorn, and Naples, delegating the suppression of disorder to special military commissioners. By these means order was restored, though not without considerable loss of life at Milan and elsewhere. At Milan alone the official returns confessed to eighty killed and several hundred wounded, a total generally considered below the real figures. As in 1894, excessively severe sentences were passed by the military tribunals upon revolutionary leaders and other persons considered to have been implicated in the outbreak, but successive royal amnesties obliterated these condemnations within three years.

Riots of May, 1898.

No Italian administration since the death of Depretis underwent so many metamorphoses as that of the Marquis di Rudini. Modified a first time within five months of its formation (July 1896) in connexion with General Ricotti's Army Reform Bill, and again in December 1897, when Zanardelli entered the cabinet, it was reconstructed for a third time at the end of May 1898 upon the question of a Public Safety Bill, but fell for the fourth and last time on 18th June 1898, on account of public indignation at the results of Rudini's home policy as exemplified in the May riots. On 29th June Rudini was succeeded in the premiership by General Luigi Pelloux, a Savoyard, whose only title to office was the confidence of the king. The Pelloux cabinet possessed no clear programme except in regard to the Public Safety Bill, which it had taken over from its predecessor. Presented to parliament in November 1898, the Bill was read a second time in the following spring, but its third reading was violently obstructed by the Socialists, Radicals, and Republicans of the Extreme Left. After a series of scenes and scuffles the Bill was promulgated by royal decree, the decree being post-dated to allow time for the third reading. Again obstruction precluded debate, and on 22nd July 1899 the decree automatically acquired force of law, pending the adoption of a Bill of indemnity by the Chamber. In February 1900 it was, however, quashed by the supreme court on a point of procedure, and the Public Safety Bill

Pelloux and obstruction.

as a whole had again to be presented to the Chamber. In view of the violence of Extremist obstruction, an effort was made to reform the standing orders of the Lower House, but parliamentary feeling ran so high that General Pelloux thought it expedient to appeal to the country. The general election of June 1900 not only failed to reinforce the cabinet, but largely increased the strength of the extreme parties (Radicals, Republicans, and Socialists), who in the new Chamber numbered nearly 100 out of a total of 508. General Pelloux therefore resigned, and on 24th June a Moderate Liberal cabinet was formed by the aged Signor Saracco, president of the Senate. Within five weeks of its formation King Humbert was shot by an anarchist assassin named Bresci while leaving an athletic festival at Monza, where his Majesty had distributed the prizes (29th July 1900). The death of the unfortunate monarch, against whom an attempt had previously been made by the anarchist Acciarito (22nd April 1897), caused an outburst of profound sorrow and indignation. Though not a great monarch, King Humbert had, by his unfailing generosity and personal courage, won the esteem and affection of his people. During the cholera epidemic at Naples and Busca in 1884, and the Ischia earthquake of 1885, he, regardless of danger, brought relief and encouragement to sufferers, and rescued many lives. More than £100,000 of his civil list was annually devoted to charitable purposes. Humbert was succeeded by his only son, Victor Emmanuel III. (born 11th November 1869), a liberal-minded and well-educated prince, who at the time of his father's assassination was returning from a cruise in the eastern Mediterranean. The remains of King Humbert were laid to rest in the Pantheon at Rome beside those of his father, Victor Emmanuel II. (9th August). Two days later Victor Emmanuel III. swore fidelity to the constitution before the assembled Houses of Parliament and in the presence of his consort, Elena of Montenegro, whom he had married in October 1896. During the first year of the new reign (1st June 1901) the royal household was gladdened by the birth of a princess, named Yolanda Margherita of Savoy.

Death of King Humbert.

Accession of King Victor Emmanuel III.

The later course of Italian foreign policy was marked by many vicissitudes. Admiral Canevaro, who had gained distinction as commander of the international forces in Crete (1896–98), assumed the direction of foreign affairs in the first period of the Pelloux administration. His diplomacy, though energetic, lacked steadiness. Soon after taking office he completed the negotiations begun by the Rudini administration for a new commercial treaty with France (October 1898), whereby Franco-Italian commercial relations were placed upon a normal footing after a breach which had lasted for more than ten years. By the despatch of a squadron to Central America he obtained satisfaction for injuries inflicted thirteen years previously upon an Italian subject by the United States of Colombia. In December 1898 he convoked a diplomatic conference in Rome to discuss secret means for the repression of anarchist propaganda and crime in view of the assassination of the empress of Austria by an Italian anarchist (Luccheni), but it is doubtful whether results of practical value were achieved. The action of the Tsar of Russia in convening the Peace Conference at The Hague in May 1900 gave rise to a question as to the right of the Vatican to be officially represented, and Admiral Canevaro, supported by Great Britain and Germany, succeeded in preventing the invitation of a papal delegate. Shortly afterwards his term of office was brought to a close by the failure of an attempt to secure for Italy a coaling station at San Mun and a sphere of influence in China; but his policy of active participation in Chinese affairs was continued in a modified form by his successor, the Marquis Visconti Venosta, who, entering the reconstructed Pelloux cabinet in May 1899, retained the portfolio of foreign affairs in the ensuing Saracco administration, and secured the despatch of an Italian expedition, 2000 strong, to aid in repressing the Chinese outbreak and in protecting Italian interests in the Far East (July 1900). With characteristic foresight, Visconti Venosta promoted an exchange of views between Italy and France in regard to the Tripolitan hinterland, which the Anglo-French convention of 1899 had placed within the French sphere of influence—a modification of the *status quo ante* considered highly detrimental to Italian aspirations in Tripoli. For this reason the Anglo-French convention had caused profound irritation in Italy, and had tended somewhat to diminish the cordiality of Anglo-Italian relations. Visconti Venosta is believed, however, to have obtained from France a formal declaration that France would not transgress the limits assigned to her influence by the convention. Similarly, in regard to Albania, Visconti Venosta exchanged notes with Austria with a view to the prevention of any misunderstanding through the conflict between Italian and Austrian interests in that part of the Adriatic coast. Upon the fall of the Saracco cabinet (9th February 1901) Visconti Venosta was succeeded at the foreign office by Signor Prinetti, a Lombard manufacturer, of strong temperament, but without previous diplomatic experience. The new minister continued in most respects the policy of his predecessor. The outset of his administration was marked by Franco-Italian *fêtes* at Toulon (10th to 14th April 1901), when the Italian fleet returned a visit paid by the French Mediterranean squadron to Cagliari in April 1899; and by the despatch of three Italian warships to Prevesa to obtain satisfaction for damage done to Italian subjects by Turkish officials.

Foreign affairs.

The Saracco administration, formed after the obstructionist crisis of 1899–1900 as a cabinet of transition and pacification, was overthrown in February 1901 in consequence of its vacillating conduct towards a dock strike at Genoa. It was succeeded by a Zanardelli cabinet, in which the portfolio of the interior was allotted to Signor Giolitti. Composed mainly of elements drawn from the Left, and dependent for a majority upon the support of the subversive groups of the Extreme Left, the formation of this cabinet gave the signal for a vast working-class movement, during which the Socialist party sought to extend its political influence by means of strikes and the organization of labour leagues among agricultural labourers and artisans. The movement was confined chiefly to the northern and central provinces. During the first six months of 1901 the strikes numbered 600, and involved more than 1,000,000 workmen, many of whom obtained some temporary or permanent increase of pay. Encouraged rather than opposed by the Government, and kept, on the whole, within legal bounds by the Socialists, who had every reason to avoid embarrassing excesses, the movement constituted an important development in the economic and political life of Italy—economic, as marking a strong departure towards labour organization, and political, as proving the ascendancy acquired by the Socialist party, which, though represented by only twenty-eight deputies in the Chamber, threatened to become a dominant factor in Italian politics. A fatal strike riot at Berra, near Ferrara, at the end of June 1901, during which the troops were obliged to use their firearms, induced the Socialists, however, to engage in a campaign against the army, and caused a

Zanardelli-Giolitti Cabinet.

split between the ministerial and anti-ministerial members of the party. The two factions then entered upon a struggle for mastery, the former in the hope of realizing Socialist aims by pacific legislative means, and the latter in order to maintain the violent revolutionary attitude characteristic of Italian Socialism.

After the adoption of heroic measures for the restoration of Italian finance in 1894–95, the condition of the Italian exchequer remained as satisfactory as is possible in a country where interest on national debt absorbs nearly one-half of the total revenue. Income largely increased without further taxation; trade and industry more than recovered from the depression of 1893–94; military expenditure remained stationary at the level of £9,560,000 fixed by the Army Bill of May 1897, while military pensions were consolidated at £1,440,000; the naval estimates, of about £4,000,000 a year, were supplemented by special credits for shipbuilding; banking institutions (including the Bank of Naples, which was saved from failure by an operation effected in 1897 by Signor Luzzatti, treasury minister) greatly strengthened their position, and largely liquidated the enormous quantities of real estate by which they were encumbered through the crisis of 1889–93. Savings banks returns showed satisfactory progress, co-operation in all its forms rapidly developed, and the creation of a State institute for insuring the working classes against illness and destitution marked a step towards the realization of an ideal long entertained by Italian economists and statesmen. Agriculture began slowly to adopt modern methods, though hampered by lack of adequate markets, and suffering more than it could profit by the unwholesome effect of high protective duties. The most serious defects in the public life of Italy were to be found in parliamentary instability and the consequent interference of favour-hunting deputies with the working of State departments, in excessive bureaucracy, and in faulty administration of justice. Nevertheless Italy, with her popular monarchy, comparatively strong defensive organizations, valuable alliances, and sober, intelligent, and industrious people, promised, if honestly and firmly governed, to develop gradually into a strong and prosperous state. Taxation, though heavy, was not unbearable, and the discontent existing in parts of the country was dangerous to the State only in so far as it was fomented by, and served as a handle for, Socialist and Clerical agitators.

Conclusion.

AUTHORITIES.—**In Italian.**—*Atti Ufficiali della Camera dei Deputati.* Montecitorio, Rome.—*Atti Ufficiali del Senato del Regno.* Palazzo Madama, Rome.—*Manuale ad uso dei Deputati.* Rome. (A useful collection of the chief Italian laws.)—Green Books (1870–1900).—MARCO MINGHETTI. *La Convenzione di Settembre.* Bologna, 1899.—ALESSANDRO GUICCIOLI. *Quintino Sella*, 2 vols. Turin, 1887–88.—C. CORSI. *Italia (1870–1895).* Turin, 1896. LUIGI CHIALA. *Pagine di Storia Contemporanea;* vol. i. (*Dal Convegno di Plombières al Congresso di Berlino*), Turin, 1892; vol. ii. (*Tunisi*), Turin, 1895; vol. iii. (*La Triplice e la Duplice Alleanza*), Turin, 1898.—LUIGI CHIALA. *La Spedizione di Massaua.* Turin, 1888.—ACHILLE PLEBANO. *Storia della Finanza Italiana;* vol. i. (1861–76), Turin, 1899; vol. ii. (1876–87–88), Turin, 1900.—*Discorsi della Corona.* Naples, 1897.—VICO MANTEGAZZA. *La Guerra in Africa.* Florence, 1896.—ORESTE (General) BARATIERI. *Memorie d'Africa.* Rome, 1898.—*Nuova Antologia* (leading Italian review). 1865–1900.—TITO CANOVAI. *L'Italia Presente.* Rome, 1898. **In French.**—CHARLES SEIGNOBOS. *Histoire de l'Europe Contemporaine* (1814–96) (chapters on Italy). Paris, 1897.—C. DE LA JONQUIÈRE. *Les Italiens en Erythrée.* Paris, 1897. **In German.**—*Europäischer Geschichtskalender* (1860–1900), 41 vols. H. Schulthess, Nördlingen. — P. D. FISCHER. *Italien und die Italiener, am Schlusse des neunzehnten Jahrhunderts.* Berlin, 1899. **In English.**—W. J. STILLMAN. *The Union of Italy* (1815–95) (Cambridge Historical Series). 1898.—J. BOLTON KING, M.A. *A History of Italian Unity* (1814–71), 2 vols. London, 1899.—J. BOLTON KING and THOMAS OKEY. *Italy To-day.* London, 1901. (Written from the Italian Radical standpoint.)

(H. W. S.)

LITERATURE SINCE 1880.

The period between 1880 and 1902 is interesting to the student of Italian literature, apart from the intrinsic merit of the writers representing it, chiefly from the fact of its embracing almost the entire literary effort of the younger, and necessarily much altered, generation which sprang up after the unification of Italy. The period was also characterized by the increased impulse towards national culture given to all classes by the new order of things. This impulse took two parallel directions: on the one side we have a return to a deeper and more organized investigation of the first origins and developments of national literature, on the other a tendency to realize more and more broadly the influence of foreign history and of the new currents in foreign literature and research. Therefore, because of this influence exercised by the thought of other nations on the minds of the younger generation, many writers who would otherwise have remained in the sphere of literature pure and simple come to be classed among historical or scientific writers, while for merits of style their achievement is such that they cannot be overlooked even in a purely literary survey of the period. The first name we meet of those still living in 1902 among those who may be called the fathers of the period is that of Giosuè Carducci (*q.v.*), one of the grandest literary and poetic figures of his time. His genius has admirably summed up the two above-mentioned tendencies, insomuch that his poetic production, ranging from 1850 to the publication of a complete edition of his work in 1896, came upon Italy like a burst of fresh life and renewed vigour, while his essays inaugurated a broader, fuller, and in many ways till then unknown method of literary criticism.

The greater part of Carducci's work is anterior to the present period, but he was brought into more fraternal contact with the aims of the younger generation by the efforts of Angelo Sommaruga, who became, about 1880, the publisher of a group of young unknown writers all destined to some, and a few to great, accomplishment. The period of his prosperity was a strange one for Italy. The first ten years of the newly constituted kingdom had passed more in stupor than activity; original contributions to literature had been scarce, and publishers had preferred bringing out inferior translations of not always admirable French authors to encouraging the original work of Italians—work which it must be confessed was generally mediocre and entirely lifeless. Sommaruga's creation, a literary review called *La Cronaca Bizantina*, gathered together such beginners as Giovanni Marradi, Matilde Serao, Edoardo Scarfoglio, Guido Magnoni, and Gabriele d'Annunzio. In order to obtain the sanction of what he considered an enduring name, the founder turned to Giosuè Carducci, then living in retirement at Bologna, discontented with his fate, and still not generally known by the public of his own country. The activity of Sommaruga exercised a great influence on Giosuè Carducci. Within the next few years he published the three admirable volumes of his *Confessioni e Battaglie*, the *Ça Ira* sonnets, the *Nuove Odi Barbari*, and a considerable number of articles, pamphlets, and essays, which in their collected edition form the most living part of his work. His lyrical production, too, seemed to reach its perfection in those five years of tense, unrelenting work; for the *Canzone di Legnano*, the Odes to Rome and to Monte Mario, the Elegy on the urn of Percy Bysshe Shelley, the ringing rhymes of the *Intermezzo*, in which he happily blended the satire of Heine with the lyrical form of his native poetry—all belong to this period, together with the essays on Leopardi and on Parini, the admirable

discussions in defence of his *Ça Ira*, and the pamphlet called *Eterno Femminino regale*, a kind of self-defence, undertaken to explain the origin of the Alcaic metre to the Queen of Italy, which marks the beginning of the last evolution in Carducci's work (1881). The revolutionary spirits of the day, who had always looked upon Giosuè Carducci as their bard and champion, fell away from him after this poem written in honour of a queen, and the poet, wounded by the attitude of his party, wrote what he intended to be his defence and his programme for the future in pages that will remain amongst the noblest and most powerful of contemporary literature. From that time Carducci appears in a new form, evolved afterwards in his last Odes, *Il Piemonte*, *La Bicocca di San Giacomo*, the Ode to the daughter of Francesco Crispi on her marriage, and the one to the church where Dante once prayed, *Alla Chiesetta dei Polenta*, which is like the withdrawing into itself of a warlike soul weary of its battle.

The same qualities which placed Carducci among the classics of Italy in his earlier days remained consistently with him in later life. His thought flows limpid, serene, sure of itself above an undercurrent of sane and vigorous if pagan philosophy. Patriotism, the grandeur of work, the soul-satisfying power of justice, are the poet's dominant ideals. For many years the national struggle for liberty had forced the best there was in heart and brain into the atmosphere of political intrigue and from one battlefield to another; Carducci therefore found a poetry emasculated by the deviation into other channels of the intellectual virility of his country. On this mass of patriotic doggerel, of sickly, languishing sentimentality as insincere as it was inane, he grafted a poetry not often tender, but always violently felt and thrown into a mould of majestic form; not always quite expected or appreciated by his contemporaries, but never commonplace in structure; always high in tone and free in spirit. The adaptation of various kinds of Latin metres to the somewhat sinewless language he found at his disposal, whilst it might have been an effort of mere pedantry in another, was a life-giving and strengthening inspiration in his case. Another of his characteristics, which made him peculiarly precious to his countrymen, is the fact that his poems form a kind of lyric record of the Italian struggle for independence. The tumultuous vicissitudes of all other nations, however, and the pageantry of the history of all times, have in turns touched his particular order of imagination. The more important part of his critical work which belongs to this later period consists of his *Conversazioni Critiche*, his *Storia filosofica della letteratura Italiana*, and a masterly edition of Petrarch. That he should have had the faults of his qualities is not remarkable. Being almost a pioneer in the world of criticism, his essays on the authors of other countries, though appearing in the light of discoveries to his own country, absorbed as it had hitherto been in its own vicissitudes, have little of value to the general student beyond the attraction of robust style. And in his unbounded admiration for the sculptural lines of antique Latin poetry he sometimes relapsed into that fascination by mere sound which is the snare of his language, and against which his own work in its great moments is a reaction.

Fiction in an original form has only revived in Italy since about 1880. Before that time Italian novels, with the solitary exception of *I promessi sposi*, simply did not exist; the demand for fiction seemed amply and dangerously easily satisfied by inept translations from foreign writers, while the authors chosen were seldom those most worthy of translation. The first to shake off this yoke and write on lines of his own was Antonio Fogazzaro (*q.v.*), whose work is traceable to no particular parentage, except in so far as he has directly continued the traditions of Manzoni. His ideal of literary achievement in point of style is simplicity, and the effect thus attained by him is considerable. His chief works are *Daniele Cortis*, *Malombra*, and among the later ones *Piccolo Mondo Antico*, in which the details of the domestic life of a small corner of Italy during the stirring times of her national struggle, with its sharpened emotions and highly-strung aspirations, are presented with extreme vividness and noiselessly woven into genuine drama. Not the least of Fogazzaro's merits is the capacity for delicate humour both in characterization and reflection, which he shares with so few of his contemporaries, or indeed of his countrymen. Fogazzaro is a poet by temperament, with an intense appreciation of the higher emotions in life and art; the personages of his preference in his own work are the simpler souls attracted by singleness of heart and nobility of purpose. He might have won for himself an even greater place in the literature of his country had his medium been a language entirely national and less dialectal.

Giovanni Verga (born 1840) has also contributed some powerful work, inspired from the fierce passions and primitive manners of humble Sicilian life. His two best novels, however, *Malavoglia* and *Mastro Don Gesualdo*, are not his best work, and he will live longest by his short stories (*e.g.*, *Cavalleria Rusticana*). Fogazzaro and Verga faithfully chronicled between them the inner and popular life of northern and southern Italy.

Gabriele d'Annunzio is, however, the Italian writer whose reputation has travelled farthest. Of Dalmatian extraction, he was born at Pescara (Abruzzi) in 1863. The first years of his youth were spent in the freedom of the open fields; at sixteen he was sent to school in Tuscany. While still at school he published a small volume of verses called *Primo Vere* (1879), in which, side by side with some almost brutal imitations of Lorenzo Stecchetti, the then fashionable poet of *Postuma*, were some translations from the Latin, distinguished by such agile grace that Giuseppe Chiarini on reading them brought the unknown youth before the public in an enthusiastic article. The young poet then went to Rome, where he was received as one of their own by the *Cronaca Bizantina* group. Here he published *Canto Nuovo* (1882), *Terra Vergine* (1882), *L' Intermezzo di Rime* (1883), *Il Libro delle Vergini* (1884), and the greater part of the short stories that were afterwards collected under the general title of *San Pantaleone* (1886). In *Canto Nuovo* we have admirable poems full of pulsating youth and the promise of power, some descriptive of the sea and some of the Abruzzi landscape, commented on and completed in prose by *Terra Vergine*, the latter a collection of short stories dealing in radiant language with the peasant life of the author's native province. With the *Intermezzo di Rime* we have the beginning of d'Annunzio's second and characteristic manner. His conception of style was new, and he chose to express all the most subtle vibrations of voluptuous life. Both style and contents began to startle his critics; some who had greeted him as an *enfant prodige*—Chiarini amongst others—rejected him as a perverter of public morals, whilst others hailed him as one bringing a current of fresh air and the impulse of a new vitality into the somewhat prim, lifeless work hitherto produced.

Meanwhile the Review of Angelo Sommaruga perished in the midst of scandal, and his group of young authors found itself dispersed. Some entered the teaching career and were lost to literature, others threw themselves into journalism. Gabriele d'Annunzio took this latter course, and joined the staff of the *Tribuna*. For this paper, under the pseudonym of "Duca Minimo," he did some of his most brilliant work, and the articles he wrote during that period of originality and exuberance would well repay being collected. To this period of greater maturity and deeper culture belongs *Il Libro d' Isotta* (1886), a love poem, in which for the first time he drew inspiration adapted to modern sentiments and passions from the rich colours of the Renaissance. *Il Libro d' Isotta* is interesting also, because in it we find most of the germs of his future work, just as in *Intermezzo melico* and in certain ballads and sonnets we find descriptions and emotions which later went to form the æsthetic contents of *Il Piacere*, *Il Trionfo della Morte*, and *Elegie Romane* (1892).

D'Annunzio's first novel, *Il Piacere*, appeared in 1889, and was followed in 1891 by *L' Innocente*, and in 1892 by *Giovanni Episcopo*. These three novels created a profound impression. *L' Innocente*, admirably translated into French by Georges Herelle, brought its author the notice and applause of foreign critics. His next work, *Il Trionfo della Morte* (1894), was followed at a short distance by *Le Vergini della Roccio* (1896) and *Il Fuoco* (1900), which in its descriptions of Venice is perhaps the most ardent glorification of a city existing in any language.

D'Annunzio's poetic work of this period, in most respects his finest, is represented by *Il Poema Paradisiaco* (1893), the *Odi Navali* (1893), a superb attempt at civic poetry, and *Laudi* (1900).

A later phase of d'Annunzio's work is his dramatic production, represented by *Il Sogno di un mattino di primavera* (1897), a lyrical fantasia in one act; his *Citta Morta* (1898), written for Sarah Bernhardt, which is certainly among the most daring and original of modern tragedies, and the only one which by its unity, persistent purpose, and sense of fate seems to continue in a measure the traditions of the Greek theatre. In 1898 he wrote his *Sogno di un Pomeriggio d'Autunno* and *La Gioconda*; in the succeeding year *La Gloria*, an attempt at contemporary political tragedy which met with no success, probably through the audacity of the personal and political allusions in some of its scenes; and finally *Francesca da Rimini* (1901), a perfect reconstruction of mediæval atmosphere and emotion, magnificent in style, and declared by one of the most authoritative Italian critics—Edoardo Boutet—to be the first real although not perfect tragedy which has ever been given to the Italian theatre.

The work of d'Annunzio, although by many of the younger generation injudiciously and extravagantly admired, is almost the most important literary work given to Italy since the days when the great classics welded her varying dialects into a fixed language. The psychological inspiration of his novels has come to him from many sources—French, Russian, Scandinavian, German—and in much of his earlier work there is little fundamental originality. His creative power is intense and searching, but narrow and personal; his heroes and heroines are little more than one same type monotonously facing a different problem at a different phase of life. But the faultlessness of his style and the wealth of his language have been approached by none of his contemporaries, whom his genius has somewhat paralysed. In his later work, when he begins drawing his inspiration from the traditions of bygone Italy in her glorious centuries, a current of real life seems to run through the veins of his personages. And the lasting merit of d'Annunzio, his real value to the literature of his country, consists precisely in that he opened up the closed mine of its former life as a source of inspiration for the present and of hope for the future, and created a language, neither pompous nor vulgar, drawn from every source and district, suited to the requirements of modern thought yet absolutely classical, borrowed from none, and, independently of the thought it may be used to express, a thing of intrinsic beauty. As his sight became clearer and his purpose strengthened, as exaggerations, affectations, and moods dropped away from his conceptions, his work became more and more typical Latin work, upheld by the ideal of an Italian Renaissance in art and letters.

Some of the most remarkable poetic work between 1890 and 1902 was that of Ada Negri (born 1870) and Pascoli. The former, in her first book of poems, *Tempeste* (1891), tells the helpless tragedy of the forsaken poor and of those whom life has conquered in words of hot, vehement beauty. The promise of more polished form, however, was insufficiently fulfilled in her second work, *Fatalita* (1892), while the violent burst of emotion which startles the reader into admiration in her first poems had a tendency to repeat itself on the same lines, therefore dwindling into a mannerism. Pascoli, a mild and solitary spirit, is best known by his *Myricæ* and *Poemetti*, both poems of domestic life and social ideals.

The next name of importance to fiction we find during this period is that of Matilde Serao (born 1856). She was born at Patrasso, Greece. Her father was a political emigrant, and her mother was a Greek. On returning to Naples she became a schoolmistress, and she afterwards, with truly delicious grace, described those years of laborious poverty in the preface to a book of short stories called *Leggende Napolitane* (1881). But attention was first attracted to her name by her *Novelle*, published in a paper of Rocco de Zerbi's, and later by her first novel, *Fantasia* (1883), which definitely established her as a writer full of feeling and analytical subtlety. She spent the years between 1880 and 1886 in Rome, where she published her next five volumes of short stories and novels, all dealing with ordinary Italian, and especially Roman, life, and distinguished by great accuracy of observation and depth of insight: *Cuore Inferno* (1881), *Fior di Passione* (1883), *La conquista di Roma* (1885), *La Virtu di Checchina* (1884), and *Piccole anime* (1883). She then founded *Il Corriere di Roma*, the first Italian attempt to model a daily journal on the lines of the Parisian press. The paper was short-lived, and when it was given up Matilde Serao established herself in Naples, where she edited *Il Corriere de Napoli*, and later founded *Il Mattino*, which became by 1902 the most important and most widely read daily paper of southern Italy. But the stress of a journalistic career in no way limited her literary activity; in the ten years between 1890 and 1900 she produced *Pasce di Cuccagna*, *Ventre di Napoli*, *Addio Amore*, *All' Erta Sentinella*, *Castigo*, *La Ballerina*, *Suor Giovanna della Croce*, novels in which the character of the people is rendered with minute, sensitive power and sympathetic breadth of spirit.

Matilde Serao's place as a contemporary Italian novelist is one apart: she is a naturalist, but her naturalism should be understood in a much wider sense than that which is generally given to it. She is a naturalist because her books reflect life with the utmost simplicity of means, sometimes with an utter neglect of means, and at the same time she is an idealist through her high sense of the beauty and nobility which humanity can attain, and to which her writings continually aspire. All her work is truly and profoundly Italian; it is the literature of a great mass of individuals, rather than of one peculiarly accentuated individual; the joy and pain of a whole class rather than the perplexities of a unique case or type pulsates through her pages.

Matilde Serao's defects are always defects of style; her want of sufficient choice of detail often clogs the movement of her narrative and mars the artistic effect of her always animated pages. Like Fogazzaro's, her speech is too often the popular speech of her particular province, in description as well as in dialogue.

Among those writers who, although they have produced some works of fiction of considerable merit, cannot, strictly speaking, be termed novelists we may mention Edmondo d'Amicis (born 1846). His best-known books are personal diaries and descriptions of travel, worthy of consideration for a certain limpidity of expression and grace of thought. Enrico Panzacchi (born 1842) is a serious critic and graceful poet; and Felice Cavallotti (born 1842) is the author, among other minor poetry, of the stirring *Marcia de Leonida*.

The activity of this more recent period of Italian literature was manifested quite as much in the field of critical research as in that of artistic creation: Carducci, Alessandro d'Ancona (born 1835), Adolfo Bartoli (born 1833), Alessandro Torraca, and Cassini have done much for the history of Italian literature, while Tivaroni (1812–1872), amongst others, contributed similar work in the service of political and social history. In the realm of synthetic historical reconstruction we find Professor Pasquale Villari (born 1827), with his studies on Machiavelli and Savonarola; Del Lungo (born 1841), with several admirable contributions to the history of Old Florence; Molmenti (born 1852), who has done the same for Venice; Senatore Negri (1809–1896), with his many essays on historical personages; Ruggero Bonghi (1826–1895), whose *Roman History*, admirably

begun, was never carried beyond the first centuries, owing to the preoccupations of political life; Domenico Comparetti (born 1835), to whom we owe some curious studies on Virgil in the Middle Ages; Arturo Graf (born 1848), who has also contributed numerous pamphlets on mediæval studies, besides a learned and interesting work on the various legends of the Devil; and Ferrero, whose first volume of a History of the Greatness and Decadence of Rome (1901) promised to be a work both profound and original.

A characteristic movement of modern Italian literature, brought about by the excessively grave social difficulties that latterly came to be connected with the life of the country, was caused by the extraordinary interest in social studies taken by all classes. It would be impossible not to mention Lombroso's (*q.v.*) studies in criminology, and Loria's (born 1819) studies in economics, precisely because of the great influence they exercised on that section of the general studious public in no way professionally dedicated to such studies, and because such writers on subjects hitherto little dealt with helped to create the style and language most suitable to them, and henceforth adopted. (M. He.)

Ithaca. See Greece: *Ionian Islands.*

Ithaca, capital of Tompkins county, New York, U.S.A., at the head of Cayuga Lake, at an altitude of 389 feet. Most of the city is in the level valley, from which it spreads up the heights on the west. It is on the Lehigh Valley and the Delaware, Lackawanna, and Western railways. It is the seat of Cornell University. Situated in a fertile farming region, its manufactures relate largely to agriculture, and consist in great part of agricultural tools and implements. It was chartered as a city in 1888. Population (1880), 9105; (1890), 11,079; (1900), 13,136—1310 foreign-born and 364 negroes.

Ito Hirobumi, Marquis (1838- ——), Japanese statesman, was born in 1838, being the son of Ito Jûzô, and (like his father) began life as a retainer of the Lord of Choshiu, one of the most powerful nobles of Japan. Choshiu, in common with many of his fellow Daimios, was bitterly opposed to the rule of the Shôgun or Tycoon, and when this rule resulted in the conclusion of the treaty with Commodore Perry in 1854, the smouldering discontent broke out into open hostility against both parties to the compact. In these views Ito cordially agreed with his chieftain, and was sent on a secret mission to Yedo to report to his lord on the doings of the Government. This visit had the effect of causing Ito to turn his attention seriously to the study of the British and of other military systems. As a result he persuaded Choshiu to remodel his army, and to exchange the bows and arrows of his men for guns and rifles. But Ito felt that his knowledge of foreigners, if it was to be thorough, should be sought for in Europe, and with the connivance of Choshiu he, in company with Inouye and three other young men of the same rank as himself, determined to risk their lives by committing the then capital offence of visiting a foreign country. With great secrecy they made their way to Nagasaki, where they concluded an arrangement with the agent of Messrs Jardine, Matheson & Co. for passages on board a vessel which was about to sail for Shanghai (1863). At that port the adventurers separated, three of their number taking ship as passengers to London, while Ito and Inouye preferred to work their passages before the mast in the *Pegasus,* bound for the same destination. For a year these two friends remained in London studying English methods, but then events occurred in Japan which recalled them to their country. The treaties lately concluded by the Shôgun with the foreign Powers conceded the right to navigate the strait of Shimonoseki, leading to the Inland Sea. On the northern shores of this strait stretched the feudal state ruled over by Prince Choshiu, who refused to recognize the clause opening the strait, and erected batteries on the shore, from which he opened fire on all ships which attempted to force the passage. The Shôgun having declared himself unable in the circumstances to give effect to the provision, the treaty Powers determined to take the matter into their own hands. Ito, who was better aware than his chief of the disproportion between the fighting powers of Europe and Japan, memorialized the Cabinets, begging that hostilities should be suspended until he should have had time to use his influence with Choshiu in the interests of peace. With this object Ito hurried back to Japan. But his efforts were futile. Choshiu refused to give way, and suffered the consequences of his obstinacy in the destruction of his batteries and in the infliction of a heavy fine. The part played by Ito in these negotiations aroused the animosity of the more reactionary of his fellow-clansmen, who made repeated attempts to assassinate him. On one notable occasion he was pursued by his enemies into a tea-house, where he was concealed by a young lady beneath the floor of her room. Thus began a romantic acquaintance, which ended in the lady becoming the wife of the fugitive. Subsequently (1868) Ito was made Governor of Hiogo, and in the course of the following year became Vice-Minister of Finance. In 1871 he accompanied the Daimio Iwakura on an important mission to Europe, which, though diplomatically a failure, resulted in the enlistment of the services of European authorities on military, naval, and educational systems. After his return to Japan Ito served in several cabinets as head of the Bureau of Engineering and Mines, and in 1886 he accepted office as Prime Minister, a post which by 1902 he had held four times. In 1882 he was sent on a mission to Europe to study the various forms of constitutional government; on this occasion he attended the coronation of the Tsar Alexander III. On his return to Japan he was entrusted with the arduous duty of drafting a constitution. In 1890 he reaped the fruits of his labours, and nine years later he was destined to witness the abrogation of the old treaties, and the substitution in their place of Conventions which place Japan on terms of equality with the European States. In all the startling reforms in the Land of the Rising Sun Ito played a leading part. It was mainly due to his active interest in military and naval affairs that he was able to meet Li Hung-chang at the end of the Chinese and Japanese war (1895) as the representative of the conquering state, and the conclusion of the Anglo-Japanese Alliance in 1902 testified to his triumphant success in raising Japan to the first rank among civilized Powers. As a reward for his conspicuous services in connexion with the Chinese war Ito was made a marquis, and in 1897 he accompanied Prince Arisugawa as a joint representative of the Mikado at the Diamond Jubilee of Queen Victoria. At the close of 1901 he again, though in an unofficial capacity, visited Europe and the United States.

Iuka, capital of Tishomingo county, Mississippi, U.S.A., on the Southern Railroad, at an altitude of 460 feet. It is chiefly known as the site of a battle during the Civil War between a part of General Grant's army under General Rosecrans and the Confederates under General Price, in which the latter were defeated. Population (1890), 1019; (1900), 852.

Ivanovo - Voznesensk, a town of Middle Russia, government and 86 miles by rail north of Vladimir. It has thirty-eight cotton factories, which employ 26,000 hands, and thirty-two other factories, the aggregate returns being about £3,800,000 per annum. Population (1887), 22,000; (1897), 53,950.

Ivory Coast, The, a French West African colony, bounded on the S. by the Gulf of Guinea, on the W. by Liberia and French Guinea, on the N. by Senegal and the military territories of the Sudan, on the E. by the Gold Coast. The coast is low, bordered with lagoons, and difficult of access on account of the bar. Back from the coast are the Kong ranges of hills, from 3000 to 4000 feet high, terminating in steep slopes in the south. Starting on the Liberian frontier, the rivers are the Cavally, the San Pedro, the Sassandra (240 miles), which comes from the extremity of the Kong plateaus, the Bandama (225 miles), formed by the White and the Red Bandama, and the Komoe (360 miles). The climate is in general hot on the coast and (owing to the lagoons) unhealthy, the rainfall being very heavy. The fauna and flora are similar to those of Senegal and the Sudan. This country is stated to have been visited by Dieppe merchants even in the 14th century, and a French factory was established from 1700 to 1707. After exploration by Commandant Bouet Williaumez in 1838, the natives ceded some territories to the Monarchy of July. In 1843 Assinie and Grand Bassam were occupied. In 1849, and again in 1893, armed conflicts arose between the Europeans and the native tribes. France evacuated her factories in 1872, but reoccupied them in 1883. Between 1887 and 1889 Captain Binger traversed the whole region between the coast and the Niger, visited Bonduku and the Kong country, and signed protectorate treaties with the chiefs. It was to the zone between the Kong states and the hinterland of Liberia that Samory fled for refuge before he was taken prisoner, and for a short time he was master of Kong. Serious trouble was experienced with the natives as late as 1899. The boundary on the west was settled by the Franco-Liberian Agreement of 1892; that on the east by the Anglo-French Agreement of 1893 and 1898. The present northern boundary of the hinterland was fixed on the division of the Sudan (*q.v.: French*) among the other French West African colonies in 1899, when the Ivory Coast, which previously administered most of the Kong protectorate, received the circles of Odjenné, Kong, and Buna. The present area of the colony is estimated at 119,500 square miles, and its population at 1,500,000. It was separated from Senegal in 1893, and is administered by a governor — himself, however, since 1895, under the governor-general of French West Africa—assisted by a council composed of three official and three civilian members. The Ivory Coast, like Guinea and Dahomey, has been allowed to manage its own finances, with the result that it has had to make no claim upon France. In 1899 both revenue and expenditure materially exceeded the budget estimates, the former amounting to £71,000, the latter to £72,000, but the small apparent deficit was in reality fully provided for. The budget for 1900 showed an increase on the former one, and balanced at £56,000. Indirect contributions were estimated to produce £54,000.

The natives cultivate almost nothing but maize and rice; Europeans are trying the cultivation of coffee, which gives good results. Palm-tree products and rubber are collected. It is worth noticing that the collection of the latter in increasing quantities is being effected without destroying the source of supply. Inland there are immense forests rich in mahogany, which are now beginning to be worked. Gold is found, but not in sufficient quantities to tempt Europeans to work it; the natives, however, obtain it to a value ranging from £1000 to £36,750 in the year. The exportation of ivory has almost ceased. By the agreement of 1898 commerce as far as 9° N. is duty-free for at least thirty years. The value of the trade has rapidly increased. In 1900 imports were valued at £263,000, of which £103,000 was the share of France and her colonies. The principal items in 1898 (total, £224,000), apart from specie (£22,000), were: cotton fabrics (almost entirely from Great Britain), £34,400; intoxicants (mostly from the United States), £30,400; and leaf tobacco (Holland, the United States, and Germany), £18,600. Exports increased in value from £202,000 in 1898 (of which only £37,400 worth went to France) to £323,000 in 1900. Three articles of export at present stand out high above all others: mahogany, valued at £46,000 in 1898 and £24,000 in 1899; palm oil, £70,000 in 1898, £73,000 in 1899; rubber, £52,000 in 1898, £114,000 in 1899. The lagoon of Grand Bassam, affording shelter for vessels, constitutes a good inland roadstead. Similarly, Assinie, 30 miles to the east, is situated on a lagoon. Elima is the centre of coffee plantations covering 1500 acres. Grand Lahou has the trade of the Bandama. Grand Bassam is in regular communication by steamer with Bordeaux and Marseilles and Liverpool. It is also connected with Europe by submarine cable. Inland, roads have been constructed. A considerable portion of a telegraph line connecting the coast with the Sudan has been laid down, and a railway, 178 miles long, running inland from Abidjean is under construction.

AUTHORITIES.—BINGER. *Der Niger an Golfe de Guinée.* Paris, 1890. — HENRIQUE. *Les Colonies Françaises.* Paris, 1890.— MARCEL MOUNIER. *La Mission au Capitaine Binger.* Paris, 1892.—LEE. *French Colonies.* Foreign Office Report, 1900.— *L'Année Coloniale.* Paris, 1900. (P. L.)

Ivry-sur-Seine, a town and railway station in the arrondissement of Sceaux, department of Seine, France, about half a mile S.S.E. of the Outer Circle of Paris. It has a large hospital for incurables. There are important steel-works, breweries, and oil-works. Port traffic, including Pont d'Ivry, 1898, 266,884 tons. Population (1891), 19,830; (1901), 28,585.

Ixelles, a town of Belgium, in the province of Brabant, containing the zoological gardens—a favourite promenade—of Brussels, of which it is a suburb. Population (communal, 1880), 36,324; (1900), 58,615.

Izhevskiy Zavod, or IZHEVSKOI, town of Russia, in the Ural Mountains, government of Vyatka, 145 miles south-west of Perm, 27 miles from the Kama, on Izh river. It has one of the chief steel and rifle works of the Russian Crown. About 190,000 rifles are produced yearly at the works, while the making of sporting guns is a widely-spread domestic industry. Population, 21,500.

Izmail, a district town of Russia, government of Bessarabia, on the left bank of the Kilia branch of the Danube, 57 miles below Reni railway station. It was annexed to Russia in 1878. There are steam and horse flour-mills. It has a custom-house, and is visited every year by more than 1000 vessels. The population in 1897 was 31,000, comprising Great and Little Russians, Bulgars, Jews, Tziganes (Gypsies), &c.

Izu-no-shichi-tô, the seven (*shichi*) islands (*tô*) of Izu, which are included in the empire of Japan. They stretch in a southerly direction from a point near the mouth of Tôkyô Bay, and lie between 33° and 34° 48′ N. and between 139° and 140° E. Their names, commencing from the north, are Izu-no-Oshima, Tô-shima,

Nii-shima, Kôzu-shima, Miyake-shima, and Hachijo-shima. There are some islets in their immediate vicinity. Izu-no-Oshima, an island 10 miles long and 5½ miles wide, is only 15 miles from the nearest point of the Izu promontory. It is known to western cartographers as Vries Island, a name derived from that of Captain Martin Gerritsz Vries, a Dutch navigator, who is supposed to have discovered the island in 1643. But the group was known to the Japanese from a remote period, and used as convict settlements certainly from the 12th century and probably from a still earlier era. Hachijo, the most southerly, is often erroneously written "Fatsisio" on English charts. Izu-no-Oshima, or Vries Island, is remarkable for its smoking volcano, Mihara (2395 feet), a conspicuous object to all ships bound for Yokohama. Three others of the islands—Nii-shima, Kôzu-shima, and Miyake-shima—have active volcanoes. Those on Nii-shima and Kôzu-shima are of inconsiderable size, but that on Miyake-shima, namely, Oyama, rises to a height of 2707 feet. The most southerly island, Hachijo-shima, has a still higher peak, Nishi-yama (2913 feet), but it does not emit any smoke.

Izyum, a district town of Russia, government and 81 miles south-east of Kharkov, on the Donets. There is trade in corn and cattle. Population, 13,000.

Jaca, a town of Spain, near the French frontier, in the province of Huesca. Owing to its position on the Pyrenean high road to France, and on the projected international railway, the town has gained in commercial importance. General improvements have been effected and frontier defence works constructed in the neighbourhood. Population, 5157.

Jackson, capital of Jackson county, Michigan, U.S.A., on the Grand River, near its head, at an altitude of 925 feet. The city has a rather irregular plan, is divided into eight wards, and has an excellent water-supply by the Holly pumping system, and good sewerage. It is at the intersection of four railways: the Cincinnati Northern, the Grand Trunk, the Lake Shore and Michigan Southern, and the Michigan Central. It contains the State penitentiary and the principal shops of the Michigan Central Railroad. Its manufacturing establishments in 1890 numbered 220, with a capital of nearly $5,000,000, employing 3630 hands and producing goods valued at $5,376,347. Prominent among these were carriages and waggons, whose value was nearly one-fifth of the total product; flour, corsets, and machine-shop products. Population (1880), 16,105; (1890), 20,798; (1900), 25,180, of whom 3843 were foreign-born and 473 negroes.

Jackson, capital of Hinds county and of the state of Mississippi, U.S.A., on the Pearl river, at an altitude of 291 feet, at the intersection of three railways: the Illinois Central, the Queen and Crescent, and the Yazoo and Mississippi Valley. It has a large cotton trade. Population (1890), 5920; (1900), 7816, of whom 119 were foreign-born and 4447 negroes.

Jackson, capital of Jackson county, Ohio, U.S.A. It lies in an iron and coal region, and contains furnaces and other ironworks. It is on the Baltimore and Ohio South-Western, the Ohio Southern, and the Hocking Valley Railways. Population (1880), 3021; (1890), 4320; (1900), 4672, of whom 232 were foreign-born and 140 negroes.

Jackson, capital of Madison county, Tennessee, U.S.A., at an altitude of 425 feet, at the intersection of the Illinois Central, the Mobile and Ohio, and the Nashville, Chattanooga, and St Louis Railways. It has a large cotton trade and railway machine works. It is the seat of the South-Western Baptist University, which in 1898 had 11 instructors and 270 students. Population (1880), 5377; (1890), 10,039; (1900), 14,511, of whom 224 were foreign-born and 6108 negroes.

Jackson, Helen Maria (1831–1885), American poetess, known by her pseudonym of "H. H.," was born in Amherst, Massachusetts, on the 18th October 1831, the daughter of Nathan W. Fiske, a professor in the college at that place. Her first husband was Captain Edward B. Hunt, of the United States army. After his death, in 1863, and other bereavements, Mrs Hunt's mind turned towards serious thought on many moods of life and experience, which she expressed in a little volume of meditative *Verses* (1870), of which the aged Emerson, in the preface to his *Parnassus* (1874) remarked: "The poems of a lady who contents herself with the initials H. H. . . . have rare merit of thought and expression, and will reward the reader for the careful attention which they require." Thenceforward she was a prolific writer of prose and verse, including juvenile tales, books of travel, household hints, and novels, of which none has retained a place in American literature save *Ramona* (1884), a defence, in the form of fiction, of the Indian character, in which she had become deeply interested. *A Century of Dishonor* (1881) was an arraignment, in historical chapters, of the treatment of the Indians by the United States. In 1875 she married William S. Jackson, a merchant of Colorado Springs, Colorado; and died in San Francisco on the 12th of August 1885. (C. F. R.)

Jacksonville, capital of Duval county, Florida, U.S.A., on St Johns river. It is regularly laid out, and has a good water-supply and sewerage. It is entered by six railways, which, with the fine harbour, greatly improved by dredging, give it a large commerce. Its exports consist of cotton, lumber, naval stores, fruit, and phosphates. Its manufactures consist largely of lumber and cigars. Population (1890), 17,201; (1900), 28,429, of whom 1166 were foreign-born and 16,236 negroes.

Jacksonville, capital of Morgan county, Illinois, U.S.A., at an altitude of 578 feet, and at the intersection of the Chicago and Alton, the Chicago, Peoria, and St Louis, the Jacksonville and St Louis, and the Wabash Railways. It is the site of several state charitable institutions, the Deaf and Dumb Asylum, the Insane Asylum, and the Blind Asylum. It contains also several educational institutions, especially Illinois College, a non-sectarian institution, which in 1899 had 15 instructors and 239 students, and Illinois Women's College, which in the same year had 16 instructors and 248 students. Population (1890), 12,935; (1900), 15,078, of whom 1497 were foreign-born and 997 negroes.

Jacobabad, a town of British India, the administrative headquarters of the Upper Sind frontier district in Bombay; a station on the Quetta branch of the North-Western Railway, 37 miles from the junction at Ruk on the main line. Population (1881), 11,352; (1891), 12,396. The town was founded in 1847 by General John Jacob, for many years commandant of the Sind Horse, who died here in 1858. It has cantonments for a cavalry and an infantry regiment, with accommodation for caravans from Central Asia. It is watered by two canals. An annual horse show is held in January.

Jacobsen, Jens Peter (1847–1885), Danish imaginative writer, was born at Thisted in Jutland, on the 7th of April 1847; he was the eldest of the five children of a prosperous merchant. From 1856 to 1862 he was at school in his native town; he then read at home for a year, and was sent later in 1863 to Copenhagen. He became a student at the university in 1868. As a boy he showed a remarkable turn for science, particularly for botany. In 1870, although he was secretly writing verses already, Jacobsen definitely adopted botany as a profession. He was sent by a scientific body in Copenhagen to report on the flora of the islands of Anholt and Lœsö. About this time the discoveries of Darwin began to exercise a fascination over him, and finding them little understood in Denmark, he translated into Danish *The Origin of Species* and *The Descent of Man*. He continued to work at the lower vegetable forms with such energy that his zeal, in fact, proved fatal to him, for in the autumn of 1872, while collecting plants in a morass near Ordrup, he contracted pulmonary disease. His illness, which cut him off from scientific investigation, drove him to literature. He met the famous critic, Dr Georg Brandes, who was struck by his powers of expression, and under his influence, in the spring of 1873, Jacobsen began his great historical romance of *Marie Grubbe*. His method of composition was painful and elaborate, and his work was not ready for publication until the close of 1876. His health grew steadily but very slowly worse. In 1879, indeed, he was too ill to write at all; but in 1880 an improvement came, and he finished his second novel, *Niels Lyhne*. In 1882 he published a volume of six short stories, most of them written a few years earlier, called, from the first of them, *Mogens*. After this he wrote no more, but lingered on in his mother's house at Thisted until 30th April 1885. In 1886 his posthumous fragments were collected. It was early recognized that Jacobsen was the greatest artist in prose that Denmark has produced. He has been compared with Flaubert, with De Quincey, with Pater; but these parallelisms merely express a sense of the intense individuality of his style, and of his untiring pursuit of beauty in colour, form, and melody. Although he wrote so little, and crossed the living stage so hurriedly, his influence in the North has been far-reaching. It may be said that no one in Denmark or Norway has tried to write prose carefully since 1880 whose efforts have not been in some degree modified by the example of Jacobsen's laborious art. His *Samlede Skrifter* appeared in two volumes in 1888; in 1899 his letters (*Breve*) were edited by Edvard Brandes. In 1896 an English translation of part of the former was published under the title of *Siren Voices: Niels Lyhne*, by Miss E. F. L. Robertson. (E. G.)

Jade, or Jahde, a deep bay and estuary of the North Sea, belonging to the grand duchy of Oldenburg, Germany. The bay, which was for the most part made by storm-floods in the 13th and 16th centuries, measures 70 square miles, and has communication with the open sea by a fairway, some 2 to 3 miles wide, which never freezes, and with the tide gives access to the largest vessels. On the west side of the entrance to the bay is the Prussian naval port of Wilhelmshaven. A tiny stream, about 14 miles long, also known as the Jade, enters the head of the bay.

Jaen, a province of southern Spain. It is divided into 13 administrative districts and 97 parishes, covering 5184 square miles. In 1897 the population was 463,806. The birth-rate was 3·92 per thousand and the death-rate 38·5 per thousand; the proportion of illegitimate births was only 3·63 per cent. The main railway line from Madrid to Cordova, Seville, and Cadiz runs through the province, and has a branch from Vendellano to the important mining centre of Linares. Another line runs from Linares to Puente Jenil. There are 200 miles of first-class roads, and the municipal and provincial roads are fairly good. Apart from agriculture and mines, the only local industries are saw-milling and manufactures of oils, alcohols, and esparto-grass rugs. The mining interests of the province are progressing. More mines are being worked and fresh concessions duly registered every year, and the works also are developing. Two zinc and 294 lead mines give employment to 7800 hands. No less than 180 tons of zinc, 119,375 tons of lead, 7935 tons of carbonate have been extracted, and the factories have turned out 29,163 tons of lead and 13,000 ℔ of silver. There are in addition 349 registered and yet unproductive mines, mostly lead. In 1898 the live stock in the province included 5469 horses, 16,775 mules, 11,890 asses, 10,305 cattle, 197,519 sheep, 48,136 goats, 32,115 pigs. Agriculture is thriving; there were 520,000 acres covered with wheat crops, 342,500 acres with oats, rye, barley, maize, 115,000 acres with pod fruit, 9000 acres with vines, and 382,000 acres with olives.

Jaen, the capital of the above province. Its educational establishments include primary schools for both sexes, an institute, a school for training teachers, a couple of religious seminaries, and several convents for girls. Its silk industry, formerly in good repute, has decayed, and the local manufactures are now mostly leather, soap, alcohol, and linen stuffs. Population, 25,804.

Jaffna, a town of Ceylon, at the northern extremity of the island. In 1901 it had a population of about 47,000, while in the district or peninsula of the same name there were 299,541 persons, nearly all Tamils, the only Europeans being the civil servants and a few planters. Cocoanut planting has not been successful of recent years. The natives grow palmyras freely, and have a trade in the fibre of this palm. They also grow and export tobacco, but not enough rice for their own requirements. A steamer calls weekly, and there is considerable trade. The railway extension from Kurunegala due north to Jaffna and the coast was commenced in 1900. Annual average rainfall, 44 inches; average temperature, 81·7°. Jaffna is the seat of a government agent and district judge, and criminal sessions of the supreme court are regularly held. Much missionary and educational work is carried on in the peninsula, by Roman Catholic, Church of England, Wesleyan, and American missions.

Jagannath Shankersett (1800–1865), the recognized leader of the Hindu community of Bombay for more than forty years, was born in 1800 into a family of goldsmiths of the Daivadnya caste. Unlike his forefathers, he engaged in commerce, and, by means of diligence joined to intelligence and force of character, he soon acquired what was in those days a large fortune, a great part of which he devoted to the good of the public. So high was his credit in the city that Arabs, Afghans, and other foreign merchants chose to place their treasures in his custody rather than with the banks. Foreseeing the need of better methods of education, he became one of the founders of the School Society and the Native School of Bombay, the first of its kind in Western India, which in 1824 developed into the Bombay Native Institution, and again in 1840 into the Board of Education which preceded the Elphinstone Educational Institution founded in 1856. In all these successive advances in the educational life of those times Jagannath Shankersett took the leading and most active part. When the Students' Literary and

Scientific Society first opened their girls' schools, in spite of strong opposition of the Hindu community, Jagannath backed the reformers up, and soon set the good example of providing another girls' school entirely at his private cost. His zeal for progress was also shown in his starting at his own expense the English School, the Sanskrit Seminary, and the Sanskrit Library, all in Girgaum. He was President of the Agri-Horticultural Society of Western India, of the Victoria and Albert Museum, and Victoria Gardens Committee, and of the Bombay Association. In all municipal and sanitary affairs of Bombay he took keen interest, and his efforts in support of railways and new roads were untiring and successful. To Jagannath Shankersett, indeed, and his public-spirited friends, Sir George Birdwood and Dr Bhau Daji, Bombay is indebted for the reconstruction which, beginning in 1857, has gradually changed a close network of lanes and streets into a spacious and airy city, adorned with fine avenues and splendid buildings. He very early became and remained an acceptable adviser to the Government, and was consulted by them on all matters connected with the views and sentiments of the natives. In this way he secured for them in 1829 the right of sitting in the Grand Jury, and their inclusion in the Commission of Justices of the Peace. He was the first Indian to be nominated to the Legislative Council of Bombay under the Act of 1861, an honourable recognition of the confidential services rendered by him to a long series of governors. While, on the one hand, his weighty influence was used by Sir John Malcolm to induce the Hindus to acquiesce in the suppression of *sati* or widow-burning, his own community remember gratefully that to him they owe the cremation ground at Sonapur, still used for the burning of their dead. He died at Bombay, on the 31st July 1865, regretted by all classes of society, who in token of respect, about a year before his death, in a public meeting assembled at the Town Hall, voted a marble statue to perpetuate his memory. He was a fine type of those Indians who for generation after generation have devoted their lives to unite the races of the East and West by the strong ties of mutual regard and friendship. (N. B. W.)

Jägerndorf (Czech, *Krnov*), the chief town of a government district and principality of the same name in Austrian Silesia, situated at the confluence of the Gold-Oppa and the Oppa at the foot of the Burgberg. It is a station on the Central Moravian-Silesian and Prussian State railways. It has a château belonging to Prince Liechtenstein, who holds large estates in this district, and on the neighbouring Burgberg is a church much visited as a place of pilgrimage, and the ruins of the seat of the former princes of Jägerndorf. The town suffered severely in the Thirty Years' War, and was the scene of engagements between the Prussians and Austrians in May 1745 and January 1779. The claim of Prussia to the principality of Jägerndorf was the occasion of the First Silesian War. The partition which followed left Austria the larger portion, now part of Austrian Silesia. The town has a considerable trade and a large textile industry (cloth and woollens), a machine factory, &c. The population in 1890 was 14,257, chiefly German and Catholic (2 per cent. Czech, 4 per cent. Jewish, and 3 per cent. Protestant (1900), 14,675.

Jaice, Jajce, or Iaïtze, an ancient royal town of Bosnia, 97 miles north-west of Sarajevo by rail, splendidly situated on the slope of the Gola Planina and on the left bank of the Vrbas (an affluent of the Save), where it receives the waters of the Pliva by a magnificent waterfall of 100 feet. It is specially celebrated for its ancient fortress, which preserves within its walls portions of a still more ancient royal palace of the kings of Bosnia. There are also large catacombs. In the Franciscan church is the coffin with remains (rediscovered in 1888) of Tomashewitch, the last king of Bosnia, captured and executed by the Turks in 1493. The water-power of the Pliva fall has been used for industrial purposes. Population, 5000.

Jainism.—Considerable progress has been made in the publication and elucidation of the original authorities for this interesting form of faith. But a great deal remains yet to be done. The oldest books now in the possession of the modern Jains purport to go back, not to the foundation of the existing Order in the 6th century B.C., but only to the time of Bhadrabûhu, two centuries later. The whole of the still older literature, on which the revision then made was based, the so-called *Pûrvas*, have been lost. And the existing canonical books, while preserving a great deal that was probably derived from them, contain also much of later material. The problem remains to sort out the older from the later, to distinguish between the earlier form of the faith and its subsequent developments, and to collect the numerous data for the general, social, industrial, religious, and political history of India. Prof. Weber has given a fairly full and carefully-drawn-up analysis of the whole of the more ancient books in the second part of the second volume of his *Catalogue of the Sanskrit MSS. at Berlin*, published in 1888, and Prof. Bhandarkar has given an account of the contents of many later works in his *Report on the Search for Sanskrit MSS.*, Bombay, 1883. And a small beginning has been made in editing and translating these works. The best *précis* of a long book, given in a few pages only, can necessarily only deal with the more important features in it. And in the choice of what should be included, and what left out, the *précis*-writer will often omit precisely the points some subsequent investigator may most especially want. All the older works ought therefore to be properly edited and translated in full, and properly indexed. The Jains themselves have now printed in Bombay a complete edition of their sacred books. But the critical value of this edition, and of other editions of separate texts printed elsewhere in India, leaves much to be desired. Prof. Jacobi has edited and translated the *Kalpa Sûtra*, containing a life of the founder of the Jain Order; but this can scarcely be older than the 5th century of our era. He has also edited and translated the *Âyâranya Sutta* of the Swetambara Jains. The text, published by the Pali Text Society, is of 140 pages octavo. The first part of it, about 50 pages, is a very old document on the Jain views as to conduct, and the remainder consists of appendixes, added at different times, on the same subject. The older part may go back as early as the 3rd century B.C., and it sets out more especially the Jain doctrine of *tapas* or self-mortification, in contradistinction to the Buddhist view, which condemned asceticism. The rules of conduct in this book are for members of the Order. Dr Rudolf Hoernle has edited and translated an ancient work on the rules of conduct for laymen, the *Uvâsaga Dasâo.*[1] Prof. Leumann has edited another of the older works, the *Aupapâtika Sûtra*, and a fourth, entitled the *Dasa-vaikâlika Sûtra*, both of them published by the German Oriental Society; and finally, Prof. Jacobi has translated two more, the *Uttarâdhyâyana* and the *Sûtra Kritânga.*[2] Thus about one-hundredth part of these interesting and valuable old records are now accessible to the European scholar. It is the sect of the Svetâmbaras which has preserved the oldest literatures. Prof. Jacobi has discussed

[1] Published in the *Bibliotheca Indica*, Calcutta, 1888.

[2] These two, and the other two mentioned above, form vols. i. and ii. of his *Jaina Sûtras*, published in the *Sacred Books of the East*, 1884, 1895.

in two papers the history of the schism between them and the Digambaras, and several scholars—notably Bhagvanlâl Indrajî, Mr Lewis Rice, and Hofrath Buhler in the articles mentioned below[1]—have treated of the remarkable archæological discoveries lately made. These confirm the older records in many details, and show that the Jains, in the centuries before the Christian era, were a wealthy and important body in widely separated parts of India. A further confirmation of the substantial accuracy of the existing Jain records has been found in the numerous references to Jains, and to points of Jain belief, in the recently published Buddhist Nikâyas. These are older than the oldest of the Jain books. But the details they give show that the latter have not altered very much from the original tenets of their faith so represented, not seldom with evident bias, by their rivals the Buddhists.

It is now certain that the Jain community was really even older than the time of the Buddha, and was reorganized by his contemporary the Mahâ Vîra, named Vaddhamâna. And it is also clear that the Jain views of life were, in the most important and essential respects, the exact reverse of the Buddhist views. The two orders, Buddhist and Jain, were not only, and from the first, independent, but directly opposed the one to the other. In philosophy the Jains are the most thorough-going supporters of the old animistic position. Nearly everything, according to them, has a soul within its outward visible shape—not only men and animals, but also all plants, and even particles of earth, and of water (when it is cold), and fire and wind. The Buddhist theory, as is well known, is put together without the hypothesis of "soul" at all. The word the Jains use for soul is *jîva*, which means life; and there is much analogy between many of the expressions they use and the view that the ultimate cells and atoms are all, in a more or less modified sense, alive. They regard good, and evil, and space as ultimate substances which come into direct contact with the minute souls in everything. And their best-known position in regard to the points most discussed in philosophy is *Syâd-vâda*, the doctrine that you may say "Yes" and at the same time "No" to everything. You can affirm the eternity of the world, for instance, from one point of view, and at the same time deny it from another; or, at different times and in different connexions, you may one day affirm it and another day deny it. This position both leads to vagueness of thought and explains why Jainism has had so little influence over other schools of philosophy in India. On the other hand, the Jains are as determined in their views of asceticism (*tapas*) as they were compromising in their views of philosophy. Any injury done to the "souls" being one of the worst of iniquities, the good monk should not wash his clothes (indeed, the most austere will reject clothes altogether), nor even wash his teeth, for fear of injuring living things. "Subdue the body, chastise thyself, weaken thyself, just as fire consumes dry wood." It was by suppressing, through such self-torture, the influence on his soul of all sensations that the Jain could obtain salvation. It is related of the founder himself, the Mahâ Vîra, that after twelve years' penance he thus obtained Nirvâna (Jacobi, *Jaina Sûtra*, i. 201) before he entered upon his career as a teacher. And through the rest of his life, till he died at Pâvâ, shortly before the Buddha, he followed the same habit of continual self-mortification. The Buddha, on the other hand, obtained Nirvâna in his 35th year, under the Bodhi-tree, after he had abandoned penance; and through the rest of his life he spoke of penance as quite useless from his point of view. There is no manual of Jainism as yet published, but there is a great deal of information on various points in the introductions to the works quoted above. (T. W. R. D.)

[1] The *Hatthi Gumphâ* and three other inscriptions at Cuttack, Leyden, 1885; *Sravana Belgola* inscriptions, Bangalore, 1889; *Vienna Oriental Journal*, vols. ii.–v.; *Epigraphia Indica*, vols. i.–iv.

Jalaun, a town and district of British India, in the Allahabad district of the North-West Provinces. The town has a population of about 10,000, but is not a municipality. Formerly it was the residence of a Mahratta governor, but never the headquarters of the district, which are at Orai. The district of JALAUN forms part of British Bundelkhand; area, 1480 square miles. The population in 1881 was 418,142; in 1891, 396,361; and in 1901, 400,619; average density, 268 per square mile; land revenue and rates, Rs.5,92,905, the incidence of assessment being R.1:1:4 per acre; cultivated area (1896–1897), 283,641 acres, of which 59,810 were irrigated, including 47,075 from Government canals; number of police, 1743; number of vernacular schools (1896–97), 62, with 2264 pupils; registered death-rate (1897), 58·9 per thousand. The two largest towns are Kunch (13,408) and Kalpi (12,713). The district is now traversed by the line of the Indian Midland Railway from Jhansi to Cawnpore. A small part of it is watered by the Betwa canal, a "protective" work which has never paid the interest on the capital expended.

Jalisco, a state of Mexico, bounded on the N. by the states of Sinaloa, Durango, Zacatecas, and Aguascalientes; on the E. by Zacatecas, San Luis Potosí, Guanajuato, and Michoacan; on the S. by Colima and Michoacan; and on the W. by the Pacific. It has an area of 31,855 square miles, and had a population in 1879 of 983,484, and in 1900 of 1,137,311. It is well timbered, and has a climate varying according to the altitude. It is rich through its mines, agriculture, and stock-raising. The capital, Guadalajara, had in 1895 a population of 83,934; and amongst other towns are Zapotlanejo (20,270), Ciudad Guzmán (17,374), Lagos (14,716), Sayula (8819), Tamazula (8783), Autlan (8710), Teocaltiche (7568), Ameca (7212), Cocula (7090), Etzatlan (6753), La Barca (6465), Zacualco (6338), Tepatitlan (5994), Tizapan el Alto (5708), Colotlan (5590), Atotonilco el Alto (5551), Arandas (5367), and Ahualuco (5302).

Jalon, a river of Spain, having its source near Estiras, in the province of Soria, where it flows for nearly 32 miles in mountainous districts, before it enters the province of Saragossa. In this province it pursues a direction from west to east, passing near Alhama, Ateca, Calatayud, thence to Paracuellos, Ricla, Rueda, and, going under the imperial canal, joins the Ebro on its right bank at Alagon, after a total course of 180 miles. It has many tributaries in the provinces of Soria and Saragossa. It is not navigable.

Jalpaiguri, or JULPIGOREE, a town and district of British India, in the Rajshahi division of Bengal. The town is on the right bank of the river Tista, and has a railway station about 300 miles due north of Calcutta. Population (1891), 9682. There is a Government high school, with 226 pupils in 1896–97, and one printing-press. The district of JALPAIGURI occupies an irregularly-shaped tract south of Darjiling and Bhutan and north of the state of Cooch Behar. It includes the Western Dwars, annexed from Bhutan after the war of 1864–65. Area, 2962 square miles. The population in 1881 was 581,096; in 1891, 681,352, showing an increase of 17 per cent.; average density, 230 persons per square mile. In 1901 the population was 787,954, showing a further increase of 16 per cent. Land revenue and rates, Rs.7,57,965; number of police, 336; number of boys at school (1896–97), 9691,

being 17·7 per cent. of the male population of school-going age; registered death-rate (1897), 34·03 per thousand. The Western Dwars portion of the district is the principal centre of tea cultivation in Bengal. In 1897 the number of gardens was 285, employing 37,627 hands, with 65,072 acres under tea, yielding 24 million pounds. All these figures show a considerable increase on the previous year. The other portion of the district produces jute. There are 3 steam jute presses, employing 77 hands, with an out-turn of 26,000 bales; and 5 hand-presses, employing 130 hands, with an out-turn of 30,000 bales. The district is traversed by the main line of the Eastern Bengal Railway to Darjiling. It is also served by the Bengal Dwars Railway, with 102 miles open in 1900, and net earnings of £12,929.

Jamaica, the largest island of the British West Indies, lying between the Caribbean Sea and the Gulf of Mexico, about 80 miles to the southward of the eastern extremity of Cuba, within 17° 40′ and 18° 30′ N. and 76° 10′ and 78° 38′ W. It possesses many varieties of climate, due principally to the differences of altitude. Nearly one-half of the area of the whole island is above 1000 feet in height, and temperate in climate. At Kingston the temperature ranges from 70°·7 to 87°·8, and this is generally applicable to all the low-lying land round the coast. At Cinchona, at an elevation of 4907 feet, it varies from 57°·5 to 68°·5. The rainfall varies greatly. For the whole island the annual average is 66·3 inches; at Kingston it is 32·6; at Cinchona it is 105·57; in parts of the north-east it exceeds 200 inches. No month is, as a rule, quite without rain, but the heavy rains come in May and October, the latter being the heavier and lasting the longer. Except near lagoons and morasses, the island is healthy. Yellow fever rarely occurs nowadays. When it did occur in 1885 and 1897, the deaths due to it were in each case under 100, or less than 1 per cent. of the general mortality. The climate of the Santa Cruz mountains is, by reason of its dryness and equability, an ideal one for persons in the early stages of consumption, and for rheumatic subjects. About a century ago Jamaica suffered much from hurricanes, which destroyed buildings and crops. But now, fortunately, they pass to the north and east, and also to the south and west, with comparative frequency, but they rarely strike the island itself.

Flora and Fauna.—Jamaica is most favourably situated for the botanist. The flora shows types from North, Central, and South America, as well as a few European forms and the common plants found everywhere in the tropics. Of flowering plants there are about 2180 distinct species, besides many varieties, and of ferns about 450 species, a number of both being indigenous. The great number of species may be to some extent accounted for by the ranges of altitude, temperature, and humidity to be found in different parts. Amongst the woods suitable for cabinet work, mahogany, cedar, mahoe, yacca, and satinwood are most used. The principal objects of the Government botanical department are the supply of plants yielding products new to the agriculture of the colony, or of a better kind, 40,000 plants being on an average distributed annually; and the providing of information regarding the kind of soil, climate, &c., fitted for the plants, their proper cultivation and preparation for the markets. The principal public garden, with the official residence of the director of public gardens and plantations, is at Hope (700 feet), 5 miles from Kingston; other gardens are at Castleton (580 feet), in the centre of the island; the Hill Gardens at Cinchona (3000 to 6300 feet), in the Blue Mountains; the arboretum, Bath (70 feet), in the east end; and gardens in Kingston and at King's House. Forty-three of the birds of Jamaica are presumed to be peculiar to the island. The chief are the quail, the mountain partridge, the Jamaica heron, ducks, doves, and pigeons. The list by Alfred and Edward Newton, given in the *Jamaica Handbook* for 1881, still remains the standard. The land-crab is considered a delicacy, the land-turtle is eaten, but the iguana is not now used as food. In the sea around the coast there is a fair supply of good fishes, excellent in their way, but lacking for the most part the flavour of fishes of temperate waters. The more popular studies of entomology and conchology still reward the collector by the discovery of new and rare species, or of important facts of structure and life-history. The island is justly celebrated for the number of species of land-shells to be found in it. Similarly with the bats, birds, lizards, and amphibia, there is very much to reward the trained observer or enthusiastic collector. The very abundant and often large limestone caves all over the island, some with and others without water, have not yet been thoroughly explored, but, judging from results elsewhere, should contain unique specimens. In marine zoology, the coral reefs, with their varied skeleton-forming polyps and anemones, the numerous alcyonarians, various coral-dwelling animals, and fishes of brilliant hues and strange forms, are readily accessible along most parts of the coast.

Ethnology.—Only recently has anything like a systematic investigation and study been made of the relics of Jamaica's long-extinct Arawâk Indian inhabitants, but this has shown that the island is rich in such evidences, and more yet remains to be discovered. Collectors still find an abundance of aboriginal petaloid celts and other implements, flattened skulls and vessels in the limestone caves, miscellaneous objects from their kitchen-middens, and now and again an image or rock-carving. The inhabitants at present consist of Maroons, the descendants of those slaves of the Spaniards who fled into the fastnesses of the mountains on the conquest of the island by the British; the descendants of white settlers; British officials; a few still surviving natives of Africa originally imported as slaves; the descendants of African slaves; a mixed race of British and African blood; coolies from India, and a few Chinese. The number of white inhabitants, other than British, is very small. The Maroons live by themselves, and are an almost negligible quantity. The negroes are developing into a land-owning peasantry; the coloured section enter into trade and the professions; the white settlers are not increasing; the coolies on the expiration of their indentures frequently devote themselves to shopkeeping, as do the Chinese.

Area and Population.—The island is divided into three counties—Surrey in the east, Middlesex in the centre, and Cornwall in the west, which are again subdivided into fifteen parishes, as follows:—

County.	Parish.	Area in Square Miles.	Population by Census of 1891.	Population estimated, 1901.
Surrey	Portland	285	31,998	37,817
	St Thomas	274	32,176	37,299
	St Andrew	166	37,885	42,161
	Kingston	$5\frac{1}{12}$	46,542	52,475
	Port Royal	$2\frac{1}{12}$	1,962	
Middlesex	St Mary	249	42,915	51,671
	St Ann	476	54,127	67,133
	St Catherine	470	65,509	76,295
	Clarendon	474	57,105	68,692
	Manchester	302	55,462	70,294
Cornwall	Hanover	167	32,088	37,373
	St James	234	35,050	38,967
	Trelawny	333	30,996	35,095
	St Elizabeth	462	62,256	77,553
	Westmoreland	308	53,450	62,905
		$4207\frac{1}{6}$	639,521	755,730

The following table shows the changes in population according to the census of 1881 and 1891:—

	1881 Census.	1891 Census.
White	14,432	14,692
Coloured	109,946	121,955
Black	444,186	488,624
East Indian	11,016	10,116
Chinese	99	481
Not stated	1,125	3,653
Total	580,804	639,521
Males	282,957	305,958
Females	297,847	333,563

No census of the population was taken in 1901.

The following table gives the annual rate of births and deaths per thousand estimated on the mean population, the marriages celebrated, and the illegitimate births per hundred:—

	1881.	1891.	1900–1.
Births per thousand	36·7	38·3	35·7
Deaths ,,	26·0	22·7	21·6
Marriages celebrated	2178	3560	3221
Illegitimate births per hundred	57·7	60·7	62·4

The only emigration of any importance in the last quarter of the 19th century was during the years 1883–86, when the Panama Canal was in course of construction. The emigration was confined almost entirely to adult men, and resulted in a loss to the island of about 20,000 of the population, the chief loss taking place in 1883–84, when 34,852 emigrated to the Isthmus, and only 14,600 returned. Towards the close of 1900 about 2500 labourers emigrated to work on the construction of a railway in Ecuador.

The number of Indian immigrants between 1870 and 1880 was 9023; since then it has been as follows:—1880, 747; 1881, 504; 1882, none; 1883, 396; 1884, 680; 1885, 601; 1886 to 1890, none; 1891, 2136; 1892, none; 1893, 484; 1894, none; 1895, 698; 1896 to 1898, none; 1899, 615; 1900, 650.

Government.—The system of Crown government (instituted in 1865) by a governor, assisted by a legislative council consisting of *ex-officio* and nominated members, worked well till 1884, when matters came to a deadlock on account of a vote forced by the Government for damages for the seizure of the *Florence*, a vessel suspected of a breach of the foreign enlistment laws. This resulted in the resignation of all the unofficial members, and in the unwillingness of any private person to accept the position of a nominated member. Accordingly a change was made by which members elected by a limited suffrage were substituted for members nominated by the Crown, and the council was reconstituted with three *ex-officio*, four nominated officials, and nine elected members, with the governor as president. In 1895 the number of elected members was increased from nine to fifteen, *i.e.*, one for each parish of the island, the number of nominated and official members being at the same time proportionately increased from eleven to fifteen, but four of these seats were left vacant. In 1900 four additional nominated members were called in to take their seats, raising the official side of the House to fifteen in number, with fifteen elected members. The local affairs of the various parishes are controlled by elected parochial boards, subject to supervision by the Government.

Religion.—Under the disestablishment law of 1870, which arranged for a gradual disendowment of the Church of England, there are still in receipt of official salary five island curates and one stipendiary curate. The Disestablished Church of England in Jamaica has, including these, 102 clergy; the Baptists, 63; the Wesleyans, 49; the Presbyterian Church, 30; the Moravians, 25; the Roman Catholics, 12; the United Methodists, 9; the Christian Church, 7; the Congregationalists, 5; and the Church of Scotland, 4. The Salvation Army has a branch in the island. There are two Jewish synagogues in Kingston. The Church of England maintains a theological college, a deaconess home, and an orphanage; the Roman Catholics maintain a training college for female teachers, two industrial schools, and two orphanages; and the Baptists have a theological college.

Education.—There has been some reduction in the expenditure for education, and a slight alteration in the school age, which is now 6 to 14. Some inefficient schools have been closed. No grants to new denominational schools will be made, and closely-situated denominational schools will be amalgamated, where practicable, with Government schools. The elementary schools, attendance at which is voluntary, numbered in 1901, 720. They rose from 687 in 1881 steadily to 962 in 1895, since which date they have steadily declined. There were in 1901, 86,491 scholars on the books and 47,441 in average attendance. These schools are subsidized by the State, and receive (in addition) grants in lieu of fees, which were abolished in 1893. The teachers, both male and female, for these elementary schools are trained in the main at three training colleges subsidized by the Government. For higher education there are the University College and High School at Hope near Kingston, Potsdam School in St Elizabeth, Wolmer's Free School in Kingston (for boys and girls) founded in 1729, the Montego Bay Secondary School, and numerous other endowed and self-supporting establishments. Every year a scholarship is awarded of a total value of £600, spread over three, four, or five years, tenable at any of the universities of Great Britain and Ireland. Other smaller scholarships, varying from £60 to £10, are given every year. The Cambridge Local Examinations have been held regularly since 1882. In 1900, 263 candidates (168 boys and 95 girls) entered; of these 199 passed, including the best senior boy and the best senior girl in the empire.

Negroes.—A negro peasant population is growing up, which will, it is to be hoped, in a generation or two prove a mainstay and a support to the industries of the island. Two generations ago the Jamaica negro was treated little better than an ox, and too often purposely kept from all advance either in morals or education; and the consequences of this state of things remain. In many cases a field negro will not work for his employer more than four days a week. He may till his own plot of ground on one of the other days or not, as the spirit moves him, but four days a week will keep him easily. He has little or no care for the future. If by chance he is out of employment (and it is probably his own doing if he is), his needs are few. He has possibly squatted on some one's land, and has no rent to pay. Clothes he need hardly buy, fuel he wants only for cooking purposes, and food is ready to his hand for the picking. Unfortunately a wide-spread indulgence in prædial larceny is a great hindrance to agriculture as well as to moral progress. But that habits of thrift are being inculcated is shown by the steady increase in the accounts in the Government savings banks. That superstition is still prevalent amongst the negroes is unfortunately evidenced by the cases of *obeah*, or witchcraft, that come before the courts from time to time. The years that have passed since emancipation have been all too short to enable the ministers of religion and educators to grapple with the beliefs which are the outcome of centuries of the blackest superstition.

Finance.—The public debt of the colony was in 1901 £3,702,362. The public revenue for 1900–1 was £760,386, and the expenditure £763,662. Nearly half the public revenue (£360,000) is raised by customs duties, in very many cases by an *ad valorem* charge of 16⅔ per cent. Another chief source of revenue consists of licences, excise and internal revenue (£156,575). The more important items of the expenditure of 1900–1 were Debt Charges, £221,323; Administrative Departments (Governor, &c., £6584 + Privy Council £103 + Legislative Council £1257 + Colonial Secretariat £5182 + Clerks to Parochial Boards £947 + Registrar-General £4835 + Registrar of Titles £1563), £20,471; Railway, £51,288; Judicial, £40,306; Medical, £50,234; Police and Prisons, £74,846; Education, £56,071; and Public Works £74,873. Ecclesiastical charges (owing to the results of disestablishment) dwindled from £10,000 in 1879 to £2090 in 1901.

Defence.—There are military forces to the number of about 1750, consisting of a detachment of an infantry regiment and a company of Royal Artillery and one of Royal Engineers, and headquarters staff and four companies of the West India Regiment. There is also a militia, infantry and artillery, about 800 strong. The entrance to the harbour of Port Royal is strongly fortified.

Agriculture.—A Board of Agriculture has recently been appointed by the Government in order to develop the productive resources of the island; and there is also an agricultural society with twenty-six branches throughout the island. Agricultural enterprise in Jamaica may be divided into three kinds—pen-keeping (*i.e.*, the breeding of horses, mules, cattle, and sheep), planting, and a combination of the two. The principal industries of the planter are sugar, coffee, banana and (latterly) orange cultivation, cocoa, cocoanuts, ginger, limes, logwood, nutmegs, pimento, pineapples, and tobacco. Tobacco cultivation was till recently carried on principally by settlers from Cuba, many of whom, however, after the close of the Spanish-American war returned to their own country. Bee-keeping is a rising industry. Sugar estates have been gradually decreasing in number for years, but well-managed estates in advantageous situations still yield good profits. Jamaica Blue Mountain coffee realizes the highest price in the London market, and Jamaica ginger maintains its high reputation. The increase in the planting and exportation of bananas has been remarkable, the value of fruit exported in 1879 having been 2·9 per cent. of the total exports, and in 1899, 41·4 per cent. Of other fruits, the chief exported are oranges, and, to a small extent, grape-fruit, limes, pineapples, and mangoes. Of Crown lands there are about 100,000 acres, of which much is

suitable for cultivation. About 18,000 acres of Crown land are leased to some 2000 tenants; 46,000 are unplanted. Crown lands are sold in small lots to settlers on easy terms.

Manufactures.—The manufactures are few. In addition to the sugar and coffee estates and cigar factories, there are tanneries and breweries, electric light and gas works, iron-foundries, potteries, and factories for the production of cocoanut oil, essential oil, ice, matches, and mineral waters. There is an important establishment at Spanish Town for the production of logwood extract.

Trade.—The following table shows the fluctuations in the imports for home consumption in the years specified :—

	1879.	1889.	1899.
Live animals, food, drink, and narcotics	£633,565	£660,676	£674,094
Raw material	39,776	33,996	63,286
Manufactured articles	668,356	841,911	1,033,388
Coin and bullion	5,645	61,017	17,664
Total	£1,347,342	£1,597,600	£1,788,432

In 1900 the imports amounted to £1,806,865. The following shows the source of supply of the imports for the years named :—

	1879.	1889.	1899.
United Kingdom	50·90	55·0	44·7
United States	31·40	33·9	45·1
Canada	13·96	9·2	7·1
Other countries	3·74	1·9	3·1
	100·0	100·0	100·0

The exports for the same years and 1900 were :—

1879.	1889.	1899.	1900.
£1,357,530	£1,614,824	£1,662,542	£1,868,079

The following is a comparative statement of the proportion of exports during the years stated :—

	1879.		1889.		1899.	
Fruit		2·9		20·3		41·4
Sugar	30·6	45·0	16·3	25·4	9·8	15·9
Rum	14·4		9·1		6·1	
Coffee		18·3		19·4		10·5
Dye-woods		14·0		25·0		8·8
Pimento		5·8		3·2		8·3
Minor products		14·0		6·7		15·1
		100·0		100·0		100·0

The exports for these years were distributed in the following manner :—

	1879.	1889.	1899.
United Kingdom	73·2	37·3	20·0
United States	14·9	50·2	59·0
Canada	1·0	2·3	1·0
Other countries	10·9	10·2	20·0
	100·0	100·0	100·0

Shipping and Navigation.—Several steamship companies run steamers between Jamaica and England, and between Jamaica and the United States and Canada. In 1900 Messrs Elder, Dempster, and Company started their Imperial Direct West India Line with a subsidy of £40,000 contributed jointly by the Imperial Exchequer and the Jamaica Government, with a view to the encouragement of a fruit trade with England. Two steamers, in connexion with the Royal Mail and Direct Lines respectively, go round the island once a week, calling at all the principal ports. A number of sailing "droghers" also ply from port to port. Kingston harbour, the finest in the West Indies, has a total area of about sixteen square miles, of which about seven have a depth of from seven to ten fathoms. After Kingston, the principal ports are Port Antonio, Port Morant, Montego Bay, Lucea, Rio Bueno, and Port Maria, in addition to numerous reef-protected roadsteads. The ports of the island are cleared on an average by 1178 vessels of 829,390 tons annually.

Internal Communication.—Many miles of good driving-roads and bridle-paths have been made, opening up much land for cultivation and beautiful scenery for tourists. Many bridges have been built, rendering passable at all times streams which are unfordable during the rainy season. The main roads, about 1912 miles in extent, under the control of the Public Works Department, encircle the island, with several connexions from north to south. The parochial roads, which are maintained by the parochial boards, measure about 4318 miles. The railway (retransferred to the Government by the American company which had bought it in 1889, but which had failed to work it efficiently) traverses the island diagonally from Kingston in the south-east to Montego Bay in the north-west (113 miles distant), and also in a north-easterly direction to Port Antonio and in a central direction northwards to Ewarton.

Posts and Telegraphs.—Jamaica is included in the Postal Union and in the Imperial penny post and parcel post schemes. There is a weekly mail service to and from England by means of the Royal Mail and Direct Lines, but mails are also carried *viâ* the United States by the Hamburg-American and other companies. There are 149 post-offices in the island, and a tri-weekly (and in many cases a daily) post for letters, book packets, and parcels. Jamaica is connected with America, through Cuba, by the lines of the West India and Panama Telegraph Company, and with Halifax, Nova Scotia, through Bermuda, by the Direct West India Cable. There are telegraph stations at 70 post-offices.

Banking.—In Kingston there are branches of the Colonial Bank of London and the Bank of Nova Scotia. In the Government Savings Bank in Kingston in 1900 there were 32,218 depositors, including charities, societies, clubs, &c., with a total of £468,817 on deposit. There are fourteen branches of the Government savings banks, and thirteen sub-branches. Penny banks have also been established in nearly all the districts of the island by ministers of religion and others.

Currency.—The coins in circulation are British coins, gold and silver of all denominations, but not bronze, instead of which local nickel is used. United States gold passes as currency. English weights and measures are used.

KINGSTON, the capital of Jamaica, stands on a gravelly soil. The population by local census (1901) was 46,542. It covers, with its suburbs, an area of 1080 acres of ground regularly sloping down to the sea. An underground system of drainage is being introduced. The principal streets have been or are being reconstructed, brick, macadam, and asphalt being used in different parts, and the irregularities, due to neglect and heavy washings by rains, are being rectified. The water-supply has been increased, and there is a constant house-to-house supply throughout the city. A system of electric tramways runs throughout the town and suburbs. In the town, Myrtle Bank Hotel, the Jamaica Club, the additions to the lunatic asylum, and the theatre, and to the north of it, the Mico Training College and the Church of England Theological College, are the principal recent buildings. The Institute of Jamaica maintains a public library, museum, and art gallery, especially devoted to local interests. There is a good supply of both gas and electric light, as well as a telephone service and a supply of ice in the city.

PORT ROYAL, formerly the finest town in the British West Indies, never recovered from the effects of the fire of 1816. It is now only a naval and military station, and has been removed from the jurisdiction of the Kingston municipal authorities and placed under a separate board with control by the military and naval authorities. Commanding as it does the entrance to the harbour, it is strongly fortified. The commodore on the station resides there. The naval hospital is of considerable importance.

SPANISH TOWN, the former capital (5019), has since the removal of the seat of government to Kingston in 1872 gradually sunk in importance, the only public office now maintained there being the Record Office.

MONTEGO BAY (4803), on the north-west coast, is the second town in the island in respect of commerce, but PORT ANTONIO (1784), on the north-east, promises, owing to its fruit trade, to surpass it.

Included in the government of Jamaica are the Turks and Caicos Islands, which geographically form part of the Bahama Islands, to which they at one time belonged; the Cayman Islands, which lie from 110 to 150 miles north-west of the west end; the Morant Cays, about 33 miles south-east of the east end of the island; and the Pedro

Cays, about 40 miles south-west of Portland Point, the most southerly point of the island. The inhabitants of the Turks and Caicos Islands (5350 in 1901) live almost entirely by the profits of the salt industry, the salt being made from the sea by evaporation in salt-ponds, the bulk of the product going to the United States. The sea around the Caicos Islands produces a considerable quantity of sponges. The Cayman Islanders, who are in the fortunate position of having no pauper roll, live chiefly by turtling and by the exportation of phosphates. The Morant and Pedro Cays, which are uninhabited, are leased for the purposes of collecting guano, boobies' eggs, and turtle. Turks Islands are reached in two days by steamers which ply monthly between Jamaica and Halifax.

See *Jamaica Handbook*, 1901; BACON and AARON'S *New Jamaica* (1890); W. P. LIVINGSTONE'S *Black Jamaica* (1900); ROBERT T. HILL'S *The Geology and Physical Geography of Jamaica* (1899); MAXWELL HALL'S *Rainfall Atlas* (1892). (F. CU.)

Jamaica, in the western part of Long Island, formerly a village of Queens County, New York, U.S.A., but since 1st January 1898 a part of the fourth ward of the borough of Queens, one of the five boroughs of which New York City is composed. Population (1880), 3922; (1890), 5361.

James, David (1839–1893), English actor, was born in London in 1839, his real name being Belasco. He began his stage career at an early age, and after 1863 gradually made his way up in the profession in humorous parts. His creation, in 1875, of the part of Perkyn Middlewick in *Our Boys* made him famous as a comedian, the performance obtaining for the piece a then unprecedented "run" from 16th January 1875 till 18th April 1879. In 1885 David James had another notable success as Blueskin in the burlesque *Little Jack Sheppard* at the Gaiety Theatre, his principal associates being Fred Leslie and Nelly Farren. His song in this burlesque, "Botany Bay," became widely popular. In the part of John Dory in *Wild Oats* he again made a great hit at the Criterion Theatre in 1886; and among his other most successful impersonations were Simon Ingot in *David Garrick*, Tweedie in *Tweedie's Rights*, Macclesfield in *The Guv'nor*, and Eccles in *Caste*. His unctuous humour and unfailing spirits, combined with his ripe knowledge of theatrical methods and traditions, made him a great popular favourite. He died 2nd October 1893.

James, Henry (1843——), American author, was born in New York on the 15th of April 1843. His father was Mr Henry James, a theological writer of considerable originality, from whom both he and his brother Professor William James derived their psychological subtlety and their idiomatic, picturesque English. Most of Henry's boyhood was spent in Europe, where he studied under tutors in England, France, and Switzerland. In 1860 he came back to America, and began reading law in the Harvard Law School, only to find speedily that literature, not law, was what he most cared for. His earliest short story appeared in 1865, in the *Atlantic Monthly*, and frequent stories and sketches followed. In 1869 he again went to Europe, where he has since made his home, for the most part in London. Among his specially noteworthy works are the following: *Watch and Ward*, 1871; *Roderick Hudson*, 1875; *The American*, 1877; *Daisy Miller*, 1878; *A Life of Hawthorne*, 1879; *The Portrait of a Lady*, 1881; *Portraits of Places*, 1884; *The Bostonians*, 1886; *The Tragic Muse*, 1890; *Essays in London*, 1893; *The Two Magics*, 1898. As a novelist, Mr James is a modern of the moderns both in subject-matter and in method. He is entirely loyal to contemporary life and reverentially exact in his transcription of the phase. His characters are for the most part people of the world who conceive of life as a fine art and have the leisure to carry out their theories. Rarely are they at close quarters with any ugly practical task. They are subtle and complex with the subtlety and the complexity that come from conscious preoccupation with themselves. They are specialists in conduct and past masters in casuistry, and are full of variations and shadows of turning. Moreover, they are finely expressive of *milieu;* each belongs unmistakably to his class and his race; each is true to inherited moral traditions and delicately illustrative of some social code. To reveal the power and the tragedy of life through so many minutely limiting and apparently artificial conditions, and by means of characters who are somewhat self-conscious and are apt to make of life only a pleasant pastime, might well seem an impossible task. Yet it is precisely in this that Mr James is pre-eminently successful. The essentially human is what he really cares for, however much he may at times seem preoccupied with the *technique* of his art or with the mask of conventions through which he makes the essentially human reveal itself. Nor has "the vista of the spiritual been denied him." No more poignant spiritual tragedy has been recounted in recent fiction than the story of Isabel Archer in *The Portrait of a Lady*. Mr James's method is as modern as his subject-matter. He early fell in love with the "point of view," and the good and the bad qualities of his work all follow from this literary passion. He is a very sensitive impressionist, with a *technique* that can "fix" the most elusive phase of character and "render" the most baffling surface. The skill is unending with which he places his characters in such relations and under such lights that they flash out in due succession their continuously varying facets. At times he may seem to forget that a character is something incalculably more than the sum of all its phases; and then his characters tend to have their existence, as Positivists expect to have their immortality, simply and solely in the minds of other people. But when his method is at its best, the delicate phases of character that he transcribes coalesce perfectly into clearly-defined and suggestive images of living, acting men and women. Doubtless, there is a certain initiation necessary for the enjoyment of Mr James. He presupposes a cosmopolitan outlook, a certain interest in art and in social artifice, and no little abstract curiosity about the workings of the human mechanism. But for speculative readers, for readers who care for art in life as well as for life in art, and for readers above all who want to encounter and comprehend a great variety of very modern and finely modulated characters, Mr James holds a place of his own, unrivalled as an interpreter of the world of to-day.

James, Henry James, 1st BARON (1828——), English lawyer and statesman, son of P. T. James, surgeon, was born at Hereford, 30th October 1828, and educated at Cheltenham College. A prizeman of the Inner Temple, he was called to the bar in 1852 and joined the Oxford circuit, where he soon came into prominence. In 1867 he was made "postman" of the Court of Exchequer, and in 1869 became a Q.C. As the result of the general election of 1868 he obtained a seat in Parliament for Taunton as a Liberal, by the unseating of Mr Serjeant Cox on a scrutiny in March 1869, and he kept the seat till 1885, when he was returned for Bury. He attracted attention in Parliament by his speeches in 1872 in the debates on the Judicature Act. In 1873 (September) he was made Solicitor-General, and in November Attorney-General, and knighted; and when Mr Gladstone returned to power in 1880 he resumed his office. He was responsible for carrying the Corrupt Practices Act, 1883. On

Mr Gladstone's conversion to Home Rule, Sir Henry James parted from him and became one of the most influential of the Liberal Unionists: Mr Gladstone had offered him the Lord Chancellorship in 1886, but he declined it; and the knowledge of the sacrifice he had made in refusing to follow his old chief in his new departure lent great weight to his advocacy of the Unionist cause in the country. He was one of the leading counsel for *The Times* in the Parnell Commission, and from 1892 to 1895 was Attorney-General to the prince of Wales. In 1895 he entered the Unionist Ministry as Chancellor for the Duchy of Lancaster, and was made a peer as Baron James of Hereford.

James River, a river of Virginia, U.S.A., rising in the Allegheny Front, on the boundary between Virginia and West Virginia, and flowing across the Appalachian Valley, through the Blue Ridge and down the Atlantic slope with a general eastward course, to the foot of Chesapeake Bay. Its length is 350 miles, and it drains an area of 9684 square miles. Besides many rapids in its upper course, it flows over falls at Richmond, where it crosses the "Fall Line," which have been utilized as sources of power. Below this point the river is a navigable and tidal estuary.

Jameson, Leander Starr (1853——), British Colonial administrator, son of R. W. Jameson, a writer to the signet in Edinburgh, was born at Edinburgh in 1853, and was educated for the medical profession at University College Hospital, London (M.R.C.S. 1875; M.D. 1877). After acting as House Physician, House Surgeon, and Demonstrator of Anatomy, and showing promise of a successful professional career in London, his health broke down from overwork in 1878, and he went out to South Africa and settled down in practice at Kimberley. There he rapidly acquired a great reputation as a medical man, and besides numbering President Kruger and the native chief Lobengula among his patients, came much into contact with Mr Cecil Rhodes. In 1888 he enabled the British South Africa Company to obtain concessions in Matabeleland by visiting Lobengula at Bulawayo; and when the Chartered Company proceeded to open up the country, he abandoned his medical practice and joined the pioneer expedition of 1889. From this time his fortunes were bound up with Mr Rhodes's schemes in the north. In 1890 he obtained the concession from Gungunhana in Gazaland which prevented Portugal from practically asserting her claim to the country. In 1891 Dr Jameson was appointed Administrator of Rhodesia. The events connected with his vigorous administration and the wars with the Matabele are narrated under RHODESIA. At the end of 1894 "Dr Jim" came to England, and was *fêted* on all sides; he was made a C.B., and returned to Africa in the spring of 1895 with enhanced prestige. On the last day of that year the world was startled to learn by telegraph from Africa that he, with a force of 600 Bechuanaland Police, had made a raid into the Transvaal from Mafeking in support of a projected rising in Johannesburg, which had been connived at by Mr Rhodes at the Cape (see RHODES and TRANSVAAL). It need only be stated here that Dr Jameson's force was compelled to surrender at Doornkop; he and his officers were sent to Pretoria, and first sentenced to be shot, but then handed over to the British Government for punishment. They were tried in London under the Foreign Enlistment Act in May 1896, and Dr Jameson was sentenced to fifteen months' imprisonment at Holloway. Dr Jameson served a year in prison, and was then released on account of ill-health. He still retained the affections of the white population of Rhodesia, and subsequently returned there in an unofficial capacity. He was the constant companion of Mr Rhodes on his journeys up to the end of his life, and when Mr Rhodes died in 1902, Dr Jameson was left one of the executors of his will.

Jamestown, a city of Chautauqua county, New York, U.S.A., at the outlet of Chautauqua Lake. It is on the Erie and the Jamestown and Chautauqua Railways, at an altitude of 1317 feet. It is a popular summer resort, with an irregular plan, a good water-supply and sewer system and other municipal improvements. A good and cheap water power from the lake outlet is rapidly bringing it into prominence as a manufacturing city. Population (1890), 16,038; (1900), 22,892, of whom 7270 were foreign-born and 77 negroes.

Jamestown, a district in James City county, Virginia, U.S.A., near the mouth of the James river. The first permanent English settlement within the limits of the United States was founded here in 1607 by 105 colonists under Christopher Newport. At that time it was a peninsula, but the action of the river has changed the peninsula to an island. The town was the capital of the colony until 1699, after which it declined in population and importance, and there are now only a few ruins to mark the spot. The first colonial assembly in America was held here in 1619. It was the scene of an Indian massacre in 1622, and was burned in 1676 during Bacon's rebellion.

Jamkhandi, a native state of India, in the Deccan division of Bombay, ranking as one of the Southern Mahratta Jagirs. Area, 555 square miles. The population in 1881 was 83,917; in 1891, 102,162; average density, 184 persons per square mile; estimated gross revenue, Rs.10,73,324, of which Rs.62,660 was expended on public works in 1897–98; tribute, Rs.20,841; number of police, 326; number of schools 41, with 2318 pupils. The chief, whose title is Bhau Saheb Patwardhan, is a Brahman by caste. The state is under British administration. The town of JAMKHANDI is situated in 60° 30′ N. and 75° 22′ E., 68 miles east of Kolhapur. It has a high school, with 261 pupils in 1897–98. Population (1891), 12,504.

Jammu, or JUMMOO, capital of the native state of Jammu and Kashmir in Northern India, situated in 32° 44′ N. and 74° 54′ E., on the river Tavi, a tributary of the Chenab. Population (1891), 34,352; (1901), 34,097. It is connected with Sialkot in the Punjab by a railway 16 miles long constructed by the state. In 1898 the town was devastated by a fire, which destroyed most of the public offices. Jammu was formerly the residence of an independent Rajput dynasty, which was conquered by the Sikhs at the beginning of the 19th century, and acquired by Ghulab Singh as the nucleus of his dominions, to which the British added Kashmir in 1846. The state of Jammu proper, as opposed to Kashmir, consists of a submontane tract, forming the upper basin of the Chenab. Population (1891), 1,439,543; (1901), 1,515,998, showing an increase of 5 per cent., compared with an increase of 22 per cent. for Kashmir. A land settlement has recently been introduced under British supervision.

Jamsetjee Jeejeebhoy, Sir, 1st BART. (1783–1859), Indian merchant and philanthropist, was born in Bombay in 1783, of poor but respectable parents, and was left an orphan in early life. At the age of sixteen, with a smattering of mercantile education and a bare pittance, he commenced a series of business travels which were destined eventually to lead him to fortune and fame. After a preliminary visit to Calcutta, he undertook a voyage to China, which in those times was fraught with so much difficulty and risk that it was regarded as a venture betokening considerable enterprise and courage; and he subsequently initiated a systematic trade with that

country, being himself the carrier of his merchant wares on his passages to and fro between Bombay and Canton and Shanghai. His second return voyage from China was made in one of the East India Company's fleet, which, under the command of Sir Nathaniel Dance, defeated the French squadron under Admiral Linois (15th February 1804); and on his fourth return voyage from China, the Indiaman in which he sailed was forced to surrender to the French, by whom he was carried as a prisoner to the Cape of Good Hope, then a neutral Dutch possession; and it was only after much delay, and with great difficulty, that he made his way to Calcutta in a Danish ship. Nothing daunted, he undertook yet another voyage to China, which was more successful than any of the previous ones. By this time he had fairly established his reputation as a merchant possessed of the highest spirit of enterprise and considerable wealth, and thenceforward he settled down permanently in Bombay, where he directed his commercial operations on a widely extended scale. His system of conducting business on strictly moral principles, and under his own personal supervision, combined with the high esteem in which he was held for his sagacity, wide experience, and energy, resulted in success after success, until he was recognized throughout India as the prince of merchants. By 1836 his firm was large enough to engross the energies of his three sons and other relatives; and he had amassed what at that period of Indian mercantile history was regarded as fabulous wealth. An essentially self-made man in the strictest sense of the term, and having experienced in early life the miseries of poverty and want, in his days of affluence Jamsetjee Jeejeebhoy developed an active instinct of sympathy with his poorer countrymen, and commenced that career of private and public philanthropy which is his chief title to the admiration of mankind. His liberality was unbounded, and the absorbing occupation of his later life was the alleviation of human distress. To his own community he gave lavishly, but his benevolence was mainly cosmopolitan. Hospitals, schools, homes of charity, pension funds, were founded or endowed by him, while numerous public works in the shape of wells, reservoirs, bridges, causeways, and the like, not only in Bombay, but in other parts of India, were the creation of his bounty. The total of his known benefactions amounted at the time of his death, which took place in 1859, to over £230,000. It was not, however, the amount of his charities so much as the period and circumstances in which they were performed that made his benevolent career worthy of the fame he won. In the first half of the 19th century the different communities of India were much more isolated in their habits and their sympathies than they are now. Jamsetjee Jeejeebhoy's unsectarian philanthropy awakened a common understanding and created a bond between them which has proved not only of domestic value but has had a national and political significance. His firm faith in the benevolence and protection of British rule, of which he gave evidence by placing all his endowments, and even his own wealth, in British securities, infused in the people of India for the first time a spirit of firm confidence in that rule and an unquestioning faith in its stability. These great services were recognized first in 1842 by the bestowal of a knighthood upon him, and in 1858 by that of a baronetcy. These were the very first distinctions of their kind conferred by Queen Victoria upon a British subject in India. His title devolved in 1859 on his eldest son CURSETJEE, who, in pursuance of a provision in the letters-patent, took the name of Sir Jamsetjee Jeejeebhoy as second baronet. At his death, which occurred in 1877, his eldest son, MENEKJEE, assumed the same patronymic and became Sir Jamsetjee Jeejeebhoy, the third baronet. Both had the advantage of a thoroughly good English education, and continued the career of benevolent activity and devoted loyalty to British rule which had signalized the life-work of the founder of the family. They both visited England to do homage to their sovereign; and their public services were recognized by their nomination to the order of the Star of India, as well as by appointment to the Legislative Councils of Calcutta and Bombay. On the demise of the third baronet, the title devolved upon his brother, COWSAJEE, who became Sir Jamsetjee Jeejeebhoy, fourth baronet, and the recognized leader of the Parsee community all over the world. Since their emigration from Persia, that community had never had a titular chief or head, its communal funds and affairs being managed by a public body, more or less democratic in its constitution, termed the "Parsee Panchayat." The first Sir Jamsetjee, by the hold that he established on the community, by his charities and public spirit, gradually came to be regarded in the light of its chief; and the recognition which he was the first in India to receive at the hands of the British sovereign finally fixed him and his successors in the baronetcy in the position and title of its recognized official leader. (M. M. BH.)

Janesville, capital of Rock county, Wisconsin, U.S.A., on the river Rock and the Chicago and North-Western and the Chicago, Milwaukee and St Paul Railways, at an altitude of 802 feet. Its site is level and the plan irregular. It is in an agricultural region, and its manufactures consist largely of farming implements and machines, waggons and carriages. The Wisconsin school for the blind is situated here. Population (1890), 10,836; (1900), 13,185, of whom 2409 were foreign-born.

Janet, Paul (1823–1899), French philosophical writer, was born in Paris on 30th April 1823. He was professor of moral philosophy at Bourges (1845–48) and Strasburg (1848–57), and of logic at the Lycée de Louis le Grand, Paris (1857–64). In 1864 he was appointed to the chair of philosophy at the Sorbonne, and elected a member of the Academy of the Moral and Political Sciences. He wrote a large number of books and articles upon philosophy, politics, and ethics, on idealistic lines: *La Famille*, *Histoire de la Philosophie dans l'antiquité et dans le temps moderne*, *Histoire de la science politique*, *Philosophie de la Revolution Française*, &c. They are not characterized by much originality of thought. In philosophy he was a follower of Victor Cousin, and through him of Hegel. His principal work in this line, *Théorie de la morale*, is little more than a somewhat patronizing reproduction of Kant. He died in October 1899.

Jang Bahadur, Sir, MAHARAJA (1816–1877), ruler of Nepal, was a grand-nephew of Bhim Singh Thappa, the famous military minister of Nepal, who from 1804 to 1839 was *de facto* ruler of the state under the Queen Tripuri and her successor. Bhim Singh's supremacy was threatened by the Kala Pandis, and many of his relations, including Jang Bahadur, went into exile in 1838, thus escaping the cruel fate which overtook Bhim Singh in the following year. The Pandi leaders, who then reverted to power, were in turn assassinated in 1843, and Matabar Singh, uncle of Jang Bahadur, was created prime minister. He appointed his nephew general and chief judge, but shortly afterwards he was himself put to death. Fateh Jang thereon formed a ministry, of which Jang Bahadur was made military member. In the following year, 1846, a quarrel was fomented, in which Fateh Jang and thirty-two other chiefs were assassinated, and the queen appointed Jang Bahadur sole minister. The queen quickly changed her mind, and planned the death of her new minister, who at once appealed to the maharaja. But the plot failed. The

king and the queen wisely sought safety in India, and Jang Bahadur firmly established his own position by the removal of all dangerous rivals. He succeeded so well that in January 1850 he was able to leave for a visit to England, from which he did not return to Nepal until 6th February 1851. On his return, and frequently on subsequent dates, he frustrated conspiracies for his own assassination. The reform of the penal code, and a desultory war with Tibet, occupied his attention until news of the Indian Mutiny reached Nepal. Jang Bahadur resisted all overtures from the rebels, and sent a column to Gorakpur in July 1857. In December he furnished a force of 14,000 Gurkhas, which reached Lucknow on 11th March 1858, and took part in the siege. The moral support of the Nepalese was more valuable even than the military services rendered by them. Jang Bahadur was made a G.C.B., and a tract of country annexed in 1815 was restored to Nepal. Various frontier disputes were settled, and in 1875 Sir Jang Bahadur was on his way to England when he had a fall from his horse in Bombay and returned home. He received a visit from the prince of Wales in 1876. On 25th February 1877 he died, having reached the age of sixty-one. Three of his widows immolated themselves on his funeral pyre. (W. L.-W.)

Janina, or YANINA, capital of the vilayet of the same name, Albania, Turkey-in-Europe, on the west side of Lake Janina, 80 miles west of Larissa and 50 miles east of Corfu, the seat of a Greek archbishopric. Apart from the embroidery work of the women it has no special industry, and since 1881 its commercial importance has greatly diminished. Prior to the annexation of Thessaly to Greece a large proportion of the dealings in the grain produce of that province were transacted and settled in Janina. The export trade is now limited to cheese, hides, bitumen, and sheepskins, the annual value being about £120,000, and the import trade, valued at about double the export trade, to the supply of local wants. Population, 20,000.

Janiuay, a town in a beautiful valley near the centre of the province of Iloilo, island of Panay, Philippine Islands. The neighbouring country is hilly but fertile, producing rice, sugar, and tobacco; and wheat grows in the vicinity of the town. The women weave and sell beautiful fabrics of pineapple fibre, silk, cotton, and abacá. The language is Panay-Visayan. Population, 28,000.

Janjira, a native state of India, in the Konkan division of Bombay, situated along the coast among the spurs of the Western Ghats, 40 miles south of Bombay city. Area, 324 square miles. The population in 1881 was 76,361; in 1891, 81,780; average density, 252 persons per square mile. In 1901 the population was 85,392, showing an increase of 4 per cent. The estimated gross revenue is Rs.5,09,750, of which Rs.64,704 was expended on public works in 1897–98; no tribute; number of police, 135; number of schools, 60, with 3709 pupils. The chief, whose title is Nawab Saheb, is by descent a Sidi or Abyssinian Mahommedan; and his ancestors were for many generations admirals of the Mahommedan rulers of the Deccan. The present (1902) nawab was educated at the Rajkot college, and is K.C.I.E. He is entitled to a salute of nine guns. The state, popularly known as Habsan (=Abyssinian), did not come under direct subordination to the British until 1870. It supplies sailors and fishermen, and also firewood, to Bombay, with which it is in regular communication by steamer. The town of JANJIRA is merely a fortress on a small island of the same name, The principal seaport is Shrivardhan; population (1891), 7102. Murud had a population in 1891 of 5883. The Nawab of Janjira is also chief of the state of JAFARABAD, on the south coast of the peninsula of Kathiawar. Area, 42 square miles; population (1891), 12,389. The town of JAFARABAD is on the estuary of a little river, about a mile from the sea, and has considerable trade; population (1891), 5212.

Janssen, Pierre Charles César (1824–——), French astronomer, was born on 22nd February 1824 at Paris, and studied mathematics and physics at the Faculty of Sciences in that city. For some time he taught in the Lycée Charlemagne and the School of Architecture, but his life was mainly devoted to astronomical observations and especially to the study of the sun. In the pursuit of scientific knowledge he travelled all over the world. Thus in 1857 he went to Peru in order to determine the magnetic equator; in 1867 he carried out optical and magnetic observations at the Azores with Saint Claire Deville; in 1874 he visited Japan to view the transit of Venus; and he made several long expeditions to enjoy the opportunity for observations afforded by a total eclipse of the sun, *e.g.*, to Trani (1867), Guntoor (1868), Algiers (1870), Siam (1875), and the Caroline Islands (1883). To see the eclipse of 1870 he escaped from Paris, then invested by the German army, in a balloon. At the great Indian eclipse of 1868 he employed the spectroscope to reveal the nature of the red prominences as masses of glowing vapour, and devised a method (which was almost simultaneously thought of by several other astronomers) of observing them under ordinary conditions, when the sun's disk is not obscured by the moon. He also devoted much attention to the spectroscopic analysis of the sun's composition, particularly in reference to the question whether it contains oxygen or not. His efforts were directed towards eliminating, or getting an accurate estimate of, the disturbing effects of the oxygen in the earth's atmosphere, and his bold project of establishing an observatory on the top of Mont Blanc was prompted by a perception of the advantages to be gained by reducing the thickness of air through which observations have to be made. This observatory, the foundations of which were fixed in the snow that appears to cover the summit to a depth of ten metres, was built in September 1893, and Janssen, in spite of his sixty-nine years, made the ascent and spent four days taking observations. In 1875 he was appointed director of the astrophysical observatory which the French Government established in that year at Meudon.

Jaora, a native state of India, in the Malwa Agency. It lies in two isolated tracts, between Rutlam and Neemuch. Area, with the dependencies of Piplauda and Pant Piplauda, 581 square miles. The population in 1881 was 108,434; in 1891, 117,650, showing an increase of 8 per cent.; average density, 203 persons per square mile. The estimated revenue is Rs.8,00,000; subsidy for military contingent, Rs.1,61,810. The chief, whose title is Nawab, is a Mahommedan of Afghan descent. The late Nawab, who died in 1895, was an honorary major in the British army. His son was educated in the Daly College at Indore, with a British officer for his tutor. The administration is highly spoken of. There is an accumulated surplus of nearly Rs.3,00,000. The town of JAORA is on the Rajputana-Malwa railway, 20 miles north of Rutlam. Population (1881), 19,902; (1891), 21,844. It is well laid out, with many good modern buildings, and has a high school and dispensary. In 1897–98 the exports of opium amounted to 876 chests, on which the duty was Rs.4,94,650. To celebrate Queen Victoria's Diamond Jubilee, a Victoria Institute and a Zenana Dispensary were opened in 1898.

JAPAN.

I. Geography and Statistics.

Eastern Asia stretches two arms into the ocean, Kamchatka in the north, Malacca in the south, and between them lies a long, attenuated cluster of islands constituting the Japanese empire. On the extreme north are the Kuriles (called by the Japanese *Chishima*, or the "myriad isles"), which extend to east longitude 156° 32′ and to north latitude 50° 56′; and on the extreme south are the Pescadores (called by the Japanese *Hoko-tô*), which extend to east longitude 119° 20′ and to north latitude 21° 48′. Thus the islands of Japan cover 37° 12′ of longitude and 29° 8′ of latitude. There are five large islands, namely, Ezo, or Yezo, as it was called in the ninth edition of this work (which with the Kuriles is called *Hokkai-do*, or the north-sea district); Nippon (the "origin of the sun"), which is the main island; Shikoku (the "four provinces"), which lies on the east of the main island; Kiushiu (the "nine provinces"), which lies on the south of Nippon, and Formosa (called by the Japanese *Taiwan*), which forms the most southerly link of the chain. Formosa and the Pescadores were added to the empire after the victorious war with China in 1894–95. The following table shows the number, the lengths of coast-line in miles, and the areas in square miles of the various groups of islands, only those being indicated that have a coast-line of at least 1 *ri* (2½ miles), or those that, though of less development, are inhabited; except in the case of Formosa and the Pescadores, where the whole numbers are given:—

Position and extent.

	Number.	Length of Coast in miles.	Area in square miles.
Nippon	1	4,765·03	86,373·57
Isles adjacent to Nippon	166	1,275·09	470·30
Shikoku	1	1,100·85	6,861·39
Isles adjacent to Shikoku	74	548·12	175·40
Kiushiu	1	2,101·28	13,778·68
Isles adjacent to Kiushiu	150	2,405·06	1,821·85
Ezo	1	1,423·32	30,148·41
Isles adjacent to Ezo	12	110·24	30·51
Sado	1	130·05	335·92
Oki	4	182·27	130·40
Isle adjacent to Oki	1	3·09	0·06
Awaji	1	94·43	217·83
Isle adjacent to Awaji	1	5·32	0·83
Iki	1	86·47	50·96
Isle adjacent to Iki	1	4·41	0·47
Tsushima	1	454·49	261·94
Isles adjacent to Tsushima	5	454·49	261·94
Riukiu (or Loochoo Islands)	55	768·74	935·18
Chishima (Kuriles)	32	1,496·23	6,159·42
Ogasawara Islands (commonly called Bonin)	20	174·65	26·82
Taiwan (Formosa)	1	731·31	13,429·31
Isles adjacent to Formosa	29	128·32	not surveyed
Hoko-tô (Pescadores)	48	98·67	85·50
Totals	607	18,541·93	161,556·69

If the various islands of smaller dimensions than the above be included, a total of over 3000 in number is reached, but there has not been any absolutely accurate calculation of this figure.

Population. The population of the various parts of the empire was as follows on 31st December 1898:—

	Population.	Population per square mile.
Nippon[1]	33,327,935	380·0
Shikoku	3,013,817	430·0
Carry forward	36,341,752	387·0

[1] The figures include the population of the small isles adjacent to each of the islands indicated.

	Population.	Population per square mile.
Brought forward	36,341,752	387·0
Kiushiu	6,808,908	404·1
Hokkaido	610,155	15·5
Formosa	2,640,309	195·5
Hoko-tô (Pescadores)	49,787	582·3
Grand totals	46,450,911	288·0

The following figures show the rate of increase between the years 1889 and 1898:—

	Males.	Females.	Totals.
1889	20,246,336	19,825,684	40,072,020
1894	21,122,899	20,690,316	41,813,215
1898	22,072,057	21,688,149	43,760,815

According to historical records, the population of the empire in the year A.D. 610 was 4,988,842, and in 736 it had grown to 8,631,770. It is impossible to say how much reliance may be placed on these figures, but from the 18th century, when the name of every subject had to be inscribed in the roll of a temple as a measure against his adoption of Christianity, a tolerably trustworthy census could always be taken. The returns thus obtained show that from the year 1723 until 1846 the population remained almost stationary, the figure in the former year being 26,065,422, and that in the latter year 26,907,625. There had, indeed, been five periods of declining population in that interval of 124 years, namely, the periods 1738–44, 1759–62, 1773–74, 1791–92, and 1844–46. But after 1872, when the census showed a total of 33,110,825, the population grew steadily, its increment between 1872 and 1898 inclusive, a period of 27 years, being 10,649,990. Such a rate of increase invests the question of subsistence with great importance. In former times the area of land under cultivation increased in a marked degree. Returns prepared at the beginning of the 10th century showed 2½ million acres under crops, whereas the figure in 1834 was over 8 million acres. But the development of means of subsistence has been signally outstripped by the growth of population during recent years. Thus, during the ten-years period 1888–97, the population received an increment of 4,089,964, or over 10 per cent., whereas the food-producing area remained almost stationary. Indeed, there was reason to think that in 1901 Japan proper, as distinguished from the northern island of Ezo, had nearly reached the limit of her capacity for the production of food-stuffs, and that her people would henceforth become more and more dependent upon supplies from abroad, for it was plain that, under the greatly improved conditions of life resulting from the enlightened government of the *Meiji* era, a steady growth of population was to be anticipated.

Divided according to castes, the population groups itself as follows:—

	Heads of Families.	Members of Families.
Nobility (*kwazoku*)	706	3,845
Former *samurai* (*shizoku*)	439,386	1,666,310
Commoners (*heimin*)	8,179,704	33,470,864

The following table shows the number of marriages and divorces in Japan in 1889 and 1898:—

	Marriages.	Marriages per 1000 of Population.	Divorces.	Divorces per 100 of Population.
1889	340,445	8·50	107,478	2·68
1898	471,217	10·77	99,469	2·27

The fact that, speaking roughly, one divorce takes place for every four marriages, has often evoked severe comment from foreign critics. But it should be observed that the causes of divorce in Japan differ from those operative in Europe. The great majority of marriages among the lower orders are merely arrangements designed to test a couple's suitability to each other as helpmates in the struggle of life. If experience shows incompatibility of temper or any other mutually repellent disposition, divorce follows as a matter of course. On the other hand, divorces among persons of the upper classes are comparatively rare, and divorces on account of a wife's unfaithfulness are almost unknown.

The number of households in Japan at the close of 1898 was 8,175,208, and it follows that the average number of persons per household was 5·35.

The number of births per 100 inhabitants during the decade ended 1898 varied from 2·99 to 3·14—the male children averaging 104 to every 100 female—and the number of deaths per 100 inhabitants varied from 2·04 to 2·28. Illegitimate births exhibit an evident tendency to increase, as may be seen from the figures for the five years ended 1898:—

	Illegitimate Births.	Number per 100 of population.
1894	76,407	0·182
1895	80,168	0·189
1896	84,479	0·198
1897	90,128	0·208
1898	108,485	0·248

The Japanese show a steadily growing disposition to visit foreign countries. In 1889 the number residing abroad was only 18,688, whereas in 1898 it was 70,801. The bulk of that increase was due to emigration to Hawaii, where 36,000 Japanese are now employed on the sugar plantations, and to settling in Korea, where the Japanese residents increased from 5589 in 1889 to 15,309 in 1898. The Australian colonies, especially Queensland, also attract Japanese enterprise—there were 6000 Japanese living there in 1898, against only 450 ten years previously,—and more than 3000 find employment in Russian colonies.

If the Chinese element be excepted, the number of foreigners residing in Japan underwent little change during the period 1889–99, as the following figures show:—

Foreigners residing in Japan.

	1889.	1899.
Americans	899	1,296
British	1,701	2,013
Russians	63	134
Dutch	85	85
French	335	463
Portuguese	108	158
Germans	550	532
Peruvians	...	3
Swiss	57	94
Belgians	31	26
Italians	37	51
Danes	79	59
Swedes and Norwegians	33	42
Spaniards	15	50
Brazilians	...	1
Austro-Hungarians	56	83
Hawaiians	16	...
Chinese	4,975	6,372
Koreans	8	188
Greeks	...	1
Australians	1	...
Mexicans	...	3
Canadians	13	...
Others	...	30
	9,062	11,684

This slow growth of the foreign residents is remarkable when contrasted with the fact that the volume of the country's foreign trade, which constitutes the business in which they are engaged, grew in the same period from 136 million *yen*[1] to 443 millions. It may be added that out of 11,589 foreigners residing in Japan at the close of 1898, the number engaged in commerce and other professions was 10,654; the number in the service of the Government was 100, and the number in the service of private companies, institutions, &c., was 718, the remainder being officials.

In 1898 there were 21 towns in Japan having a population of over 50,000. They were as follows:—

Urban Populations.

Tôkyô	1,440,121	persons
Osaka	821,235	,,
Kyôtô	353,139	,,
Nagoya	244,145	,,
Kobe	215,780	,,
Yokohama	193,762	,,
Hiroshima	122,306	,,
Nagasaki	107,422	,,
Kanazawa	83,595	,,
Sendai	83,325	,,
Hakodate	78,040	,,
Fukuoka	66,190	,,
Wakayama	63,667	,,
Tokushima	61,501	,,
Kumamoto	61,463	,,
Toyama	59,558	,,
Okayama	58,025	,,
Otaru	56,961	,,
Kagoshima	53,481	,,
Niigata	53,366	,,
Sakai	50,203	,,

The first three on the above list, namely, Tôkyô, Osaka, and Kyôtô, are called "cities" (*fu*), the remainder being "towns" (*shi*). The number of towns having a population of over 20,000 is 76.

Mountains.

The Japanese islands may be said to be traversed throughout their entire length from north to south by a range of mountains forming a kind of backbone, which sends out lateral branches at various places. A special feature is that lofty summits are separated by comparatively low passes, owing to the fact that the latter lie at the level of crystalline rocks and schists constituting the original uplands upon which the summits have been piled by volcanic action. The scenery among the mountains is generally soft. Time's influence has been so strongly assisted by climatic agencies that everything rugged or abrupt has been smoothed and modified, until an impression of gentle undulation rather than of grandeur or boldness is suggested. Nowhere is the region of eternal snow reached, and seldom are masses of tender and varied foliage wanting to enhance the gentle aspect of the scenery and glorify it in autumn with tints of striking brilliancy and diversity. Extensive plains are exceptional. As a general rule, mountain alternates with valley, so that not more than one-eighth of the country's entire area is cultivable.

Fuji.

The king of Japanese mountains is Fuji-san (Peerless Mount), of which the highest point (Ken-ga-mine) is 12,395 feet above sea-level. The remarkable grace of this mountain's curve—it has been mathematically shown to be an inverted catenary—renders it one of the most beautiful objects of its kind in the world, and has obtained for it a prominent place in the field of Japanese decorative art. Great streams of lava flowed from the crater in ancient times. The course of one is still visible to a distance of 15 miles from the summit, but the rest are covered, for the most part, with deep deposits of ashes and scoriæ. On the south Fujiyama slopes unbroken to the sea, but on the other three sides the plain from which it rises is surrounded by mountains, among which, on the north and west, a series

[1] The *yen* is the Japanese monetary unit. It is equal to a fraction over 2 shillings sterling, or 50 cents (gold).

of most picturesque lakes has been formed in consequence of the ashes ejected from Fuji's crater damming the waters of the rivers. To a height of some 1500 feet the slopes of the mountain are cultivated; a grassy moorland stretches up the next 2500 feet; then follows a forest, the upper edge of which climbs to an altitude of nearly 8000 feet on one side, and finally there is a wide area of ashes and scoriæ. There is entire absence of the Alpine plants found abundantly on the summits of other high mountains in Japan, a fact due, doubtless, to the comparatively recent activity of the volcano. The ascent of Fuji presents no difficulties. A traveller can reach the usual point of departure, Gotemba, by rail from Yokohama, and thence the ascent and descent may be made in one day by a sturdy pedestrian, though two days are generally allotted to the task.

The Japanese Alps.

The provinces of Hida and Etchiu are bounded on the east by a chain of mountains, including, or having in their immediate vicinity, the highest peaks in Japan after Fuji. Six of these summits rise to a height of 9000 feet or upwards, and constitute the most imposing assemblage of mountains in Japan. The ridge from which they push their heads runs due north and south through a length of from 60 to 70 miles, and has a width of from 5 to 10 miles. It is mostly of granite, only two of the mountains—Norikura and Tateyama—showing clear traces of volcanic origin. The lower flanks of the ridge are clothed with forests of beech, conifers, and oak. Farther south, in the same range, stands Ontake, the second highest mountain in Japan proper, as distinguished from Formosa; and other remarkable though not so lofty peaks distinguish the same regions. This grand group of mountains has been well called the "Alps of Japan," and a good account of their features may be found in a book (*The Japanese Alps*) compiled by the Rev. W. Weston. On the summit of Ontake are eight large and several small craters, and there also may be seen displays of trance and "divine possession," such as are described by Mr Percival Lowell in *Occult Japan*.

The Nikko mountains.

Even more interesting and more picturesque, though less lofty, than the Alps of Japan, are the Nikkô mountains, celebrated as enclosing the mausolea of the two greatest of the Tokugawa Shoguns. The highest of these peaks are Shirane-san (7491 feet), Nantai-san (8169 feet), Nyohô-zan (8100 feet), and Omanago (7546 feet). They are clothed, for the most part, with magnificent vegetation, and everywhere they echo the voices of waterfalls and rivulets.

Mountains of the north.

In the north of the main island there are no peaks of remarkable height. The best known are Chôkai-zan, called "Akita Fuji" (the Fuji of Akita province), a volcano 7081 feet high, which was active as late as 1861; Ganju-san (7447 feet), called also "Nambu Fuji" or Iwate-zan, remarkable for the beauty of its logarithmic curves; Iwaki-san (4650 feet), known as Tsugaru-Fuji, and said by some to be even more imposing than the Peerless Mountain itself; and the twin mountain Gassan (6447 feet) and Haguro-san (5600 feet). A little farther south, enclosing the fertile plain of Aizu (Aizu-taira, as it is called), several important peaks are found, among them being Iide-san (6169 feet); Azuma-yama (6473 feet), a mountain which, after a long interval of quiescence, has given many evidences of volcanic activity during recent years; Nasu-dake (6286 feet), an active volcano; and Bandai-san (6444 feet). A terrible interest attaches to the last-named mountain, for, after having remained quiet for a time so long as to lull the inhabitants of the neighbouring district into complete security, it suddenly burst into fierce activity on 15th July 1888, discharging a vast avalanche of earth and rock, which dashed down the slopes of the mountain like an inundation, burying four hamlets, partially destroying seven villages, killing 461 people, and devastating an area of 27 square miles.

Mountains of Kôtsuke, Kai, and Shinano.

In the province of Kôtsuke, which belongs to the central part of the main island, the noteworthy mountains are Asama-yama (8136 feet), one of the best known and most violently active volcanoes of Japan; Akagi-san, a circular range of peaks surrounding the basin of an old crater and rising to a height of 6210 feet; the Haruna group, celebrated for scenic beauties, and Myogi-san, a cluster of pinnacles which, though not rising higher than 3880 feet, offer scenery wholly different from anything to be seen elsewhere in Japan; scenery which dispels the delusion that nature, as represented in the classical pictures (*bunjin-gwa*) of China and Japan, exists only in the artist's imagination. Farther south, in the province of Kai (Kôshiu), and separating two great rivers, the Fuji-kawa and the Tenryu-gawa, there lies a range of hills with peaks second only to those of the Japanese Alps spoken of above. The principal elevations in this range are Shirane-san (different from the mountain of the same name in the Nikkô group)—with three summits, Nôdori (9970 feet), Ai-no-take (10,200 feet), and Kaigane (10,330 feet)—and Hôôzan (9550 feet). It will be observed that all the highest mountains of Japan form a species of belt across the widest part of the main island, commencing on the west with the "Alps" of Etchiu, Hida, and Shinano, and ending on the east with Fuji-yama. In all the regions of the main island southward of this belt the only mountains of conspicuous altitude are Omine (6169 feet) in Yamato, Odai-yama (5540 feet) in the same province, and Daisen or Oyama (5951 feet) in Hôki.

Mountains of Shikoku.

The island of Shikoku has no mountains of notable magnitude. The highest is Ishitsuchi-yama (7743 feet), but there are several peaks varying from 3000 to 6000 feet.

Mountains of Kiushiu.

Kiushiu, though abounding in mountain chains, independent or connected, is not remarkable for lofty peaks. In the neighbourhood of Nagasaki, over the celebrated solfataras of Unzen (called also Onsen), stands an extinct volcano, whose summit, Fugen-dake, is 4800 feet high. More notable is Aso-san, some 20 miles from Kumamoto; for though the highest of its five peaks has an altitude of only 5544 feet, it boasts the largest crater in the world, with walls nearly 200 feet high and a basin from 10 to 14 miles in diameter. Aso-san is still an active volcano, but its eruptions during recent years have been confined to ashes and dust. Only two other mountains in Kiushiu need be mentioned—a volcano (4000 feet high) on the island Sakura-jima, in the extreme south; and Kirishima-yama (5528 feet), on the boundary of Hyûga, a mountain specially sacred in Japanese eyes, because on its eastern peak (Takachiho-dake) the god Ninigi is believed to have descended as the forerunner of the first Japanese sovereign, Jimmu.

The following list shows the principal mountains of Japan in the order of their altitudes, as well as the provinces in which they are situated:—

	Height in feet.	Province.
Niitake-yama (Mt. Morrison) .	14,350	Formosa.
Setsuri-san (Mt. Sylvia) . .	12,800	Formosa.
Fuji-san	12,395	Suruga.
Ontake	10,446	Shinano.
Norikura-dake.	10,387	Hida.
Shirane-san	10,330	Kai.
Akaishi-yama	10,147	Shinano.
Yariga-dake	10,144	Hida.
Orenge-yama	9,977	Etchiu.
Komaga-take	9,842	Kai.

	Height in feet.	Province.
Yakushi-dake	9,816	Kai.
Yatsuga-dake	9,612	Kai.
Tate-yama	9,186	Etchiu.
Kokushi-dake	8,438	Shinano.
Kimpu-san	8,369	Kai.
Yariga-mine	8,369	Etchiu and Hida.
Tateshima-yama	8,300	Shinano.
Iwasugo-yama	8,251	Shinano.
Nantai-san	8,169	Shimotsuke.
Asama-yama	8,136	Shinano.
Nyohô-zan	8,100	Shimotsuke.
Kabushi-dake	8,064	Kai.
Myôkô-zan	8,051	Echigo.
Takatsuma-yama	7,956	Echigo.
Yake-yama	7,906	Echigo.
Cha-cha-nobori	7,900	Kuriles.
Ena-san	7,874	Mino.
Hiuchi-dake	7,816	Iwashiro.
Haku-san	7,797	Kaga.
Ishitsuchi-yama	7,743	Iyo.
Azuma-yama	7,733	Shinano.
Daimugen-yama	7,647	Suruga.
Omanago	7,546	Shimotsuke.
Akanagi-san	7,513	Shimotsuke.
Shirane-san	7,491	Kôtsuke.
Ganju-san	7,447	Rikuchiu.
Tsurugi-san	7,355	Awa.
Chôkai-san	7,081	Ugo.
Kuroboshi-yama	7,047	Tôtômi.

Rivers. Japan is abundantly watered. Indeed, there is probably no other country in the world that possesses a closer network of streams, supplemented by canals and lakes. But the quantity of water carried seawards by these numerous rivers varies within wide limits; for whereas, during the rainy season in summer and while the snows of winter are melting in spring, great volumes of water sweep down from the mountains, these broad rivers dwindle at other times to petty rivulets trickling among a waste of pebbles and boulders. Neither are there any long rivers, as compared with Occidental figures, and all are so broken by shallows and rapids that navigation is generally impossible except by means of flat-bottomed boats drawing only a few inches. The chief rivers are given in the above table. There are eleven other rivers—the Iwata, the Ota, the Abashiri, the Shônai, the Iwaki, the Midori, the Yodo, the Hei, the Takatsu, the Watari, and the Abe—varying in length from 59 to 49 miles, in the order here set down, but they are not of sufficient importance to warrant fuller notice.

	Length in miles.	Source.	Point of Exit.
Ishikari-gawa	407 (?)	Ishikari-dake	Otaru.
Shinano-gawa	215	Kimpu-zan	Niigata
Teshio-gawa	192	Teshio-dake	Sea of Japan.
Tone-gawa	177	Monju-zan Kôtsuke	Choshi (Shimosa).
Mogami-gawa	151	Dainichi-dake (Uzen)	Sakata.
Yoshino-gawa	149	Yahazu-yama (Tosa)	Tokushima (Awa).
Kitakami-gawa	146	Nakayama-dake (Rikuchiu)	Ishinomaki (Rikuzen).
Tenryu-gawa	136	Suwako (Shinano)	Tôtômi Bay.
Go-kawa or Iwame-gawa	122	Maruse-yama (Bingo)	Iwami Bay.
Abukuma-gawa	122	Asahi-dake (Iwashiro)	Matsushima Bay.
Tokachi-gawa	120	Tokachi-dake	Tokachi Bay.
Sendai-gawa	112	Kunimi-zan (Hyûga)	Kumizaki (Satsuma).
Oi-gawa	112	Shirane-zan (Kai)	Suruga Bay.
Kiso-gawa	112	Kiso-san (Shinano)	Bay of Ise.
Ara-kawa	104	Chichibu-yama	Tôkyô Bay.
Naga-gawa	102	Nasu-no-yama (Shimotsuke)	Naka-no-minato (Hitachi).
Aka-no-gawa	97	Osenuma (Kôtsuke) and Inawashiro Lake	Matsugasaki (Echigo).
Imizu-gawa	93	Dainichi-dake (Mino)	Fushiki (Etchiu).
Jinzu-gawa	93	Norikura-dake (Hida)	Toyama (Etchiu).
Tama-gawa	92	Daibosatsu-toge (Kai)	Haneda (Tôkyô Bay).
Asahi-gawa (called also Nishi-O-kawa)	90	Mimasaka (N.W.)	Kojima Bay.
Shiribeshi-gawa	88	Shiribeshi-dake	Suttsu Bay.
Ki-no-kawa	85	Odai-san (Yamato)	Wakayama.
Shingû-gawa	85	Yoshino-san (Yamato)	Shingû (Kii).
Chikugo-gawa	85	Bungo and a second source in Higo	Chikushi Bay.
Fuji-kawa	85	Yatsuga-dake (Kai)	Suruga Bay.
Ono-gawa	83	Aso-san (Higo)	Oita (Bungo).
Kushiro-gawa	81	Kushiro-numa	Kushiro.
Miya-kawa	78	Odai-san (Yamato)	Ise Bay.
Kuzuryu-gawa	78	Mino	Fukui (Echizen).
Yahagi-gawa	78	Shinano	Chita Bay (Owari).
Hitaka-gawa	76	Kôya-san	Kii Bay.
Banyû-gawa	75	Yamanaka Lake (Kai)	Sagami Bay.
Yoshii-gawa (called also Higashi-O-kawa)	75	Mimasaka (N.)	Kajima Bay.
Yura-kawa	74	Wakasa	Tango Bay.
Omono-gawa	73	Kurikoma-dake (Rikuzen)	Tsuchizaki (Akita)
Naka-gawa	68	Tsurugi-san	South of Awaji.
Takahashi-gawa	68	Border of Izumo	Kurashiki (Bitchiu).
Koko-gawa	68	Tamba	Harima Bay.
Mimizu-gawa	68	Border of Higo	Hyûga Bay.
Toshibetsu-gawa	64	Toshibetsu	Sea of Japan.
Yûbetsu-gawa	64	Kitami plains	Northern Sea.
Nyodo-gawa	64	Iyo	Tosa Bay.
Oyodo-gawa	61	Kirishima-yama	Miyazaki.
Monobe-gawa	61	Border of Awa	Tosa Bay.
Naruse-gawa	61	Border of Uzen	Nobiru.
Nojiro-gawa	61	Osaru-zan (Rikuchiu)	Nojiro (Ugo).
Mabechi-gawa	61	Border of Rikuchiu	Hachinohe (Mutsu).
Kuma-gawa	59	Border of Hyûga	Yatsushiro.

Lakes and waterfalls. Japan has many lakes, remarkable for the beauty of their scenery rather than for their extent. Some are contained in alluvial depressions in the river valleys; others have been formed by volcanic eruptions, the ejectamenta damming the courses of the rivers and piling up their waters until exits were found over cliffs or through gorges. Some of these lakes have become favourite summer resorts for foreigners touring or residing in Japan. To that category belong especially the lakes of Hakone, of Chiusenji, of Shôji, of Inawashiro, and of Omi. Among these the highest is Lake Chiusenji, which is 4375 feet above sea-level, has a maximum depth of 93 fathoms, and empties itself at one end over a fall (Kegon) 250 feet high. The Shôji lakes lie at a height of 3160 feet, and their neighbourhood abounds in scenic charms; Lake Hakone is at a height of 2428 feet; Inawashiro, at a height of 1920 feet; and Omi, at a height of 328 feet. The Japanese associate Lake Omi with eight views of special loveliness (*Omi-no-hakkei*). Lake Suwo, in Shirano, which is emptied by the Tenryu-gawa, has a height of 2624 feet. In the vicinity of many of these mountain lakes thermal springs, with remarkable curative properties, are to be found, and there can be no doubt that among the features of Japan's future will be the establishment of health-resorts in regions offering so many attractions. The names and sizes of the principal lakes, so far as they have been surveyed, are as follow:—

Name.	Circumference in miles.
In the Tôkaidô Region.	
Ashi-no-ko[1] (Lake Hakone in Sagami)	11·78
Inba-numa (Shimosa)	29·28
Tega-numa (Shimosa)	...
Kasumi-ga-ura (Hitachi)	87·89
Kita-ura (Hitachi)	36·60
Kare-numa (Hitachi)	...
Ushiku-numa (Hitachi)	...
Kawaguchi-ko (Kai)	...
Nishino-umi (Kai)	...
Yamanaka-ko (Kai)	...
Motosu-ko (Kai)	...
Shôji-ko (Kai)	...
Ukijima-numa (Suruga)	...
In the Tôsandô Region.	
Biwa-ko (Omi)	180·20
Suwa-ko (Shinano)	11·10
Chiusenji-ko (Shimotsuke)	19·52
Sumoto-ko (Shimotsuke)	...
Inawashiro-ko (Iwashiro)	33·06
Shinai-numa (Rikuzen)	...
Kawara-numa (Mutsu)	33·33
Tawada-ko (Mutsu)	37·48
Jûsan-gata (Mutsu)	...
Hachiro-gata (Ugo)	36·60

[1] By the terms *ko* or *numa* or *ike* a lake is to be understood; by the terms *ura* or *kata*, a lagoon.

In the Hokuriku Region.

Name.	Circumference in miles.
Kita-gata (Echizen)	...
Kawakita-gata (Kaga)	...
Shibayama-gata (Kaga)	...
Ochi-gata (Noto)	...
Fukushima-gata (Echigo)	...
Yoroi-gata (Echigo)	...
Ebisuminato-gata (Sado)	...

In the Kanai Region.

Omuku-no-ike (Yamashiro)	10·44
Sayama-ike (Kawachi)	...

In the Sanindô Region.

Nakano-umi (Izumo)	39·77
Shinji-ko (Izumo)	31·72
Tôgô-no-ike (Hôki)	...
Koyama-ike (Inaba)	...

In the Sanyôdô Region.

Tokiwa-ike (Nagato)	8

In the Saikaidô Region.

Ikeda-ko (Satsuma)	...

(There are also about 40 small lakes at Kirishima-yama.)

In the Nankaidô Region.

There are no large lakes in this region; only such small ones as Hôjô-ike and Mano-ike.

In the Hokkaidô Region.

Name.	Circumference in miles.
Tôya-ko (Iburi)	24·40
Shikotsu or Chitose-ko (Kushiro)	27·00
Harutori or Kushiro-ko (Kushiro)	...
Fure-numa (Nemuro)	36·60
Saruma-ko (Kitami)	48·80
Notoro-ko (Kitami)	...

Meteorology. There are seventy-four meteorological stations in the Japanese empire, whence reports are constantly forwarded by telegraph to the central observatory in Tôkyô, and the latter issues daily statements of the climatic conditions during the previous twenty-four hours, as well as forecasts of the weather during the next twenty-four. The whole country is divided into seven districts for meteorological purposes, and storm-warnings are addressed to one or more of the divisions when such a precaution is judged necessary. At the most important stations observations are taken every hour; at the less important, six observations daily; and at the least important, three observations. This work is carried on by Japanese experts solely. Hitherto no attempt has been made to strike averages of the observations covering a number of years; but as without such averages no trustworthy deduction can be drawn, the reports of the observatories for the ten years ending 1900 are now collated to form the following table:—

AVERAGES OF METEOROLOGICAL OBSERVATIONS.

	Atmospheric Pressure.			Temperature of the Air.			Mean of the Tension of Vapours in the Air.	Mean of the Humidity of Air per cent.	Quantity of Rain and Snow.		Number of Days.									Velocity of Wind per second.	
	Mean Normal.	Max. Absolute.	Min. Absolute.	Mean Normal.	Max. Absolute.	Min. Absolute.			Total Quantity.	Max. in 24 hours.	Rain, Snow, Hail.	Snow.	Hail.	Thunder.	Fog.	Frost.	Clear Sky.	Cloudy Sky.	Tempestuous.	Mean Velocity in 24 hrs.	Max. of Velocity.
	mm.	mm.	mm.				mm.		mm.	mm.										Metres.	
1. Nagasaki	761·8	775·5	737·2	14° 6′	34° 8′	3° 7′	10·3	67	1822·2	122·8	165·8	14·6	19·7	12·0	0·8	37·6	41·5	136·8	19·3	2·1	21·2
2. Kôchi	761·2	777·9	737·2	15° 8′	34° 7′	5° 4′	12·4	74	2815·7	186·0	145·5	4·1	0·4	11·3	0·7	30·5	69·8	126·1	13·6	2 2	22·7
3. Kanazawa	761·5	776·0	741·6	13° 3′	34° 8′	6° 2′	10 0	78	2468·7	89·3	216·0	55·8	30·3	12·7	0 3	27·8	18·8	212·1	20·7	2·3	19·3
4. Tôkyô	760·6	775·6	738·9	14° 0′	34° 0′	6° 4′	10·3	73	1467·7	110·8	146·5	11·9	7·3	14·9	18 0	68·3	55·1	137·2	47·4	3·5	22·2
5. Hakodate	760·2	775·5	738·2	8° 2′	31° 9′	18° 8′	7·5	78	1186·4	81·5	192·5	108·1	33·3	10·4	15·1	72 1	20·4	163·4	158·2	5 0	23·5
6. Kagoshima	761·3	774·5	749·8	17° 0′	34° 5′	4° 2′	11·8	73	1967·2	123·2	162·8	6 4	3·4	12·7	0·8	48·5	49 8	146·1	18·2	27·0	19 2
7. Osaka	761·5	775·9	738·5	14° 9′	35° 8′	3° 5′	10·5	73	1346·6	86·7	14·4	16·1	8·5	13·4	4·1	8·4	44·5	103·1	55·8	3·6	21·9
8. Akamagaseki	761·6	775·1	742·4	15° 2′	34° 3′	4° 2′	11·1	75	1430·9	94·6	154·5	20·2	29·7	13·5	7·8	7·4	7·1	152·4	78·8	4·5	3·9
9. Sakai	761·7	776·1	740·0	14° 3′	35° 6′	5° 2′	10·7	77	1997·7	131·2	207·8	49·0	31·8	12·4	6·0	37·4	21·1	168·0	55·5	3 4	24·5
10. Akita	760·7	775·4	740·2	10° 2′	32° 9′	15° 6′	8·9	80	1754·6	82·7	234·8	91·7	31·4	11·1	6 5	40·7	15·1	202·1	8·7	4·2	28·3
11. Ishinomaki	760·6	775·0	739·6	11° 0′	31° 2′	10° 1′	9·3	78	1183·1	86·8	144 0	45 2	5·8	10·0	31·8	56·7	25·7	133·5	117·4	4·2	25·4
12. Nemuro	759·6	775·6	732·6	5° 3′	30° 0′	17° 3′	6·3	78	961·4	81·0	160·4	92·8	45·4	6 0	87·5	116·1	29·2	154·8	196·5	6·5	30·4
13. Wakayama	761·3	775·4	738·9	15° 4′	34° 1′	3° 2′	10·3	72	1651·1	136·0	137·0	13·3	10·3	10·6	2·6	52·6	32·6	153·0	25·0	2·9	24·1
14. Hiroshima	762·8	776·3	741·6	14° 9′	34° 5′	4° 1′	11·1	78	1823·3	105·9	130·6	24 6	8·0	8·0	12·0	54·0	47·6	121·0	10·0	2·3	21·8
15. Kyôtô	762·8	775·5	740·1	14° 2′	35° 1′	8° 8′	10·4	73	1770·2	102·2	157·0	93·9	6·6	10·0	5·0	97·0	31·6	141·6	5·3	1·6	13·6
16. Miyako	760·8	775·0	739·0	10° 3′	32° 7′	11° 5′	8·2	76	1523·9	119·5	145·3	36·6	14·3	7·3	15·0	88·6	45·6	129·0	22·3	2·5	17·9
17. Sapporo	759·5	774·8	735·0	7° 2′	31° 4′	23° 1′	7·1	79	1059·7	71·3	184·6	110·0	33·3	6·0	14·3	98·0	20 0	127·3	104·3	3 8	23·1
18. Pescadores	759·0	772·1	737·5	22° 6′	32° 8′	8° 8′	17·8	84	1240·2	204·3	146·0	—	—	21·0	5·5	—	35·5	128·0	237·0	11·1	24·1
19. Henchung	758·7	770·5	737·5	24° 7′	33° 2′	12° 0′	19·7	83	2911·8	237·8	161·5	—	—	35·5	—	—	21·0	127·5	81·0	4·8	21·1
20. Taipeh	759·9	774·3	734·3	21° 7′	36° 1′	4° 1′	16·3	82	2485·6	183·2	190·0	—	—	50·0	21·5	1·5	18·5	194·0	72·5	1·6	25·2
21. Nafa (Riukiu)	760·1	772·5	738·8	22° 5′	33° 4′	8° 3′	16·5	79	2377·7	177·6	111·0	—	1 5	26·5	2·5	—	17·0	193·0	77·0	4·4	29·6
22. Nagano	761·4	777·7	742·9	11° 9′	33° 6′	11° 6′	9·1	81	1389·7	73·2	176·0	67·0	3·5	18·5	15·5	118·0	2·5	14·5	52·5	2·4	21·8

N.B.—For the first five places in the above list the averages cover 10 years; for the next seven—from Kagoshima to Nemuro inclusive—they cover 7 years; for the next five places—from Wakayama to Sapporo inclusive—they cover 3 years; and for the last five places they cover 2 years. The quantity of rain and snow is the total height of the water collected at the hours of observations without taking count of duration. The number of days of rain, snow, &c., is reckoned for a period of 24 hours since the last observation, whatever may have been the duration of the phenomena, and a fall of rain, snow, or hail less than $\frac{1}{10}$th of a millimetre is not taken into account. The columns of snow and hail include all the days when these phenomena presented themselves in the above degree, and consequently these days are repeated in the three columns. As to foggy days, a thick fog is to be understood. For calculating cloudiness the standard 10 is taken, a cipher indicating absolute cloudlessness, and 10 a completely overcast sky. A "clear day" is when the quantity of cloud does not exceed 2 according to this scale, all other days being counted cloudy. A tempestuous day is when the velocity of the wind exceeds 2 metres per second. The temperatures in the table are centigrade.

The tables on the next page afford data for comparing the climates of Peking, Shanghai, Hakodate, Tôkyô, and San Francisco.

Climate. As might be expected from the large extension of the Japanese islands in a northerly and southerly direction, great varieties of climate exist. As general characteristics may be mentioned hot and humid though short summers, and long, cold, and clear winters. The equatorial currents laving the shores of the islands produce conditions differing from those existing at corresponding latitudes on the neighbouring continent. In Kiushiu, Shikoku, and the southern half of the main island, the months of July and August alone are marked by inconvenient heat at the sea-level, while in elevated districts a cool and even bracing temperature may always be found, though the direct rays of the sun retain inconvenient power. Winter, also, in these districts does not last more than two months, from the end of December to the beginning of March; for although the latter month is not free from frost, and even snow, the balminess of spring makes itself plainly perceptible. On the other hand, in the northern half of the main island, in Ezo and in the Kuriles, the cold is severe during the winter, which lasts for at least four months, and snow falls sometimes to great depths. This may be illustrated by saying that whereas in Tôkyô the number of frosty nights during a year does not average much over 60, the corresponding number in Sapporo or

the north-west of Ezo is 145. But the variation of the thermometer in winter and summer being considerable—as much as 40° C. in Tôkyô—the climate proves somewhat trying to persons of weak constitution. On the

	Longitude.	Latitude.	Mean Temp.
Peking . . .	116° 29′ E.	39° 57′ N.	11° 48′ [1]
Shanghai . .	121° 20′ E.	31° 12′ N.	15° 12′
Hakodate . .	140° 45′ E.	41° 46′ N.	8° 6′
Tôkyô . . .	139° 47′ E.	35° 41′ N.	13° 54′
San Francisco . .	122° 25′ E.	37° 48′ N.	13° 30′

	Hottest Month.	Mean Temp. of Hottest Month.
Peking	July	26° 6′
Shanghai . . .	,,	28° 6′
Hakodate . . .	August	21° 44′
Tôkyô	,,	26° 24′
San Francisco . .	September	16° 12′

	Coldest Month.	Mean Temp. of Coldest Month.	Difference.
Peking . .	January	−4° 36′	30° 42′
Shanghai . .	,,	−3° 30′	31° 36′
Hakodate . .	,,	−2° 36′	24° 0′
Tôkyô . . .	,,	2° 24′	24° 0′
San Francisco .	,,	9° 48′	6° 48′

other hand, the mean daily variation is in general less than in other countries having the same latitude: it is greatest in January, when it reaches 10° C., and least in July, when it barely exceeds 5° C. The monthly variation is very great in March, when it usually reaches 24° C.

There are two wet seasons in Central Japan, each of six weeks' duration, the first commencing in June, the second in September. Between these seasons are the dog days (*doyo*), from the middle of July till the second half of August. September is the wettest month; January the driest. During the four months from November to February inclusive only about 18 per cent. falls of the whole rain for the year. In the districts on the east of the main island the snowfall is insignificant, seldom attaining a depth of more than four or five inches, and generally melting in a few days, while bright, sunny skies are usual. But in the mountainous provinces of the interior and in those along the western coast, deep snow covers the ground throughout the whole winter, and the sky is usually wrapped in a veil of clouds. These differences are due to the action of the north-westerly wind that blows over Japan from Siberia. The intervening sea being comparatively warm, this wind arrives at Japan having its temperature increased and carrying moisture which it deposits as snow on the western faces of the Japanese mountains. Crossing the mountains and descending their eastern slopes, the wind becomes less saturated and warmer, so that the formation of clouds ceases.

Railways.—The work of railway building was commenced by the *Meiji* Government in 1869, and the first line—that between Tôkyô and Yokohama, a distance of 18 miles—was opened for traffic in 1872. But private capitalists showed no inclination to engage in such enterprise, and when at length in 1888 a company—the *Nippon Tetsudo Kaisha* (Japan Railway Company)—was projected, its organization could not be completed until the Treasury guaranteed 8 per cent. on the paid-up capital for 15 years. Progress was slow at first, so that in 1888 the total length of lines in operation was only 318 miles, of which 205 miles had been built by the Government and 113 by private enterprise. Thenceforth the work of construction proceeded more rapidly, so that the average annual addition made to private lines until the close of 1899 was 208 miles, and that made to State lines, 40 miles.

[1] The temperatures are centigrade.

The total length of lines open for traffic at the end of 1899 was 3639 miles, of which 833 miles had been constructed by the State and 2806 miles by private companies. The expenditure on account of State lines had been 70 million *yen* in round numbers, or 84,034 *yen* per mile; and that on account of private lines, 187 millions (including debentures and loans), or 66,286 *yen* per mile. The difference in cost of construction is explained by the facts that portions of the State lines were built before experience had indicated cheap methods; that extensive works for carriage-building, repairs of locomotives, &c., are connected with the Government lines, and that it fell to the lot of the State to undertake lines running through districts that present exceptional engineering difficulties, such districts being naturally avoided by private companies. The number of passengers and the quantity of goods carried over all the lines during 1899 were 102,115,942 and 18,820,034 tons respectively; the gross earnings amounted to 38,219,272 *yen*, and the working expenses to 18,833,217 *yen*, leaving a net profit of 19,386,055 *yen*. Thus the working expenses represented 49 per cent. of the earnings and the net profits averaged a little over 7½ per cent. of the invested capital.

The Government programme involves the construction of 1230 miles of new railways, and private companies—which number 103 in all—have obtained charters for building 961 miles, the former work involving an outlay of 114½ million *yen*, and the latter an outlay of 60 millions. Thus the lines in operation and projected total 5830 miles, and the capital involved aggregates 431½ million *yen*.

The programme of railway construction, as originally planned and subsequently carried out in great part, had for its basis a grand trunk line extending the whole length of the main island from Aomori on the north to Shimonoseki on the south, a distance of 1153 miles; and a continuation of the same line throughout the length of the southern island of Kiushiu, from Moji on the north—which lies on the opposite side of the strait from Shimonoseki—to Kagoshima on the south, a distance of 232¾ miles; as well as a line from Moji to Nagasaki, a distance of 163½ miles. Of this main road the State undertook to build the central section (376 miles), between Tôkyô and Kobe (*viâ* Kyôtô); the Japan Railway Company undertook the portion (457 miles) northward of Tôkyô to Awomori; the Sanyo Railway Company undertook the portion (320 miles) southward of Tôkyô to Shimonoseki; and the Kiushiu Railway Company undertook the lines in Kiushiu. The whole line is now in operation, with the exception of two sections, measuring 45¼ miles and 89¼ miles respectively, namely, the part of the Sanyo railway between Mitajiri and Shimonoseki, and the part of the Kiushiu railway between Kumamoto and Kagoshima. It is not literally correct to say that this main trunk line has been constructed as originally planned. The first project was to carry the Tôkyô–Kyôtô line through the interior of the island so as to secure it against enterprises on the part of a maritime enemy. Such engineering difficulties presented themselves, however, that the coast route was ultimately chosen, and though the line through the interior was subsequently constructed, strategical considerations have not been allowed to govern its direction completely.

When Japan began to build railways, much discussion was taking place in England and India as to the relative advantages of the wide and narrow gauges, and so strongly did the arguments in favour of the metre gauge appeal to the Indian Government that it adopted the latter in 1873, although some 5000 miles of wide-gauge roads had already been built. The English advisers of the Japanese Government maintained similar views, and it resulted that the

metre (3 feet 6 inches) gauge was chosen. Some fitful efforts made in later years to change the system proved unsuccessful, and there is now little reason to foresee any departure from the metre gauge. The lines, too, are single, for the most part: only 250 miles of double track exist out of the 3639 miles of line that have been built; and as the embankments, the cuttings, the culverts, and the bridge-piers have not been constructed for a double line, any change now would be very costly. The average speed of passenger trains in Japan is 18 miles an hour, the corresponding figure over the metre-gauge roads in India being 16 miles, and the figure for English parliamentary trains from 19 to 28 miles. British engineers surveyed the routes for the first lines and superintended the work of construction, but within a few years the Japanese were able to dispense with foreign aid altogether, both in building and operating their railways. They also construct carriages and waggons, but not locomotives, for though one was successfully built at the Kobe workshops under the superintendence of a British engineer, the enterprise did not continue. The lines are well ballasted, but the carriages are not comfortable, and the points and signal arrangements are of old patterns. Nevertheless there is tolerable immunity from accidents and irregularities, and seeing that the working expenses average only 49 per cent. of the gross earnings, whereas the corresponding figure in England is 55, it can scarcely be doubted that the management is efficient.

Central civil administration.

The central administration of public affairs is carried on by a cabinet, under the personal direction of the Sovereign, and by nine State departments, namely, those of foreign affairs, home affairs, finance, war, the navy, justice, education, agriculture, and commerce. The heads of these departments are called "ministers of State." They form a cabinet, under the direction of a minister president of State. Thus the cabinet numbers ten members, exclusive of the Emperor. Each department has a parliamentary and a permanent vice-minister, and is divided into bureaux presided over by chiefs. There is a privy council, charged with the duty of advising the Sovereign upon all questions submitted to it; and there are also a board of audit, which discharges important functions with regard to the public accounts; an administrative court, which takes cognizance of all legal questions connected with officials; and an administrative bureau of the House of Peers, as well as one of the House of Representatives. The affairs of the Imperial household and of the Imperial estates are managed by a household department under a minister, who has not a seat in the cabinet and is independent of ministerial vicissitudes. As a general rule, the portfolios of war and of the navy have changed hands on occasions of cabinet changes, but there is a growing tendency to invest these portfolios with a technical character and to make their tenure independent of the cabinet's life. Under the control of the central administration, though not forming an integral part of it, are the bureau of Tôkyô police, the Hokkaido bureau, the governors of prefectures and their staffs, and the government of Formosa.

Officials.

Japanese officials are divided into four classes: the first comprising those that receive their commissions directly from the Emperor and are entitled to report personally to him; the second, those that receive their commissions through the minister of a department and have the *entrée* to the palace on State occasions; the third, those commissioned similarly to the second class, but not having the *entrée* to the palace; and the fourth, those temporarily engaged and having the status of mere employés. There is also another classification into nine ranks, each having two grades. The place occupied by an official in this list is granted by the Emperor as a recognition of merit, and the designation is prefixed to the name, like a title, in official documents. Thus *Shô-ni-i Kôshaku Itô*, "First-grade second rank Marquis Itô"; or *Jû-sanmi Danshaku Iwakura*, "Second-grade third rank Baron Iwakura." Admission to officialdom is by examination, except in the case of candidates possessing certain duly attested educational qualifications.

The following table shows the number of officials belonging to the central Government and their respective emoluments:—

Officials.	Total Number.	Total Yearly Emoluments. Yen.	Average Yearly Emoluments. Yen.
First-class .	259	1,010,540	3,962 (£397)
Second-class .	4,269	4,296,208	1,006 (£101)
Third-class .	38,082	9,094,462	238 (£24)
Fourth-class .	26,266	4,186,500	159 (£16)
Totals .	68,876	18,587,710	269 (£27)

There has been of late years a steady tendency towards increase in the number of central Government officials. In 1893 the total was only 45,508, against 68,876 at present, and the emoluments aggregated 10,745,348 *yen*, whereas they now aggregate 18,587,710 *yen*.

Local administration.

For purposes of local administration the whole empire is divided into 47 prefectures (*ken*); 653 counties (*gun*); 48 towns (*shi*), and 14,734 districts (*cho* or *son*). The three metropolitan prefectures of Tôkyô, Osaka, and Kyôtô are called *fu*, and the districts are divided into "urban" (*cho*) and "rural" (*son*), according to the number of houses they contain. The prefectures are named after their chief towns, except in the case of Hokkaido and Okinawa. The names of the prefectures, with their population and superficies, are as follow:—

Prefecture.	Area in square miles.	Population.
Tôkyô	749·76	1,507,642[1]
Kanagawa . . .	927·79	776,642
Saitama . . .	1,585·30	1,174,094
Chiba	1,943·85	1,273,387
Ibaraki . . .	2,235·67	1,131,556
Tochigi . . .	2,854·14	788,324
Gumma . . .	2,427·21	774,604
Nagano . . .	5,088·41	1,237,584
Yamanashi . . .	1,727·50	498,539
Shizuoka . . .	3,002·76	1,199,805
Aichi	1,864·17	1,591,357
Miye	2,196·56	495,389
Gifu	4,001·84	996,062
Shiga	1,540·30	712,024
Fukui	1,621·50	633,840
Ishikawa . . .	1,611·59	392,905
Toyama . . .	1,587·80	785,554

The above 17 prefectures form Central Japan.

Prefecture.	Area in square miles.	Population.
Niigata . . .	4,914·55	1,812,289
Fukushima . . .	5,042·57	1,057,971
Miyagi . . .	3,223·11	835,830
Yamagata . . .	3,576·89	829,210
Akita	4,493·84	775,077
Iwate	5,359·17	720,380
Awomori . . .	3,617·89	612,171

The above 7 prefectures form Northern Japan.

Prefecture.	Area in square miles.	Population.
Kyôtô	1,767·43	931,576[2]
Osaka	689·69	1,311,909[2]
Nara	1,200·46	538,507

[1] This is not the population of the city proper, but that of the urban prefecture called Tôkyô-fu.

[2] This is not the population of the city proper, but of the urban prefecture.

Prefecture.	Area in square miles.	Population.
Wakayama	1,851·29	681,572
Hyogo	3,318·31	1,667,226
Okayama	2,509·04	1,132,000
Hiroshima	3,103·84	1,436,415
Yamaguchi	1,324·34	986,161
Shimane	2,597·48	721,448
Tottori	1,335·99	418,929

These 10 prefectures form Southern Japan.

Prefecture.	Area in square miles.	Population.
Tokushima	1,616·82	699,398
Kagawa	976·46	700,402
Ehime	2,033·57	997,481
Kochi	2,720·13	616,549

The above 4 prefectures form the island of Shikoku.

Prefecture.	Area in square miles.	Population.
Nagasaki	1,401·49	821,323
Saga	984·07	621,011
Fukuoka	1,894·14	1,362,743
Kumamoto	2,774·20	1,151,401
Oita	2,400·27	839,485
Miyazaki	2,904·54	454,707
Kagoshima	3,589·76	1,104,631
Okinawa	935·18	1,104,631

The above 8 prefectures form Kiushiu.

Prefecture.	Area in square miles.	Population.
Hokkaido	36,328·34	610,155

In the system of local administration full effect is given to the principle of popular representation. Each prefecture (urban or rural), each county, each town and each district (urban or rural) has its local assembly, the number of members being fixed in proportion to the population. There is no superior limit of number in the case of a prefectural assembly, but the inferior limit is 30. For a town assembly, however, the superior limit is 60 and the inferior 30; for a county assembly the corresponding figures are 40 and 15, and for a district assembly, 30 and 8. These bodies are all elective. The property qualification for the franchise in the case of prefectural and county assemblies is an annual payment of direct national taxes to the amount of 3 *yen;* and in the case of town and district assemblies, 2 *yen;* while to be eligible for election to a prefectural assembly a yearly payment of 10 *yen* of direct national taxes is necessary; to a county assembly, 5 *yen*, and to a town or district assembly, 2 *yen*. In towns and districts franchise-holders are further divided into classes with regard to their payment of local taxes. Thus, for town electors there are three classes, differentiated by the following process:—On the list of ratepayers the highest are checked off until their aggregate payments are equal to one-third of the total taxes. These persons form the first class. Next below them the persons whose aggregate payments represent the same fraction (⅓) of the total amount are checked off to form the second class, and all the remainder form the third class. Each class elects one-third of the members of assembly. In the districts there are only two classes, namely, those whose payments, in order from the highest, aggregate one-half of the total, the remaining names on the list being placed in the second class. Each class elects one-half of the members. This is called the system of *ô-jinushi* (large land-owners), and it is found to work satisfactorily as a device for conferring representative rights in proportion to property. The franchise is withheld from all local salaried officials, from judicial officials, from ministers of religion, from persons who, not being barristers by profession, assist the people in affairs connected with law courts or official bureaux, and from every individual or member of a company that contracts for the execution of public works or the supply of articles to a local administration, as well as from persons unable to write their own names and the name of the candidate for whom they vote. Members of assembly are not paid. For prefectural and county assemblies the term is four years; for town and district assemblies, six years, with the provision that one-half of the members must be elected every third year. The prefectural assemblies hold one session of 30 days yearly; the county assemblies, one session of not more than 14 days; the town and district assemblies have no fixed session: they are summoned by the mayor or the head-man (to whom further allusion will presently be made) when their deliberations appear necessary, and they continue in session till their business is concluded. Speaking broadly, the chief function of the assemblies is to deal with all questions of local finance. They discuss and vote the yearly budgets; they pass the settled accounts; they fix the local taxes within a maximum limit which bears a certain ratio to the national taxes; they make representations to the minister for home affairs; they deal with the fixed property of the locality; they raise loans, and so on. It is necessary, however, that they should obtain the consent of the minister for home affairs, and sometimes of the minister of finance also, before disturbing any objects of scientific, artistic, or historical importance; before contracting loans; before imposing special taxes, or passing the normal limits of taxation; before enacting new local regulations or changing the old; before dealing with grants in aid made by the central Treasury, &c. The governor of a prefecture, who is appointed by the central administration, is invested with considerable power. He oversees the carrying out of all works undertaken at the public expense; he causes bills to be drafted for discussion by an assembly; he is responsible for the administration of the funds and property of the prefecture; he orders payments and receipts; he directs the machinery for collecting taxes and fees; he summons a prefectural assembly, opens it and closes it, and has competence to suspend its session, should such a course seem necessary. Many of the functions performed by the governor with regard to prefectural assemblies are discharged by a "head-man" (*gun-chô*) in the case of county assemblies. This head-man is a salaried official appointed by the central administration. He convenes, opens, and closes the county assembly; he may require it to reconsider any of its financial decisions that seem improper, explaining his reasons for doing so, and should the assembly adhere to its original view, he may refer the matter to the governor of the prefecture. On the other hand, the assembly is competent to appeal to the home minister from the governor's decision. The county head-man may also take upon himself, in case of emergency, any of the functions falling within the competence of the county assembly, provided that he reports the fact to the assembly and seeks its sanction at the earliest possible opportunity. In each district also there is a head-man, but his post is always elective and generally non-salaried. He occupies towards a district assembly the same position that the county head-man holds towards a county assembly. Over the governors stands the minister for home affairs, who discharges general duties of superintendence and sanction, has competence to delete any item of a local budget, and may, with the Emperor's consent, order the dissolution of a local assembly, provided that steps are taken to elect and convene another within three months. The machinery of local administration is completed by councils, of which the governor of a prefecture, the mayor[1] of a town, or the head-man of a county or district, is *ex*

[1] The mayor of a town (*shichô*) is nominated by the minister for home affairs from among three men chosen by the town assembly.

officio president, and the councillors are partly elective, partly nominated by the central Government. The councils may be said to stand in an executive position towards the local legislatures, namely, the assemblies, for the former give effect to the measures voted by the latter, take their place in case of emergency, and consider questions submitted by them. This system of local government has now been in operation since 1885, and has been found to work well. It constitutes a thorough method of political education for the people, since the local assemblies —prefectural, county, town, and district—aggregate no fewer than 15,492 throughout the empire. In feudal days popular representation had no existence, of course, but a very effective chain of local responsibility was manufactured by dividing the people—apart from the *samurai*—into groups of five families, which were held jointly liable for any offence committed by one of their members. Thus it cannot be said that the people were altogether unprepared for this new system.

Law.—The laws of Japan are codified. They have all been drafted since the Restoration, their bases being the laws of Europe. In the work of drafting the Japanese received large assistance from foreign experts, and no efforts were spared to adopt the best principles of Occidental jurisprudence without doing violence to the customs and traditions of the nation. The civil code, the code of civil procedure, and the commercial code are modelled chiefly on the laws of Germany; the criminal code and the code of criminal procedure, on the laws of France. In one respect the code of criminal procedure has been allowed to fall behind the spirit of the age: preliminary examinations are private, and during them the accused is not allowed the benefit of counsel. Until a recent date persons under examination might be ordered into solitary confinement by the judge, if he considered that step necessary for eliciting the truth, but the *mise en sécret* was abolished in 1899, and a judge's power in preliminary examination is limited to separation of a prisoner's cell, and to forbidding intercourse between him and other persons.

The tribunals of justice are local courts, district courts, courts of appeal, and a supreme court, each having public procurators as well as judges attached to them. Local courts are presided over by a single judge, but all the other tribunals are collegiate, the district courts, appeal courts, and the supreme court being divided into several sections, each consisting of three, five, or seven judges respectively. Trial by jury has not been adopted in Japan, and is unlikely to be ever adopted. Neither is there any law of the nature of *habeas corpus*. The code of criminal procedure provides that a prisoner must be brought up for preliminary examination within forty-eight hours from the time of his apprehension, and empowers the examining judge to grant bail, the prisoner being entitled to complain to the court if bail is refused. There are also courts of conciliation, where cases are decided without being carried to contentious issues. There are 365 tribunals of justice in the empire, presided over by 1201 judges, with the assistance of 471 public procurators and 5987 clerks. It has been complained that the number of tribunals and their *personnel* are not sufficient to discharge the business coming before them. The criticism is probably just, but statistics show that the courts perform their functions rapidly, for in 1897 they dealt with 313,571 cases altogether, namely, 7654 appeals and 133,472 first instance cases in civil suits, 8507 questions of conciliation and 8723 appeals, and 155,215 first instance or magisterial cases in criminal matters.

In order to qualify for the post of judge or public procurator two examinations have to be passed. They are separated by an interval of at least two years, during which time the aspirant receives practical training in the duties of his profession. The Constitution provides that a judge's appointment shall be for life, and in practice he is not removed except by decision of the Disciplinary Court, or in consequence of a sentence for crime.

The number of police-offices in the empire (including Formosa) is 13,821, and the total number of police officials of all grades 32,910, or 1 for every 1421 of the population. The police force has been increased by 4591 since 1885, but of that increment the newly-organized force for Formosa represents 2934.

Crime.

The new criminal code came into operation in 1882, a reform which meant not only the complete abolition of torture, but also a sudden and striking change from laws of extreme severity to laws framed in accordance with the most humane principles of Western jurisprudence. An experiment so daring surprised foreign onlookers, and seemed to justify the apprehensions they freely expressed. But it does not appear from the records that by abandoning the system of heavy penalties encouragement was offered to crime. Taking the eight-years period from 1890 to 1897, by which time the police had learned to discharge their functions efficiently, and the compilation of statistics had become quite trustworthy, it is found that the number of persons charged with crimes or delicts in every thousand of the population stood at 3·21 in 1890, at 3·46 in 1891, at 3·71 in 1892, at 3·83 in 1893, at 3·88 in 1894, at 3·41 in 1895, at 3·40 in 1896, and at 3·32 in 1897. There is thus a tendency towards a decrease rather than an increase of crime, and the suitability of the new code to the conditions existing in Japan seems to have been clearly established. A similar tendency shows itself with regard to the inmates of houses of correction, the number having fallen from 1057 in 1890 to 692 in 1897. The effect of police vigilance, aided by improving conditions of life, is apparent also in checking incendiarism. This is a question of great importance for Japan, where, owing to the inflammable nature of the materials used in building habitations, danger of fire is always imminent. In the early part of the *Meiji* era fully 7 houses out of every 1000 in the country were destroyed yearly by conflagrations. In 1892 the number was 5·81, and in 1897 it had fallen to 4·20. More than 16 per cent. of these fires were due to incendiarism, but there has been a steady improvement in that respect, so that, whereas 2733 cases of arson occurred in 1892, the number in 1897 was only 1551.

Laws specially affecting Foreigners.—Under the revised treaties now in operation the following privileges are conceded to foreigners: (1) They may trade, travel, and reside in any part of Japan, enjoying full protection for their persons and property. (2) They may use the law courts on the same terms as Japanese subjects. (3) They have full religious freedom. (4) They are exempt from any taxes except those imposed on Japanese subjects. (5) They are exempt from military service, military contributions, and forced loans. (6) They may engage in all legitimate trades and mechanical operations, subject to the provisions of law. (7) They may enter into partnership with Japanese or foreigners, or become shareholders in joint-stock companies. (8) Their ships and cargoes may come to all ports open to foreign commerce without paying any higher duties or charges than those paid by Japanese subjects. (9) They are exempt from all transit dues, and they enjoy equality of treatment with Japan in regard to drawbacks, exportation, and warehousing facilities; but the coasting trade is reserved to Japanese vessels, except in the case of the existing open ports. (10) They may lease land. (11) They may take mortgages on land.

Foreigners are not at present permitted to own land in Japan in their individual capacity. The forms of tenure lawful for them are (1) tenure by ordinary lease; (2) tenure by superficies; and (3) tenure by ownership as a juridical person. Tenure by ordinary lease is limited to twenty years (subject to renewal), and the lessee is entitled to use and enjoy the object of the lease, whether land or buildings, under conditions substantially the same as those prescribed by English law, except that buildings, fixtures, trees, and plants placed there by the tenant may be removed by him at the termination of his lease. Tenure by "superficies"—a term which does not accurately represent its Japanese original, "superficial right"—is, in effect, a lease for purposes of building or planting. Such a lease may be for any term of years, fixed according to the convenience of the contracting parties, and the lessee (superficiary) is absolutely guaranteed against disturbance throughout that period—whether it be fifty or a thousand years. Even though the owner mortgages or sells the land before the expiration of the period, the rights of the superficiary are not affected, and the superficiary, on his side, may assign his superficies without prejudice to the rights of the owner. In short, this kind of tenure differs from actual ownership in name only. As to ownership by a juridical person, it is to be noted that the term "juridical person" signifies an association of two or more individuals of any nationality, or of mixed nationalities, formed for commercial, industrial, or certain other purposes, registered in Japan, and carrying on business according to the provisions of Japanese law. Such an association, in its corporate capacity, may own land. Thus two or three foreigners, contemplating the erection of a factory or mercantile premises in Japan, can become owners of land for that purpose, though as individuals they are not entitled to such a privilege.

A mortgagee does not become the owner of the mortgaged property by foreclosure, nor acquire any right of possession in it. When the debt is not discharged at the maturity of the mortgage, the property has to be sold by order of a court. There is also a special point with regard to the removal of mortgages. The purchaser of mortgaged property may offer a certain sum for the removal of the mortgage; and if the mortgagee, refusing the offer, demand a sale by auction, he must pledge himself to buy the property for a price at least 10 per cent. higher than the sum offered, in the event of that sum not being realized at the auction. Should the mortgagee be a foreigner, and the mortgaged property be land, then, since a foreigner cannot own land, the law provides that he must merely bind himself to be responsible for the difference between the amount bid at auction and a sum 10 per cent. higher than that offered originally for the removal of the mortgage. These various restrictions greatly impair the value of mortgages for business purposes. In the case of a pledge, also, Japanese law requires that the thing pledged must be actually delivered into the possession of the pledgee, except when it is in transit or stored in a public warehouse. The practice of hypothecating chattels by a registered bill of sale is not recognized.

Protection is given by Japanese law to foreign patents, designs, and trade-marks if proper steps are taken to register them. The applicant, if not domiciled in Japan, must appoint a representative domiciled there. The principles and rules governing the procedure in these matters are identical with those observed in Europe, and Japan is a member of the International Union for the Protection of Industrial Property.

The family law and the law of succession in Japan being based upon and adapted to the social conditions and customs long prevailing in the country, it has been considered wise by Japanese legislators that foreigners domiciled in Japan should be exempted from the operation of these laws, and left to be governed by the laws of their own nationalities, administered, of course, by Japanese tribunals.

Taxation.—The principal national taxes imposed in Japan are on land, incomes, business, vehicles, and *sake* (rice-beer). For purposes of taxation land is valued and a certain percentage of the assessed value is levied—5 per cent. in the case of urban lands, and 3⅓ per cent. in the case of rural lands. The assessment now adopted is generally the same as that made in 1873. Even at that time it did not amount to more than one-half of the market value of the land, and as the latter has largely appreciated, the tax actually paid is much below its nominal rate, especially in the cities, where the assessments are only a small fraction of the land's selling price. This tax is payable by the owner of the land. Income tax is payable, not only by Japanese subjects, but also by all persons having a domicile in Japan, or having resided there for more than one year. The minimum taxable income is 300 *yen* (£30) annually, and the rate for such an income is 1 per cent. As the income increases so does the rate, up to a limit of 5½ per cent., which is paid by persons having an income of 100,000 *yen* (£10,000) or upwards. The business tax is levied on various branches of business: as sales of merchandise, banking, insurance, warehousing, manufacturing, printing, photography, transportation, restaurants, hotels, factors and brokers. When levied on the amount of mercantile transactions, it is $\frac{1}{2000}$ for wholesale dealers and $\frac{3}{2000}$ for retail dealers. In other cases it is levied at the rate of $\frac{2}{1000}$ on the capital engaged, or at the rate of from 2 per cent. to 6 per cent. on the rental value of the buildings employed. When a business is carried on partly in a foreign country and partly in Japan, only the capital used in Japan is liable to tax. The taxes on vehicles and *sake* do not call for any special notice. Stamp duties and registration fees are also collected.

Local finances.

The total local expenditures are a little over 40 million *yen* annually. They increased from 25 millions to 40 millions in a period of 5 years (1895–99), but the increase is not an evidence of extravagance in administration, as 11 millions of it was devoted to useful public works, and nearly 2 millions to education. Revenue to meet these outlays is derived from five taxes—land-rate (13⅓ millions), house tax (5⅓ millions), business tax (2¾ millions), and miscellaneous tax (3½ millions). A large sum is obtained from property owned by the local administrations, and the central Treasury grants aids to the extent of 4½ million *yen*. The system of local taxation is complicated, but, speaking generally, two kinds of impost have to be paid: first, a prefectural tax; and, secondly, a town or district tax. Some of the local taxes are levied on the basis of the national tax—in which case the former must not exceed a certain fixed fraction of the latter; some are levied independently, as taxes on houses, vehicles, and draught-animals. A marked distinction is made between vehicles or animals kept for hire and those maintained by private individuals, and the same principle of graduation observed in the case of the income tax is applied to the house tax, so that the burden decreases rapidly as the poorer classes are reached.

Education.

Education is compulsory. Every child, on attaining the age of six, must attend a common elementary school, where, during a four years' course, instruction is given in morals, reading, writing, arithmetic, the rudiments of technical work, gymnastics, and poetry. Year by year the attendance at these schools increases. In 1898 4,062,418 children received education out of a total of

7,125,966, the percentage of school-goers being 68·91. The desire for instruction is keener among boys than among girls: of the former, 82·42 per cent. attend school, and of the latter only 53·73.

There are 26,322 public common elementary schools, and the total annual cost of maintaining them is £1,715,469. Hence the average yearly expense of each school is £65; the average number of students, 154; and the average annual cost per child, 8s. 6d., to which the child's parents contribute 1s. 9d. yearly, or $1\frac{3}{4}$d. per month. These elementary schools form part of the communal system, and such portion of their expenses as is not covered by tuition fees, income from school property, and miscellaneous sources, must be defrayed out of the proceeds of local taxation. The taxpayers' burden on this account is £1,150,446, and it thus appears that the four years' course of elementary education given to a Japanese child costs the taxpayer 22s. 6d., and costs the child's parents 7s The expense to parents will be still less in future, for by an ordinance issued in August 1900 it was enacted that whereas the payment of tuition fees has hitherto been the rule, and exemption from payment the exception, hereafter exemption is to be the rule and payment the exception. In short, elementary education will be virtually free.

There are also 174 public kindergartens, with an attendance of 15,000 infants, whose parents pay 3d. per month on the average for each child. In general the kindergartens are connected with elementary schools or with normal schools.

Many (4735) of the common elementary schools have a section where, subsequently to the completion of the regular curriculum, a special supplementary course of study may be pursued in agriculture, commerce, or industry (sewing in the case of girls). For the same purpose there exist also 318 higher elementary schools, to which a child can gain admittance after passing out of a common elementary school. The time devoted to these special courses is two, three, or four years, according to the degree of proficiency contemplated, and the cost to the parents is 6d. per month.

If a child, after graduating at a common elementary school, desires to extend its education, it passes into a common middle school, where training is given for practical pursuits or for admission to higher educational institutions. The ordinary curriculum at a common middle school includes moral philosophy, English language, history, geography, mathematics, natural history, natural philosophy, chemistry, drawing, and the Japanese language. Five years are required to graduate, and from the fourth year the student may take up a special technical course as well as the main course; or, in accordance with local requirements, technical subjects may be taught conjointly with the regular curriculum throughout the whole time. The law provides that there must be at least one common middle school in each prefecture. The actual number is 169, with 2061 teachers and 49,684 students, being an average of 294 students to each school, and 1 teacher to 24 students. The total annual cost of maintenance is £207,166. Thus each school requires an average outlay of £1226, of which sum the taxpayers defray £720. A student in a common middle school costs the State £2, 19s. yearly, and his five years' course represents a local tax of £14, 15s. It will be seen, therefore, that when a child has completed its four years in a common elementary school and five years in a common middle school, its education has cost the public £15, 17s. 6d.

Great inducements attract attendance at a common middle school. Not only does the graduation certificate carry considerable weight as a general qualification, but it also entitles a young man to volunteer for one year's service with the colours, thus escaping two of the three years he would have to serve as an ordinary conscript.

The graduate of a common middle school can claim admittance, without examination, to a high school, where he spends three years preparing to pass to a university, or four years studying a special subject, as law, engineering, or medicine. By following the course in a high school a youth obtains exemption from conscription until the age of 28, when one year as a volunteer will free him from all service with the colours. There are 6 high schools, with a total attendance of 4664 students, and the instructors number 351, or 1 to every 13 students. A high school certificate of graduation entitles its holder to enter a university without examination, and qualifies him for all public posts.

In addition to the schools already enumerated, which may be said to constitute the machinery of general education, there are special schools (6) and technical schools (74) where instruction is given in agriculture, commerce, mechanics, applied chemistry, navigation, electrical engineering, art (pictorial and applied), veterinary science, sericulture, and various other branches of industry. There are also 17 apprentices' schools, classed under the heading of "elementary," where courses of not less than six months, and not more than four years, may be taken in dyeing and weaving, embroidery, the making of artificial flowers, tobacco manufacture, sericulture, reeling silk, pottery, lacquer, wood-work, metal-work, or brewing. On the average, each of these schools has 67 students and 6 teachers, and costs £520 annually, or £7, 15s. per student. The taxpayers contribute £355 yearly towards the support of each school, and the expense to the student is about 2s. 6d. per month.

Normal schools are maintained for the purpose of training teachers. There are two high normal schools, one for males, the other for females, the former having 555 pupils, the latter 171; and there are 47 common normal schools, with 7302 male students and 879 females. Great difficulty is experienced in obtaining a full complement of teachers for elementary public schools. The total number required is 95,000 approximately, and the number actually available is only 64,000. That is mainly due to the very small emoluments given for such service. Out of 64,000 teachers now employed in elementary schools, only 50 get as much as £48 a year; 11,000 have less than £10 annually, and the salaries of 49,000 range from £11 to £24. Considering that a common labourer now earns £18 a year, the reason for the insufficiency of teachers is apparent.

There are two Imperial universities, one in Tôkyô and one in Kyôtô. The latter is not yet fully organized. The former has 205 professors and instructors and 2463 students. Its colleges number six — law, medicine, engineering, literature, science, and agriculture. It has a university hall where post-graduate courses are studied, and it publishes a quarterly journal giving accounts of scientific researches which indicate not only large erudition, but also original talent.

All the figures given above are independent of private educational institutions. Of these there are 1600, employing 5346 teachers and having 149,230 pupils. The tendency of the system pursued by the State is to discourage private education, for unless a private school brings its curriculum into accord with that prescribed for public institutions, its students are denied the valuable privilege of exemption from conscription, as well as the other advantages attaching to State recognition. Further, the disposition to

present large sums for educational purposes has not yet become widely effective among private individuals in Japan. Voluntary contributions in aid of public schools aggregate about £90,000 annually, but the efforts made by the people on this account are still comparatively insignificant.

The Anglo-Saxon element predominates largely among the foreigners engaged in education. Out of a total of 270 instructors, 198 are American and British. France comes third on the list with 42; Germany fourth with 16, and Russia fifth with 4.

II. Recent History.

The nation's part in the early changes.

When reference is made to the Japanese nation in connexion with the radical changes of 1867, it must be observed that only the nobles and the *samurai* (military class) are indicated—in other words, a section of the population representing about one-sixteenth of the whole. The bulk of the people—the agricultural, the industrial, and the mercantile classes—remained outside the sphere of politics, not sharing the anti-foreign prejudice, nor taking any serious interest in the great questions of the time. Foreigners often noted with surprise the contrast between the fierce antipathy displayed towards them by the *samurai* on the one hand, and the genial, hospitable reception given to them by the common people on the other. History teaches that the latter was the natural disposition of the Japanese—the former a mood educated by special experiences. Further, even the comparatively narrow statement that the restoration of the administrative power to the Emperor was the work of the nobles and the *samurai* must be taken with limitations. A majority of the nobles entertained no idea of any necessity for change. They were either held fast in the vice of Tokugawa authority, or paralysed by the sensuous seductions of the lives provided for them by the machinations of their retainers, who held the administrative authority of the fiefs in their own hands, leaving its shadow only to their lords. It was, in fact, among the retainers that longings for a new order of things were generated. Some of these men were sincere disciples of progress—a small band of students and deep thinkers who, looking through the narrow Dutch window at Deshima, had caught a glimmering perception of the realities that lay beyond the horizon of their country's prejudices. But the influence of such Liberals was comparatively insignificant. Though they showed remarkable moral courage and tenacity of purpose, the age did not furnish any strong object-lessons to enforce their propaganda of progress. The factor chiefly making for change was the *samurai's* loyal instinct, reinforced by the teachings of Chinese philosophy, by the revival of the Shinto cult, by the promptings of national enterprise, and by the suggestions of foreign intercourse.

Throughout the whole period of Tokugawa rule there had been a strong, if somewhat fitful, leaning of the national mind towards the political philosophy of Confucius and Mencius, as expounded by Choo He and Yang Wang-ming. Iyeyasu himself had given the first impetus to this disposition by his patronage of literature. Without any perception of the true spirit of the Chinese sages' teachings, he ordered that primers of the "old learning" should be procured and studied. Thus the Zen doctrines of Buddhism, which contributed so much to the development of the heroic and the sentimental, and were therefore favourable to the stability of military feudalism, gradually gave place to a theory that the only legitimate ruler was heaven-appointed, that the good of the people should be the first object of administration, and that to fail in achieving that object was to forfeit the title of administrator. A century later, another Tokugawa Shogun (Tsunayoshi) fostered a movement equally fatal to the permanency of feudalism; he encouraged the revival of the Shinto cult which teaches the divine origin of the Mikado, and constructively inculcates that every exercise of administrative authority by a subject is a usurpation. It is possible that although the current of thought inspired by the Chinese philosophy and the Japanese cult was opposed to the dual government of Yedo and Kyôtô, the system might have long survived this theoretical disapproval had nothing occurred to furnish signal proof of its practical defects. But the crisis caused by the advent of foreign ships, and by the forceful renewal of foreign intercourse, afforded a convincing proof of the Shogunate's incapacity to protect the State's supposed interests and to enforce the traditional policy of isolation which had come to be considered essential to the empire's integrity and to the sanctity of the throne. Thus it may be alleged that the nation's mind was already educated for the change which the advent of foreigners precipitated.

Character of the revolution.

But though essentially imperialistic in its prime purposes, the revolution which involved the fall of the Shogunate, and ultimately of feudalism, may be called democratic with regard to the *personnel* of those who planned and directed it. They were, for the most part, *samurai*, without either official rank or social standing. That is a point essential to a clear understanding of the issue. Fifty-five men may be said to have planned and carried out the overthrow of the Yedo administration, and only five of them were territorial nobles. Eight, belonging to the Court nobility, laboured under the traditional disadvantage of their class, poverty; and the remaining forty-two, the hearts and hands of the movement, may be described as ambitious youths, who sought to make a career for themselves in the first place, and for their country in the second. The average age of the whole did not exceed thirty. There was another element also—an element for which any student of Japanese history might have been prepared: the Satsuma *samurai* aimed not merely at overthrowing the Tokugawa, but also at obtaining the Shogunate for their own chief. Possibly it would be unjust to say that all the leaders of the great southern clan harboured that idea. But some of them certainly did, and not until they had consented to abandon the project did their union with Choshiu, the other great southern clan, become possible—a union without which the revolution could scarcely have been accomplished. This ambition of the Satsuma clansmen deserves special mention, because it bore remarkable fruit; it may be said to have laid the foundation of constitutional government in Japan. For, in consequence of the distrust engendered by such aspirations, the authors of the Restoration agreed that when the Emperor assumed the reins of power, he should pledge himself by oath to convene a deliberative assembly, and to appoint to administrative posts men of intellect and erudition wherever they might be found.

The anti-feudal idea.

At the outset the necessity of abolishing feudalism did not present itself clearly to the leaders of the revolution. Their sole idea was the unification of the nation. But when they came to consider closely the practical side of the problem, they understood how far it would lead them. Evidently that one homogeneous system of law should replace the more or less heterogeneous systems operative in the various fiefs was essential, and such a substitution meant that the feudatories must be deprived of their local autonomy and, incidentally, of their control of local finances. That was a stupendous change. Hitherto each feudal chief had collected the revenues of his fief and had employed them at will, subject

to the sole condition of maintaining a body of troops proportionate to his income. He had been, and was still, an autocrat within the limits of his territory. On the other hand, the active authors of the revolution were a small band of men mainly without prestige or territorial influence. It was impossible that they should dictate any measure sensibly impairing the local and fiscal autonomy of the feudatories. No power capable of enforcing such a measure existed at the time. All the great political changes in Japan had been preceded hitherto by wars culminating in the accession of some strong clan to supreme authority, whereas in this case there had been a displacement without a substitution—the Tokugawa had been overthrown and no new administrators had been set up in their stead. It was, moreover, certain that an attempt on the part of any one clan to constitute itself executor of the Sovereign's mandates would have stirred the other clans to vehement resistance. In short, the leaders of the revolution found themselves pledged to a new theory of government without any machinery for carrying it into effect, or any means of abolishing the old practice. An ingenious exit from this curious dilemma was devised by the young reformers. They induced the feudal chiefs of Satsuma, Choshiu, Tosa, and Hizen, the four most powerful clans in the south, publicly to surrender their fiefs to the Emperor, praying his Majesty to reorganize them and to bring them all under the same system of law. In the case of Shimazu, chief of Satsuma, and Yodo, chief of Tosa, this act must stand to their credit as a noble sacrifice. To them the exercise of power had been a reality, and the effort of surrendering it must have been correspondingly costly. But the chiefs of Choshiu and Hizen obeyed the suggestions of their principal vassals with little, if any, sense of the probable cost of obedience. The same remark applies to all the other feudatories, with exceptions so rare as to emphasize the rule. They had long been accustomed to abandon the management of their affairs to their leading clansmen, and they allowed themselves to follow the same guidance at this crisis. Out of the whole 276 feudatories, only 17 hesitated to imitate the example of the four southern fiefs.

Motives of the reformers.

An explanation of this remarkable incident has been sought by supposing that the *samurai* of the various clans, when they advised a course so inconsistent with fidelity to the interests of their feudal chiefs, were influenced by motives of personal ambition, imagining that they themselves might find great opportunities under the new régime. Some hope of that kind may fairly be assumed, and was certainly realized, in the case of the leading *samurai* of the four southern clans which headed the movement. But it is plain that no such expectations can have been generally entertained. The simplest explanation seems to be the true one: a certain course, indicated by the action of the four southern clans, was conceived to be in accord with the spirit of the Restoration, and not to adopt it would have been to shrink publicly from a sacrifice dictated by the principle of loyalty to the throne—a principle which had acquired supreme sanctity in the eyes of the men of that era. There might have been some uncertainty about the initial step; but so soon as that was taken by the southern clans their example acquired compelling force. History shows that in political crises the Japanese *samurai* is generally ready to pay deference to certain canons of almost romantic morality. There was a fever of loyalty and of patriotism in the air of the year 1869. Any one hesitating, for obviously selfish reasons, to adopt a precedent such as that offered by the procedure of the great southern clans, would have seemed to forfeit the right of calling himself a *samurai*.

But although the leaders of this remarkable movement now understood that they must contrive the total abolition of feudalism and build up a new administrative edifice on foundations of constitutional monarchy, they appreciated the necessity of advancing slowly towards a goal which still lay beyond the range of their followers' vision. Thus the first steps taken after the surrender of the fiefs were to appoint the feudatories to the position of governors in the districts over which they had previously ruled; to confirm the *samurai* in the possession of their incomes and official positions; to put an end to the distinction between Court nobles and territorial nobles, and to organize in Kyôtô a cabinet consisting of the leaders of the Restoration. Each new governor received one-tenth of the income of the fief by way of emoluments; the pay of the officials and the *samurai*, as well as the administrative expenses of the district, was defrayed from the same source, and the residue, if any, was to be passed into the treasury of the central Government.

Defects of the first measures.

The defects of this system from a monarchical point of view soon became evident. It did not give the power of either the purse or the sword to the Sovereign. The revenues of the administrative districts continued to be collected and disbursed by the former feudatories, who also retained the control of the troops, the right of appointing and dismissing officials, and almost complete local autonomy. A further radical step had to be taken, and the leaders of reform, seeing nothing better than to continue the method of procedure which had thus far proved so successful, contrived, first, that several of the administrative districts should send in petitions seeking to surrender their local autonomy, and be brought under the direct rule of the central Government; secondly, that a number of *samurai* should apply for permission to lay aside their swords and become farmers. The growth of the *samurai* class and their differentiation from the agriculturists to whom they originally belonged had been an essential feature of the feudal system. It was thought necessary that reversion to the original state of affairs in these respects should accompany the fall of feudalism. While the nation was digesting the principles embodied in these petitions, the Government made preparations for further measures of reform. The ex-chief of Satsuma, who showed some umbrage because the services of his clan in promoting the Restoration had not been more fully recognized, was induced to take high ministerial office, as were also the ex-chiefs of Choshiu and Tosa. Each of the four great clans had now three representatives in the ministry. These clans were further persuaded to send to Tôkyô—whither the Emperor had moved his court—contingents of troops to form the nucleus of a national army. Importance attaches to these details because the principle of clan representation, illustrated in the organization of the cabinet of 1871, continued to be approximately observed for many years in forming ministries, and ultimately became a target for the attacks of party politicians.

Adoption of radical measures.

On the 29th of August 1871 an Imperial decree announced the abolition of the system of local autonomy, and the removal of the territorial nobles from the posts of governors. The taxes of the former fiefs were to be paid thenceforth into the central treasury; all officials were to be appointed by the Imperial Government, and the feudatories, retaining permanently an income of one-tenth of their original revenues, were to make Tôkyô their place of residence. As for the *samurai*, they remained for the moment in possession of their hereditary pensions. Radical as these changes seem, the disturbance caused by them was not great, since they left the incomes of the military class untouched. Some of the

incomes were for life only, but the majority were hereditary, and all had been granted in consideration of their holders devoting themselves to military service. Four hundred thousand men approximately were in receipt of such emoluments, and the total amount annually taken from the taxpayers for this purpose was about two million pounds sterling. Plainly the nation would have to be relieved of this burden sooner or later. The *samurai* were essentially an element of the feudal system, and that they should survive the latter's fall would have been incongruous. On the other hand, suddenly and wholly to deprive these men and their families—a total of some two million persons—of the means of subsistence on which they had hitherto relied with absolute confidence, and in return for which they and their forefathers had rendered faithful service, would have been an act of shocking inhumanity. It may easily be conceived that this problem caused extreme perplexity to the administrators of the new Japan. They left it unsolved for the moment, trusting that time and the loyalty of the *samurai* themselves would suggest some solution.

As for the feudal chiefs, who had now been deprived of all official status and reduced to the position of private gentlemen, without even a patent of nobility to distinguish them from ordinary individuals, they did not find anything specially irksome or regrettable in their altered position. No scrutiny had been made into the contents of their treasuries. They were allowed to retain unquestioned possession of all the accumulated funds of their former fiefs, and they also became public creditors for annual allowances equal to one-tenth of their feudal revenues. They had never previously been so pleasantly circumstanced. It is true that they were entirely stripped of all administrative and military authority; but since their possession of such authority had been in most cases merely nominal, they did not feel the change except as a relief from responsibility.

Treatment of the samurai.

By degrees public opinion began to declare itself with regard to the *samurai*. If they were to be absorbed into the bulk of the people and to lose their fixed revenues, some capital must be placed at their disposal to begin the world again. The *samurai* themselves showed a noble faculty of resignation. They had been a privileged class, but they had purchased their privileges with their blood and by serving as patterns of all the qualities most prized among Japanese national characteristics. The record of their acts and the recognition of the people entitled them to look for munificent treatment at the hands of the Government which they had been the means of setting up. Yet none of these considerations blinded them to the painful fact that the time had passed them by—that no place existed for them in the new polity. Many of them voluntarily stepped down into the company of the peasant or the tradesman, and many others signified their willingness to join the ranks of common bread-winners if some aid were given to equip them for such a career. After two years' consideration the Government took action. A decree announced, in 1873, that the Treasury was prepared to commute the pensions of the *samurai* at the rate of six years' purchase for hereditary pensions and four years for life pensions—one-half of the commutation to be paid in cash, and one-half in bonds bearing interest at the rate of 8 per cent. Reducing this to arithmetic, it will be seen that a perpetual pension of £10 would be exchanged for a payment of £30 in cash, together with securities giving an income of £2, 8s.; and that a £10 life pensioner received £20 in cash and securities yielding £1, 12s. annually. It is scarcely credible that the *samurai* should have accepted such an arrangement. Something, perhaps, must be ascribed to their want of business knowledge, but the general explanation is that they made a large sacrifice in the interests of their country. Nothing in all their career as soldiers became them better than their manner of abandoning it. They were told that they might lay aside their swords, and many of them did so, though from time immemorial they had cherished the sword as the mark of a gentleman, the most precious possession of a warrior, and the one outward evidence that distinguished men of their order from common toilers after gain. They saw themselves deprived of their military employment, were invited to surrender more than one-half of the income it brought, and knew that they were unprepared alike by education and by tradition to earn bread in any calling save that of arms. Yet, at the invitation of a Government which they had helped to establish, many of them bowed their heads quietly to this sharp reverse of fortune. It was certainly a striking instance of the fortitude and resignation which the creed of the *samurai* required him to display in the presence of adversity. It is to be noted, however, that as yet the Government's measures with regard to the *samurai* were not compulsory. Men laid aside their swords and commuted their pensions at their own option.

Meanwhile differences of opinion began to develop among the leaders of progress themselves. Coalitions formed for destructive purposes are often found unable to endure the strain of constructive efforts. Such lack of cohesion might easily have been foreseen in the case of the Japanese reformers. Young men without experience of public affairs, or special education to fit them for responsible posts, found the duty suddenly devolved on them not only of devising administrative and fiscal systems universally applicable to a nation hitherto divided into a congeries of semi-independent principalities, but also of shaping the country's demeanour towards novel problems of foreign intercourse and alien civilization. So long as the heat of their assault upon the Shogunate fused them into a homogeneous party they worked together successfully. But when they had to build a brand-new edifice on the ruins of a still vivid past, it was inevitable that their opinions should vary as to the nature of the materials to be employed. In this divergence of views many of the capital incidents of Japan's modern history had their origin. It has been stated already that the declaration which the young Emperor was invited to make on assuming the reins of government included a promise constructively pointing to a representative polity, and that the promise was suggested by mutual jealousy of the planners of the Restoration rather than by any sincere desire for parliamentary institutions. Some zealous reformers certainly wished to follow, in this respect, the example of the foremost Occidental nations; but a great majority of the statesmen of the time thought only of a system which, by endowing all the clans with a share of administrative authority, would prevent the undue preponderance of any one of them. It need scarcely be repeated that the military class alone entered into this account. A "national assembly" was regarded solely as an instrument for eliciting the views of the *samurai*. Two such assemblies actually met in the years immediately following the Restoration. But they were nothing more than debating clubs. No legislative power was entrusted to them, and their opinions received little official attention. After the second fiasco they were tacitly allowed to pass out of existence. Everything, indeed, goes to show that representative government might have long remained outside the range of practical politics had not its uses derived vicarious value from special complications.

First essays in representative government.

Chief among those complications was the Korean question. The story of Japan's relations with Korea, though dating from very remote times and including several memorable incidents, may be epitomized here into the statement that from the 16th century, when the peninsula was over-run by Japanese troops, its rulers made a habit of sending a present-bearing embassy to facilitate the accession of each Japanese Shogun. But after the fall of the Tokugawa Shogunate the Korean court desisted from this custom, declared its determination to have no further relations with a country embracing Western civilization, and refused even to receive a Japanese embassy. Naturally such conduct roused deep umbrage in Japan. Already much friction had been developed among the leaders of national reform. Of the fifty-five men whose united efforts had compassed the fall of the Shogunate, five stood conspicuous above their colleagues. They were Iwakura and Sanjo, Court nobles; Saigo and Okubo, *samurai* of Satsuma, and Kido, a *samurai* of Choshiu. In the second rank came many men of great gifts, whose youth alone disqualified them for prominence—Ito, the constructive statesman of the *Meiji* era, who inspired nearly all the important measures of the time, though he did not openly figure as their originator; Inouye, who never lacked a resource or swerved from the dictates of loyalty; Okuma, a politician of subtle, versatile, and vigorous intellect; Itagaki, the Rousseau of his era, and a score of others created by the extraordinary circumstances with which they had to deal. But the five first mentioned were the captains, the rest only lieutenants. Among the five, four were sincere reformers—not free, of course, from selfish motives, but truthfully bent upon promoting the interests of their country before all other aims. The fifth, Saigo Takamori, was a man in whom boundless ambition lay concealed under qualities of the noblest and most enduring type. His absolute freedom from every trace of sordidness gave currency to a belief that his aims were of the simplest; the story of his career satisfied the highest canons of the *samurai*; his massive physique, commanding presence, and sunny aspect impressed and attracted even those who had no opportunity of admiring his life of self-sacrificing effort or appreciating the remarkable military talent he possessed. In the first part of his career, the object of his ambition was Satsuma; in the latter part, Saigo. The overthrow of the Tokugawa Shogunate presented itself to him originally as a prelude to the supremacy of the Satsuma clan, and when the abolition of feudalism defeated that purpose, Satsuma assumed in his eyes the guise of Saigo. Whether he clearly recognized his own project or was unconsciously swayed by it, there is no doubt that he looked to become supreme in the administration of State affairs. To that end the preservation of the military class was essential. By the swords of the *samurai* alone could a new *imperium in imperio* be carved out. On the other hand, Saigo's colleagues in the ministry saw clearly not only that the *samurai* were an unwarrantable burden on the nation, but also that their continued existence after the fall of feudalism would be a menace to public peace as well as an anomaly. Therefore they took the steps already described, and followed them by the enaction of a conscription law, making every adult male liable for military service without regard to his social standing. It is easy to conceive how painfully unwelcome this conscription law proved to the *samurai*. Many of them were not unwilling to commute their pensions, since their creed had always forbidden them to care for money. Many of them were not unwilling to abandon the habit of carrying swords, since the adoption of foreign costume rendered such a custom incongruous and inconvenient. But very few of them could readily consent to step down from their cherished position as the military class, and relinquish their traditional title to bear the whole responsibility and enjoy the whole honour of fighting their country's battles. They had supposed, not unreasonably, that service in the army and navy would be reserved exclusively for them and their sons, whereas now the commonest rustic, mechanic, or tradesman would be equally eligible.

The Korean question, and its effects.

While the pain of this blow was still fresh the question of Korea's contumacious conduct presented itself. It produced an immediate and violent disruption in the ranks of the little band of reformers. Saigo saw in a foreign war the sole remaining chance of achieving his ambition by lawful means. The Government's conscription scheme, yet in its infancy, had not produced even the skeleton of an army. If Korea had to be conquered, the *samurai* must be employed; and their employment would mean, if not their rehabilitation, at least their organization into a force which, under Saigo's leadership, might dictate a new polity. Other members of the cabinet believed that the nation would be disgraced if it tamely endured Korea's insults. Thus several influential voices swelled the clamour for war. But a peace party offered strenuous opposition. Its members saw the collateral issues of the problem, and declared that the country must not think of taking up arms during a period of radical transition. The final discussion took place in the Emperor's presence. Probably none of those engaged in it understood the whole scope of its national significance, or perceived that they were debating, not merely whether there should be peace or war, but whether the country should halt or advance on its newly-adopted path of progress. The peace party prevailed, and four members of the cabinet, including Saigo, resigned. This rupture was destined to have far-reaching consequences. One of the seceders immediately raised the standard of revolt. Among the devices employed by him to win adherents was an attempt to fan into flame the dying embers of the anti-foreign sentiment. The Government crushed the insurrection easily. Another seceder was Itagaki Taisuke. He believed in representative institutions, and advocated the establishment of a national assembly consisting half of officials and half of popular nominees. His views, premature and visionary, obtained no currency at the moment, but in later years became the shibboleth of a great political party.

Split among the reformers.

Saigo, the most prominent of the seceders, seems to have concluded from that moment that he must abandon his aims or achieve them by force. He retired to his native province of Satsuma, and applied his whole resources, his great reputation, and the devoted loyalty of a number of able followers to organizing and equipping a strong body of *samurai*. Matters were facilitated for him by the conservatism of the celebrated Shimazu Saburo, former chief of Satsuma, who, though not opposed to foreign intercourse, had been revolted by the wholesale iconoclasm of the time, and by the indiscriminate rejection of Japanese customs in favour of foreign. He protested vehemently against what seemed to him a slavish abandonment of the nation's individuality, and finding his protest fruitless, he set himself to preserve in his own distant province, where the writ of the Yedo Government had never run, the fashions, institutions, and customs which his former colleagues in the administration were ruthlessly rejecting. Satsuma thus became a centre of conservative influences, among which Saigo and his constantly augmenting band of *samurai* found a congenial environment. During four years this breach between the central Government and the southern clan grew constantly

wider. The former steadily organized its conscripts, trained them in foreign tactics, and equipped them wholly with foreign arms. The latter adopted the rifle and the drill of Europe, but clung to the sword of the *samurai*, and engaged ceaselessly in exercises for developing physical power.

Expedition to Formosa.

Many things happened in that four-years interval; among them a military expedition to Formosa, which led Japan to the verge of war with China. The ostensible cause of this complication was the barbarous treatment of castaways from Riukiu by Formosan aborigines. Upon the Chinese Government properly devolved the duty of punishing its subjects, the Formosans. But as the Chinese Government showed no inclination to discharge the duty, Japan took the law into her own hands. She would never have done so, however, had she not hoped to placate thereby the Satsuma *samurai*. The Riukiu islands had been for centuries an appanage of the Satsuma fief, and the Government, in undertaking to protect the islanders, not only showed consideration for the discontented clan, but also acceded to the *samurai's* wish for an over-sea campaign. From a military point of view the expedition was successful. But little glory was to be gained by shooting down the semi-savage inhabitants of Formosa, and whatever potentialities the expedition might have possessed with regard to domestic politics were marred by the bad grace shown in carrying it out and by the feebleness of its international issue. For the Tôkyô Government, by seeking at the eleventh hour to stay the departure of the ships, seemed to dissociate itself from the enterprise, and by subsequently sending an ambassador to Peking with instructions to contrive a peaceful solution, lost credit with the *samurai* whom it had hoped to gratify.

Treaty with Korea.

A year after the return of the Formosa expedition, that is to say, at the close of 1875, the Koreans completed their rupture with Japan by firing on the boats of a Japanese war-vessel engaged in the peaceful operation of coast-surveying. No choice now remained except to despatch an armed expedition against the truculent kingdom. In this matter Japan showed herself an apt pupil of Occidental methods such as had been practised against herself in former years. She assembled an imposing force of warships and transports, but instead of proceeding to extremities, she employed the squadron—which was by no means so strong as it seemed—to intimidate Korea into signing a treaty of amity and commerce, and opening three ports to foreign trade. That was the beginning of Korea's friendly relations with the outer world, and Japan naturally took credit for the fact that, thus early in her new career, she had become an instrument for extending the principle of universal intercourse opposed so strenuously by herself in the past. But the incident only accentuated the dissatisfaction of the conservative *samurai*. They did not want treaties of commerce, and they held it a national humiliation that the country should have negotiated on equal terms with a little state which they regarded as a tributary, and which acknowledged China as its suzerain.

Final abolition of sword-wearing and pensions.

Two extreme measures were now (1876) adopted by the Government: a veto against the wearing of swords, and an edict ordering the compulsory commutation of the pensions and allowances received by the nobles and the *samurai*. Three years previously the wearing of swords had been declared optional, and a scheme of voluntary commutation had been announced. Many had bowed quietly to the spirit of these enactments. But many still retained their swords and drew their pensions as of old, obstructing, in the former respect, the Government's projects for the re-organization of society, and imposing, in the latter, an intolerable burden on the resources of the Treasury. The Government thought that the time had come, and that its own strength sufficed, to substitute compulsion for persuasion. The financial measure—which was contrived so as to affect the smallest pension-holders least injuriously—evoked no complaint. The *samurai* remained faithful to the creed which forbade them to be concerned about money. But the veto against sword-wearing overtaxed the patience of the extreme conservatives. It seemed to them that all the most honoured traditions of their country were being ruthlessly sacrificed on the altar of alien innovations. Armed protests ensued. A few scores of *samurai*, equipping themselves with the hauberks and weapons of old times, fell upon the garrison of a castle, killed or wounded some 300, and then, retiring to an adjacent mountain, died by their own hands. Their example found imitators in two other places, and finally the Satsuma *samurai* rose in arms under Saigo.

Satsuma insurrection.

This was an insurrection very different in dimensions and motives from the paltry outbreaks that had preceded it. During four years the preparations of the Satsuma men had been unremitting. They were equipped with rifles and cannon; they numbered some 30,000, being thus nearly as numerous as the Government's standing army; they were all of the military class, and in addition to high training in Western tactics and in the use of modern arms of precision, they knew how to wield that formidable weapon, the Japanese sword, of which their opponents were for the most part ignorant. Ostensibly their object was to restore the *samurai* to their old supremacy, and to secure for them all the posts in the army, the navy, and the administration. But although they doubtless entertained that intention, it was put forward mainly with the hope of winning the co-operation of the military class in all parts of the empire. The real purpose of the revolt was to secure the governing power for Satsuma. A bitter struggle ensued. Beginning on 29th January 1877, it was brought to a close on 24th September of the same year by the death, voluntary or in battle, of all the rebel leaders. During that period the number of men engaged on the Government's side had been 66,000, and the number on the side of the rebels 40,000, out of which total the killed and wounded aggregated 35,000, or 33 per cent. of the whole. Had the Government's troops been finally defeated, there can be no doubt that the *samurai's* exclusive title to man and direct the army and navy would have been re-established, and Japan would have found herself permanently saddled with a military class, heavily burdening her finances, seriously impeding her progress towards constitutional government, and perpetuating all the abuses incidental to a policy in which the power of the sword rests entirely in the hands of one section of the people. The nation scarcely appreciated the great issues that were at stake. It found more interest in the struggle as furnishing a conclusive test of the efficiency of the new military system compared with the old. The army sent to quell the insurrection consisted of recruits drawn indiscriminately from every class of the people. Viewed in the light of history, it was an army of commoners, deficient in the fighting instinct, and traditionally demoralized for all purposes of resistance to the military class. The Satsuma insurgents, on the contrary, represented the flower of the *samurai*, long trained for this very struggle, and led by men whom the nation regarded as its bravest captains. The result dispelled all doubts about the fighting quality of the people at large.

Concurrently with these events the Government diligently endeavoured to equip the country with all the paraphernalia of Occidental civilization. It is easy to understand that the master-minds of the era, who had planned and carried

out the Restoration, continued to take the lead in all paths of progress. Their intellectual superiority entitled them to act as guides; they had enjoyed exceptional opportunities of acquiring enlightenment by visits to Europe and America, and the Japanese people had not yet lost the habit of looking to officialdom for every initiative. But the spectacle thus presented to foreign onlookers was not altogether without disquieting suggestions. The Government's reforms seemed to outstrip the nation's readiness for them, and the results wore an air of some artificiality and confusion. Englishmen were employed to superintend the building of railways, the erection of telegraphs, the construction of lighthouses, and the organization of a navy. To Frenchmen was entrusted the work of re-casting the laws and training the army in strategy and tactics. Educational affairs, the organization of a postal service, the improvement of agriculture and the work of colonization were supervised by Americans. The teaching of medical science, the compilation of a commercial code, the elaboration of a system of local government, and ultimately the training of military officers were assigned to Germans. For instruction in sculpture and painting Italians were engaged. Was it possible that so many novelties should be successfully assimilated, or that the nation should adapt itself to systems planned by a motley band of aliens who knew nothing of its character and customs? These questions did not trouble the Japanese nearly so much as they troubled strangers. The truth is that conservatism was not really required to make the great sacrifices suggested by appearances. Among all the innovations of the era the only one that a Japanese could not lay aside at will was the new fashion of dressing his hair. He abandoned the queue irrevocably. But for the rest he lived a dual life. During hours of duty he wore a fine uniform, shaped and decorated in foreign style. But so soon as he stepped out of office or off parade, he reverted to his own comfortable and picturesque costume. Handsome houses were built and furnished according to Western models. But each had an annex where alcoves, verandahs, matted floors and paper sliding doors continued to do traditional duty. Beefsteaks, beer, "grape-wine," knives and forks came into use on occasion. But rice-bowls and chop-sticks held their everyday place as of old. In a word, though the Japanese adopted every convenient and serviceable attribute of foreign civilization, such as railways, steamships, telegraphs, post-offices, banks, and machinery of all kinds; though they accepted Occidental sciences and, to a large extent, Occidental philosophies; though they recognized the superiority of European jurisprudence and set themselves to bring their laws into accord with it, they nevertheless preserved the essentials of their own mode of life and never lost their individuality. A remarkable spirit of liberalism and a fine eclectic instinct were needed for the part they acted, but they did no radical violence to their own traditions, creeds, and conventions. There was indeed a certain element of incongruity and even grotesqueness in the nation's doings. Old people cannot fit their feet to new grooves without some clumsiness. The Japanese had grown very old in their special paths, and their novel departure was occasionally disfigured by solecisms. The refined taste that guided them unerringly in all the affairs of life as they had been accustomed to live it, seemed to fail them signally when they emerged into an alien atmosphere. They have given their proofs, however. It is now seen that the apparently excessive rapidity of their progress did not overtax their capacities; that they have emerged safely from their destructive era and carried their constructive career within reach of certain success, and that while they have still to develop some of the traits of their new civilization, there is no prospect whatever of its proving ultimately unsuited to them.

Steps of progress.

After the Satsuma rebellion, nothing disturbed the even tenor of Japan's domestic politics except an attempt on the part of some of her people to force the growth of parliamentary government. No one reading Japanese history carefully can fail to infer that representative institutions are in the genius of the nation. From an early era the Sovereign ceased to be autocratic. All the highest offices of state became hereditary possessions of certain great families, and as generation followed generation, each unit of this oligarchy of households attained the dimensions of a clan. By and by the exigencies of the time gave birth to a military aristocracy, headed by a generalissimo (Shogun), into whose hands the administrative authority passed. But even in this military feudalism no traces of genuine autocracy were found. Just as the extensive powers nominally vested in the central figure, the Shogun, were in reality wielded by a large body of ministers and councillors, so the local autonomy enjoyed by each fief was exercised, not by the chief himself, but by his leading vassals. A united effort on the part of all the clans to overthrow this system and wrest the administrative power from the Shogun could have only one logical outcome, the combined exercise of the recovered power by those who had been instrumental in recovering it. That was the meaning of the oath taken by the Emperor at the Restoration, when the youthful sovereign was made to say that "wise counsels should be sought, and all things determined by public discussion." But the framers of the oath had the *samurai* alone in view. Into their consideration the "common people"—farmers, mechanics, tradesmen—did not enter at all, nor had the common people themselves any idea of advancing a claim to be considered. A voice in the administration would have been to them an embarrassing rather than a pleasing privilege. Thus, as already related, the first deliberative assembly was composed of nobles and *samurai* only. A mere debating club without any legislative authority, it was permanently dissolved after two sessions. Possibly the problem of a parliament might have been long postponed after that fiasco, had it not found an ardent advocate in Itagaki Taisuke (afterwards Count Itagaki). A Tosa *samurai*, conspicuous as a leader of the Restoration movement, Itagaki was among the advocates of recourse to strong measures against Korea in 1873, and his failure to carry his point, supplemented by a belief that a large section of public opinion would have supported him had there been any machinery for appealing to it, gave fresh impetus to his faith in constitutional government. Leaving the cabinet on account of the Korean question, he became the nucleus of agitation in favour of a parliamentary system, and under his banner were enrolled not only discontented *samurai*, but also many of the young men who, returning from direct observation of the working of constitutional systems in Europe or America, and failing to obtain official posts in Japan, attributed their failure to the oligarchical form of their country's polity. Thus in the interval between 1873 and 1877 there were two centres of disturbance in Japan: one in Satsuma, where Saigo figured as leader; the other in Tosa, under Itagaki's guidance. When the Satsuma men appealed to arms in 1877, a widespread apprehension prevailed lest the Tosa politicians should throw in their lot with the insurgents. Such a fear had its origin in failure to understand the object of the one side or to appreciate the sincerity of the other. Saigo and his adherents fought to substitute a Satsuma clique for the oligarchy already in power. Itagaki and his followers

Development of representative government.

struggled for constitutional institutions. The two could not have anything in common. There was consequently no coalition. But the Tosa agitators did not neglect to make capital out of the embarrassment caused by the Satsuma rebellion. While the struggle was at its height, they addressed to the Government a memorial, charging the administration with oppressive measures to restrain the voice of public opinion, with usurpation of power to the exclusion of the nation at large, and with levelling downwards instead of upwards, since the *samurai* had been reduced to the rank of commoners, whereas the commoners should have been educated to the standard of the *samurai*. This memorial asked for a representative assembly and talked of popular rights. But since the document admitted that the people were uneducated, it is plain that there cannot have been any serious idea of giving them a share in the administration. In fact, the Tosa Liberals were not really contending for popular representation in the full sense of the term. What they wanted was the creation of some machinery for securing to the *samurai* at large a voice in the management of State affairs. They chafed against the fact that whereas the efforts and sacrifices demanded by the Restoration had fallen equally on the whole military class, the official prizes under the new system were monopolized by a small coterie of men belonging to the four principal clans. It is on record that Itagaki would have been content originally with an assembly consisting half of officials, half of non-official *samurai*, and not including any popular element whatever.

But the Government did not believe that the time had come even for a measure such as the Tosa Liberals advocated. The statesmen in power conceived that the nation must be educated up to constitutional standards, and that the first step should be to provide an official model. Accordingly, in 1874, arrangements were made for periodically convening an assembly of prefectural governors, in order that they might act as channels of communication between the central authorities and the provincial population, and mutually exchange ideas as to the safest and most effective methods of encouraging progress within the limits of their jurisdictions. This was intended to be the embryo of representative institutions. But the governors, being officials appointed by the cabinet, did not bear in any sense the character of popular nominees, nor could it even be said that they reflected the public feeling of the districts they administered, for their habitual and natural tendency was to try, by means of heroic object-lessons, to win the people's allegiance to the Government's progressive policy, rather than to convince the Government of the danger of overstepping the people's capacities. These conventions of local officials had no legislative power whatever. The foundations of a body for discharging that function were laid in 1875, when a senate (*genro-in*) was organized. It consisted of official nominees, and its duty was to discuss and revise all laws and ordinances prior to their promulgation. It is to be noted, however, that expediency not less than a spirit of progress presided at the creation of the senate. Into its ranks were drafted a number of men for whom no places could be found in the executive, and who, without some official employment, would have been drawn into the current of disaffection. From that point of view the senate soon came to be regarded as a kind of hospital for administrative invalids, but undoubtedly its discharge of quasi-legislative functions proved suggestive, useful, and instructive.

The second meeting of the provincial governors had just been prorogued when, in the spring of 1878, the great minister, Okubo Toshimitsu, was assassinated. Okubo, uniformly ready to bear the heaviest burden of responsibility in every political complication, had stood prominently before the nation as Saigo's opponent. He fell under the swords of Saigo's sympathizers. They immediately surrendered themselves to justice, having taken previous care to circulate a statement of motives, which showed that they ranked the Government's failure to establish representative institutions as a sin scarcely less heinous than its alleged abuses of power. Well-informed followers of Saigo could never have been sincere believers in representative institutions. These men belonged to a province far removed from the scene of Saigo's desperate struggle. But the broad fact that they had sealed with their life-blood an appeal for a political change indicated the existence of a strong public conviction which would derive further strength from their act. The Japanese are essentially a brave people. Throughout the troublous events that preceded and followed the Restoration, it is not possible to point to one man whose obedience to duty or conviction was visibly weakened by prospects of personal peril. Okubo's assassination did not alarm any of his colleagues; but they understood its suggestiveness, and hastened to give effect to a previously formed resolve.

Assassination of Okubo.

Two months after Okubo's death, an edict announced that elective assemblies should forthwith be established in the various prefectures and cities. These assemblies were to consist of members having a high property qualification, elected by voters having one-half of that qualification; the voting to be by signed ballot, and the sessions to last for one month in the spring of each year. As to their functions, they were to determine the method of levying and spending local taxes, subject to approval by the minister of State for home affairs; to scrutinize the accounts for the previous year, and, if necessary, to present petitions to the central Government. Thus the foundations of genuine representative institutions were laid. It is true that legislative power was not vested in the local assemblies, but in all other important respects they discharged parliamentary duties. Their history need not be related at any length. Sometimes they came into violent collision with the governor of the prefecture, and unsightly struggles resulted. The governors were disposed to advocate public works which the people considered extravagant, and further, as years went by and as political organizations grew stronger, there was found in each assembly a group of men ready to oppose the governor simply because of his official status. But on the whole the system worked well. The local assemblies served as training schools for the future parliament, and their members showed devotion to public duty as well as considerable aptitude for debate.

Local government.

This was not what Itagaki and his followers wanted. Their purpose was to overthrow the clique of clansmen who, holding the reins of administrative power, monopolized the prizes of officialdom. Towards the consummation of such an aim the local assemblies helped little. Itagaki redoubled his agitation. He organized his fellow-thinkers into an association called *Jiyuto* (Liberals), the first political party in Japan, to whose ranks there very soon gravitated several men who had been in office and resented the loss of it; many that had never been in office and desired to be; and a still greater number who sincerely believed in the principles of political liberty, but had not yet considered the possibility of immediately adapting such principles to Japan's case. It was in the nature of things that an association of this kind, professing such doctrines, should present a picturesque aspect to the public, and that its collisions with the authorities should invite popular sympathy.

The Liberal party.

Nor were collisions infrequent. For the Government, arguing that if the nation was not ready for representative institutions, neither was it ready for full freedom of speech or of public meeting, legislated consistently with that theory, and entrusted to the police certain powers of control over the press and the platform. The exercise of these powers often created situations in which the Liberals were able to pose as victims of official tyranny, so that they grew in popularity and the contagion of political agitation spread.

The Progressist party.

Three years later (1881) another split occurred in the ranks of the ruling oligarchy. Okuma Shigenobu (afterwards Count Okuma) seceded from the administration, and was followed by a number of able men who had owed their appointments to his patronage, or who, during his tenure of office as minister of finance, had passed under the influence of his powerful personality. If Itagaki be called the Rousseau of Japan, Okuma may be regarded as the Peel. To remarkable financial ability and a lucid, vigorous judgment, he added the faculty of placing himself on the crest of any wave which a genuine *aura popularis* had begun to swell. He too inscribed on his banner of revolt against the oligarchy the motto "Constitutional Government," and it might have been expected that his followers would join hands with those of Itagaki, since the avowed political purpose of both was identical. They did nothing of the kind. Okuma organized an independent party, calling themselves "Progressists" (*Shimpoto*), who not only stood aloof from the Liberals but even assumed an attitude hostile to them. This fact is eloquent. It shows that Japan's first political parties were grouped, not about principles, but about persons. Hence an inevitable lack of cohesion among their elements and a constant tendency to break up into caves and coteries. These are the characteristics that render so perplexing to a foreign student the story of political evolution in Japan. He looks for differences of platform and finds none. Just as a true Liberal must be a Progressist, and a true Progressist a Liberal, so, though each may cast his profession of faith in a mould of different phrases, the ultimate shape must be the same. The mainsprings of early political agitation in Japan were personal grievances and a desire to wrest the administrative power from the hands of statesmen who had held it so long as to overtax the patience of their rivals. He that searches for profound moral or ethical bases will be disappointed. There were no Conservatives. Society was permeated with the spirit of progress. In a comparative sense the epithet "Conservative" might have been applied to the statesmen who proposed to defer parliamentary institutions until the people, as distinguished from the former *samurai*, had been in some measure prepared for such an innovation. But since these very statesmen were the guiding spirits of the whole *Meiji* revolution, it was plain that their convictions must be radical, and that, unless they did violence to their record, they must finally lead the country to representative institutions, the logical sequel of their own reforms.

Okubo's assassination had been followed, in 1878, by an edict announcing the establishment of local assemblies. Okuma's secession in 1881 was followed by an edict announcing that a national assembly would be convened in 1891.

Anti-Government agitation.

The political parties, having now virtually attained their object, might have been expected to desist from further agitation. But they had another task to perform—that of disseminating anti-official prejudices among the future electors. They worked diligently, and they had an undisputed field, for no one was put forward to champion the Government's cause. The campaign was not always conducted on lawful lines. There were plots to assassinate ministers; there was an attempt to employ dynamite, and there was a scheme to incite an insurrection in Korea. On the other hand, dispersals of political meetings by order of police inspectors, and suspension or suppression of newspapers by the unchallengeable verdict of a minister for home affairs, were common occurrences. The breach widened steadily. It is true that Okuma rejoined the cabinet for a time in 1887, but he retired again in circumstances that aggravated his party's hostility to officialdom. In short, during the ten years immediately prior to the opening of the first parliament, an anti-Government propaganda was incessantly preached from the platform and in the press.

Meanwhile the statesmen in power resolutely pursued their path of progressive reform. They codified the civil and penal laws, remodelling them on Western bases; they brought a vast number of affairs within the scope of minute regulations; they rescued the finances from confusion and restored them to a sound condition; they recast the whole framework of local government; they organized a great national bank, and established a network of subordinate institutions throughout the country; they pushed the work of railway construction, and successfully enlisted private enterprise in its cause; they steadily extended the postal and telegraphic services; they economized public expenditures so that the State's income always exceeded its outlays; they laid the foundations of a strong mercantile marine; they instituted a system of postal savings banks; they undertook large schemes of harbour improvement and road-making; they planned and put into operation an extensive programme of riparian improvement; they made civil service appointments depend on competitive examination; they sent numbers of students to Europe and America to complete their studies; and by tactful, persevering diplomacy they gradually introduced a new tone into the empire's relations with foreign Powers. Japan's affairs were never better administered.

The Constitution of 1890.

In 1890 the Constitution was promulgated. Imposing ceremonies marked the event. All the nation's notables were summoned to the palace to witness the delivery of the important document by the Sovereign to the prime minister; salvos of artillery were fired; the cities were illuminated, and the people kept holiday. Marquis[1] Ito directed the framing of the Constitution. He had visited the Occident for the purpose of investigating the development of parliamentary institutions and studying their practical working. His name is connected with nearly every great work of constructive statesmanship in the history of new Japan, and perhaps the crown of his legislative career was the drafting of the Constitution, to which the Japanese people point proudly as the only charter of the kind voluntarily given by a sovereign to his subjects. In other countries such concessions were always the outcome of long struggles

[1] A title of nobility in Japan does not indicate necessarily that its possessor belongs to the ancient aristocracy. In former times titles did not exist. There were official ranks, and very often these were prefixed to a name in the manner of a title. But actual titles were not introduced until 1885. In the interval separating the latter date from the fall of feudalism in 1871, the former territorial chiefs and Court nobles could not be titularly distinguished from commoners. But in 1885 the Emperor, acting on the advice of Ito (afterwards marquis), instituted five orders of nobility (apart from princes of the blood), namely, princes, marquises, counts, viscounts, and barons. These, of course, are translations. The Japanese terms—affixed, not prefixed, to a name—are *kô, kô, haku, shi, dan*. The greatest of the territorial nobles received the title of prince; the smallest, that of baron. The practice was also inaugurated of bestowing titles on men of merit without regard to their original social status. There are no life titles. In 1900 the princes numbered 11, the marquises 33, the counts 89, the viscounts 363, and the barons 280.

between ruler and ruled. In Japan the Emperor freely divested himself of a portion of his prerogatives and transferred them to the people. That view of the case, as may be seen from the story told above, is not untinged with romance; but in a general sense it is true. The framers of the Constitution did not err on the side of liberality. They fixed the minimum age for electors and candidates at twenty-five, and the property qualification at a payment of direct taxes to the amount of 15 *yen* (30 shillings) annually. The result was that only 460,000 persons[1] were enfranchised out of a nation of 42 millions. A bicameral system was adopted for the Diet; the Upper House being in part elective, in part hereditary, and in part nominated by the Sovereign[2]; the Lower consisting of 300 elected members. Freedom of conscience, of speech and of public meeting, inviolability of domicile and correspondence, security from arrest or punishment, except by due process of law, permanence of judicial appointments, and all the other essential elements of civil liberty were guaranteed. In the Diet full legislative authority was vested: without its consent no tax could be imposed, increased, or remitted; nor could any public money be paid out except the salaries of officials, which the Sovereign reserved the right to fix at will. In the Emperor were vested the prerogatives of declaring war and making peace, of concluding treaties, of appointing and dismissing officials, of approving and promulgating laws, of issuing urgency ordinances to take the temporary place of laws, and of conferring titles of nobility.

Working of the system.

No incident in Japan's modern career seemed more hazardous than this sudden plunge into parliamentary institutions. There had been, as shown above, some preparation. Provincial assemblies had partially familiarized the people with the methods of deliberative bodies. But provincial assemblies were at best petty arenas—places where the making or mending of roads, and the policing and scavenging of villages came up for discussion, and where political parties exercised no legislative function nor found any opportunity to attack the Government, or to debate problems of national interest. Thus the convening of a Diet, and the sudden transfer of financial and legislative authority from the throne and its entourage of tried statesmen to the hands of men whose qualifications for public life rested on the verdict of electors, themselves apparently devoid of all light to guide their choice—this sweeping innovation seemed likely to tax severely, if not to overtax completely, the progressive capacities of the nation. What enhanced the interest of the situation was that the oligarchs who held the administrative power had taken no pains to win a following in the political field. Knowing that the opening of the Diet would be a veritable letting loose of the dogs of war, an unmuzzling of the agitators whose mouths had hitherto been partly closed by legal restrictions upon free speech, but who would now enjoy complete immunity within the walls of the assembly, whatever the nature of their utterances—foreseeing all this, the statesmen of the day nevertheless stood severely aloof from alliances of every kind, and discharged their administrative functions with apparent indifference to the changes that popular representation could not fail to induce. This somewhat inexplicable display of unconcern became partially intelligible when the Constitution was promulgated, for it then appeared that the cabinet's tenure of office was to depend solely on the Emperor's will; that ministers were to take their mandate from the Throne, not from Parliament. This fact was merely an outcome of the theory underlying every part of the Japanese polity. Laws might be redrafted, institutions remodelled, systems recast, but amid all changes and mutations one steady point must be carefully preserved, the Throne. The makers of new Japan understood that so long as the sanctity and inviolability of the Imperial prerogatives could be preserved, the nation would be held by a strong anchor from drifting into dangerous waters. They laboured under no misapprehension about the inevitable issue of their work in framing the Constitution. They knew very well that party cabinets are an essential outcome of representative institutions, and that to some kind of party cabinet Japan must come. But they regarded the Imperial mandate as a conservative safeguard, pending the organization and education of parties competent to form cabinets. Such parties did not yet exist, and until they came into unequivocal existence, the Restoration statesmen, who had so successfully managed the affairs of the nation during a quarter of a century, resolved that the steady point furnished by the Throne must not be abandoned.

On the other hand, the agitators found here a new platform. They had obtained a Constitution and a Diet, but they had not obtained an instrument for pulling down the "clan" administrators, since these stood secure from attack under the ægis of the Sovereign's mandate. They dared not raise their voices against the unfettered exercise of the Mikado's prerogative. The nation, loyal to the core, would not have suffered such a protest, nor could the agitators themselves have found heart to formulate it. But they could read their own interpretation into the text of the Constitution, and they could demonstrate practically that a cabinet not acknowledging responsibility to the Legislature was virtually impotent for law-making purposes.

The Diet and the Government.

These are the broad outlines of the contest that began in the first session of the Diet and continued for several years. It is unnecessary to speak of the special points of controversy. Just as the political parties had been formed on the lines of persons, not principles, so the opposition in the Diet was directed against men, not measures. The struggle presented varying aspects at different times, but the fundamental question at issue never changed. Obstruction was the weapon of the political parties. They sought to render legislation and finance impossible for any ministry that refused to take its mandate from the majority in the Lower House, and they imparted an air of respectability and even patriotism to their destructive campaign by making "Anti-clannism" their war-cry, and industriously fostering the idea that the struggle lay between administration guided by public opinion and administration controlled by a clique of clansmen who separated the Throne from the nation. Had not the House of Peers stood staunchly by the Government throughout this

[1] Since the promulgation of the Constitution a Reform Bill has been passed, after several failures owing to disagreement between the two Houses, the House of Peers having shown itself in this matter, as in all others, strongly opposed to the Radical tendencies of the House of Representatives. In the system introduced by this Bill the property qualification for electors was reduced to payment of national taxes amounting to 10 *yen* annually, the number of franchise-holders being thus raised to 800,000, approximately; secret balloting was adopted; no property qualification was required in the case of a candidate for election, neither need he have any connexion with the locality which he sought to represent; the limits of electoral districts were extended so as to embrace whole prefectures, and the number of members of the Lower House was increased to 363.

[2] Princes and marquises sit by right of their titles; counts, viscounts, and barons are elected by their respective orders; each prefecture returns one member representing the highest taxpayers, and the Emperor nominates men of learning or public merit. The House of Peers now contains 319 members. A salary of 2000 *yen* (£200) annually is paid to the members of the Diet; each House has a president, nominated by the Sovereign from among three names selected by the House. He receives 4000 *yen* a year. The vice-president is elected by the House independently of Imperial nomination, and receives 3000 *yen* annually.

contest, it is possible that the nation might have suffered severely from the rashness of the political parties.

There was something melancholy in the spectacle. The Restoration statesmen were the men who had made modern Japan; the men who had raised her, in the face of immense obstacles, from the position of an insignificant Oriental state to that of a formidable unit in the comity of nations; the men, finally, who had given to her a constitution and representative institutions. Yet these same men were now fiercely attacked by the arms which they had themselves nerved; were held up to public obloquy as self-seeking usurpers, and were declared to be impeding the people's constitutional route to administrative privileges, when in reality they were only holding the breach until the people should be able to march into the citadel with some show of orderly and competent organization. That there was no corruption, no abuse of position, is not to be pretended; but on the whole the conservatism of the clan statesmen had only one object—to provide that the newly-constructed representative machine should not be set working until its parts were duly adjusted and brought into proper gear. On both sides the leaders understood the situation accurately. The heads of the parties, while publicly clamouring for parliamentary cabinets, privately confessed that they were not yet prepared to assume administrative responsibilities;[1] and the so-called "clan statesmen," while refusing before the world to accept the Diet's mandates, admitted within official circles that the question was one of time only.

The situation did not undergo any marked change until, the country becoming engaged in war with China (1894–95), domestic squabbles were forgotten in the presence of foreign danger. From that time an era of coalition commenced. Both the political parties joined hands to vote funds for the prosecution of the campaign, and one of them, the Liberals, subsequently gave support to a cabinet under the presidency of Marquis Ito, the purpose of the union being to carry through the Diet an extensive scheme of enlarged armaments and public works planned in the sequel of the war. The Progressists, however, remained implacable, continuing their opposition frankly for the sake of opposition, and without any pretence of consideration for the nature of the measures they opposed.

Fusion of the two parties.

The next phase (1898) was a fusion of the two parties into one large organization which adopted the name "Constitutional Party" (*Kensei-to*). By this union the chief obstacles to parliamentary cabinets were removed. Not only did the Constitutionalists command a large majority in the Lower House, but they also possessed a sufficiency of men who, although lacking ministerial experience, might still advance a reasonable title to be entrusted with portfolios. Immediately the Emperor, acting on the advice of Marquis Ito, invited Counts Okuma and Itagaki to form a cabinet. It was essentially a trial. The party politicians were required to demonstrate in practice the justice of the claim they had been so long asserting in theory. They had worked in combination for the destructive purpose of pulling down the so-called "clan statesmen"; they had now to show whether they could work in combination for the constructive purposes of administration. Their heads, Counts Okuma and Itagaki, accepted the Imperial mandate, and the nation watched the result. There was no need to wait long. In less than six months these new links snapped under the tension of old enmities, and the coalition split up once more into its original elements. It had added a novel word to the language—"office-hunting fever" (*riyokan-netsu*)—and demonstrated that the sweets of power which the "clan statesmen" had been so vehemently accused of coveting possessed even greater attractions for their accusers. The issue of the experiment was such a palpable fiasco that it effectually rehabilitated the "clan statesmen," and finally proved, what had indeed been long evident to every close observer, that without the assistance of those statesmen no political party could hold office successfully.

Enrolment of the clan statesmen in political associations.

Thenceforth it became the unique aim of Liberals and Progressists alike to join hands permanently with the men towards whom they had once displayed such implacable hostility. Marquis Ito, the leader of the *Meiji* statesmen, received special solicitations, for it was plain that he would bring to any political party an overwhelming accession of strength, alike in his own person and in the number of friends and disciples certain to follow him. But Marquis Ito declined to be absorbed into any existing party, or to adopt the principle of parliamentary cabinets. He would consent to form a new association, but it must consist of men sufficiently disciplined to obey him implicitly, and sufficiently docile to accept their programme from his hand. The Liberals agreed to these terms. They actually dissolved their party (August 1900) and enrolled themselves in the ranks of a new organization, which did not even call itself a party, its designation being *Rikken Seiyu-kai* (Association of Friends of the Constitution), and which had for the cardinal plank in its platform a declaration of ministerial irresponsibility to the Diet. A singular page was thus added to the story of Japanese political development; for not merely did the Liberals enlist under the banner of the statesmen whom for twenty years they had fought to overthrow, but they also erased from their profession of faith its essential article, parliamentary cabinets, and by resigning that article to the Progressists, created for the first time an Opposition with a solid and intelligible platform. The whole incident vividly illustrated the fact that persons, not principles, were the bases of political combinations in Japan. Marquis Ito's attraction alone gave cohesion to the *Rikken Seiyu-kai.*

Procedure of the Diet.

It could scarcely have been expected that neither tumult nor intemperance would disfigure the proceedings of a Diet whose members were entirely without parliamentary experience, but not without grievances to ventilate, wrongs (real or fancied) to avenge, and abuses to redress. On the whole, however, there was a remarkable absence of anything like disgraceful license. The politeness, the good temper, and the sense of dignity which characterize the Japanese, always saved the situation when it threatened to degenerate into a "scene." Foreigners entering the House of Representatives in Tôkyô for the first time might easily misinterpret some of its habits. A number distinguishes each member. It is painted in white on a wooden indicator, the latter being fastened by a hinge to the face of the member's desk. When present he sets the indicator standing upright, and lowers it when leaving the House. Permission to speak is not obtained by catching the President's eye, but by calling out the aspirant's number, and as members often emphasize their calls by hammering their desks with the indicators there are moments of decided din. But, for the rest, orderliness and decorum habitually prevail. Speeches have to be made from a rostrum. There are few displays of oratory or eloquence. The Japanese formulates his views with remarkable facility. He is absolutely free from *gaucherie* or self-consciousness when speaking in

[1] Neither the Liberals nor the Progressists had a working majority in the House of Representatives, nor could the ranks of either have furnished men qualified to fill all the administrative posts.

public. He can think on his feet. But his mind has never busied itself much with abstract ideas and subtleties of philosophical or religious thought. Flights of fancy, impassioned bursts of sentiment, appeals to the heart rather than to the reason of an audience, are devices strange to his mental habit. He can be rhetorical, but not eloquent. Among all the speeches hitherto delivered in the Japanese Diet it would be difficult to find a passage deserving the latter epithet. From the first the debates were recorded verbatim. Years before the date fixed for the promulgation of the Constitution a little band of students elaborated a system of stenography and adapted it to the Japanese syllabary. Their labours remained almost without recognition or remuneration until the Diet was on the eve of meeting, when it was discovered that a competent staff of shorthand reporters could be organized at an hour's notice. Japan can thus boast that, alone among the countries of the world, she possesses an exact record of the proceedings of her Diet from the moment when the first word was spoken within its walls. A special feature of the Diet's procedure helps to discourage oratorical displays. Each measure of importance has to be submitted to a committee, and not until the latter's report has been received does serious debate take place. But in ninety-nine cases out of every hundred the committee's report determines the attitude of the House, and speeches are felt to be more or less superfluous. One result of this system is that business is done with a degree of celerity scarcely known in Occidental legislatures. For example, the meetings of the House of Representatives during the session 1896–97 were 32, and the number of hours occupied by the sittings aggregated 116. Yet the result was 55 Bills debated and passed, several of them measures of prime importance, as the Gold Standard Bill, the budget, and a statutory tariff law. Such a record seems difficult to reconcile with any idea of careful legislation; but it must be remembered that although actual sittings of the Houses are comparatively few and brief, the committees remain almost constantly at work from morning to evening throughout the twelve weeks of the session's duration.

Finance.

Financial questions have occupied an important place in the story of Japan's modern career. In order to obtain a clear idea of them it is necessary to make a somewhat extended retrospect. Under the feudal system the land throughout the empire was regarded as State property, and parcelled out into 276 fiefs, great and small, which were assigned to as many feudatories. These held the land in trust, being empowered to derive revenue from it for the support of their households, for administrative purposes, and for the maintenance of armed forces, whose numbers were nominally, but not accurately, regulated in proportion to the wealth of the fief. The basis of taxation varied greatly in different districts, but, at the time of the Restoration in 1867, the generally recognized principle was that four-tenths of the gross produce should go to the feudatory, six-tenths to the farmer. In practice this rule was applied to the rice crop only, the assessments for other kinds of produce being levied partly in money and partly in manufactured goods at rates often of the most arbitrary nature. Forced labour also was exacted, and artisans and tradesmen were subjected to pecuniary levies of greater or less magnitude as official necessity arose. These last two factors, however, are of such uncertain dimensions that they do not admit of arithmetical statement for the purposes of a general review. The total yield of rice in 1867 was 154 million bushels,[1] of which the market value at prices then ruling was 24 million pounds sterling, or 240 millions of *yen*. Hence the grain tax represented, at the lowest calculation, 96 millions of *yen*, the farmers' portion being 144 millions. When the administration reverted to the Emperor in 1867 the central Treasury was empty, and the funds hitherto employed for governmental purposes in the fiefs did not at once begin to flow into the coffers of the State. They continued to be devoted to the support of the feudatories, to the payment of the *samurai*, and to defraying the expenses of local administration, the central Treasury receiving only whatever small fraction might remain after these various outlays. The Shogun himself, whose income amounted to about $3\frac{1}{2}$ millions sterling, did not, on abdicating, hand over to the Sovereign either the contents of his treasury or the control of the lands from which he derived his revenues. He contended that funds for the government of the nation as a whole should be levied from the people at large. Partly owing to this complication, and partly because of the obstinate fealty of some of the Shogun's vassals, swords were drawn, and the impecunious ministry had to engage in campaigns, which, though they placed the Treasury in command of some limited sources of revenue, had also the effect of augmenting its liabilities.

Issue of paper money.

The little band of men who had assumed the direction of national affairs saw no exit from the dilemma except an issue of paper money. This was not a novelty in Japan. Paper money had been known to the people since the middle of the 17th century, and in the era of which we are now writing no less than 1694 varieties of notes were circulating in the 270 fiefs. There were gold notes, silver notes, *cash*-notes, rice-notes, umbrella-notes, ribbon-notes, lathe-article-notes, and so on through an interminable list, the circulation of each kind being limited to the confines of the issuing fief. Many of these notes had almost ceased to have any purchasing power, and nearly all were regarded by the people as evidences of official greed and unscrupulousness. The first duty of a centralized, progressive administration should have been to reform the currency: to substitute uniform and sound media of exchange for these multitudinous and unsecured tokens which hampered trade, destroyed credit, and opposed barriers to commercial intercourse between neighbouring provinces and districts. The political leaders of the time appreciated that duty, but instead of proceeding to discharge it, saw themselves compelled by stress of circumstances to adopt the very device which in the hands of the feudal chiefs had produced such deplorable results. It was an irksome necessity, and the new Government sought to relieve its conscience and preserve its moral prestige by pretending that the object of the issue was to encourage wealth-earning enterprise, and that the notes would be lent to the fiefs for the purpose of promoting commerce and industry. The people appraised these euphemisms at their true worth, and the new notes fell to a discount of 50 per cent. Then ensued a brief but sharp struggle between rulers and ruled. The Government resorted to arbitrary measures, sometimes of great severity, to force its notes into circulation at par with silver. But there was no continuity of policy. One day men were imprisoned for discounting paper tokens; the next, they were released. In December the authorities officially recognized a depreciation of 20 per cent.; in the following April they withdrew the recognition, and proclaimed the equality of specie and paper. Now, they promised to redeem the notes in thirteen years; then, they

[1] This figure represents the closest approximation furnished by statistics. But the reader should be warned that absolute accuracy cannot be claimed for returns compiled before the *Meiji* era.

shortened the period to five, and again they postponed it indefinitely. Nothing is more astonishing than the fact that, despite this bewilderment and vacillation, the Government's financial credit gradually acquired strength, so that within five years, though the issues of paper money aggregated nearly 60 million *yen*, it circulated freely throughout the whole empire at par with silver, and even commanded at one time a small premium. It is true that by this epoch the revenues of all the fiefs had become available for the service of the State, and that only one-tenth of their total had been appropriated for the support of the territorial nobles, now deprived of all administrative functions and reduced to the rank of private gentlemen, without either titles to distinguish them from their former vassals or estates to give them local prestige. But the central Government, having diminished the taxes to about one-third of their former total, as will presently be shown, found the public income too small for the expenditure. The paper money of the fiefs, amounting to 25 million *yen*, had been exchanged for Treasury notes. The building of railways had been commenced. The foundations of an army and a navy had been laid. A postal system, a telegraph system, a prison system, a police system, and an educational system had been organized. The construction of roads, the improvement of harbours, the lighting and buoying of the coast, had been vigorously undertaken. A mercantile marine had been created. Public works had been inaugurated on a considerable scale. Many industrial enterprises had been started under official auspices as object-lessons for the people, and large sums in aid of similar projects had been lent to private persons. Thus the Government, living far beyond its income, had unavoidable recourse to further issues of fiduciary paper, and in proportion as the volume of the latter exceeded the actual currency requirements of the time, its value depreciated until in 1881, fourteen years after the Restoration, notes to the face value of 150 million *yen* had been put into circulation; the Treasury possessed specie amounting to only 8 millions, and 18 paper *yen* could be purchased with ten silver coins of the same denomination.

Method of restoring specie payments.

Up to that year (1881) fitful efforts had been made to strengthen the specie value of fiat paper by throwing quantities of gold and silver upon the market from time to time, and large sums—totalling 23 million *yen*—had been devoted to the promotion of industries whose products, it was hoped, would go to swell the list of exports, and thus draw metallic money to the country. But these superficial devices were now finally abandoned, and the Government applied itself steadfastly to reducing the volume of the fiduciary currency on the one hand and accumulating a specie reserve on the other. The steps of the programme were simple. By applying the pruning knife boldly to administrative expenditure; by transferring certain charges from the Treasury to the local communes; by suspending all grants in aid of provincial public works and private enterprises, and by a moderate increase of the tax on alcohol, an annual surplus of revenue, totalling $7\frac{1}{2}$ million *yen*, was secured. This was applied to reducing the volume of the notes in circulation. At the same time, it was resolved that all officially conducted industrial and agricultural works should be sold —since their purpose of instruction and example seemed now to have been sufficiently achieved—and the proceeds, together with various securities (aggregating 26 million *yen* in face value) held by the Treasury, were applied to the purchase of specie. The latter was a delicate and difficult operation. Had the Government entered the market openly as a seller of its own fiduciary notes, its credit must have suffered. There were also ample reasons to doubt whether any available stores of precious metal remained in the country. In obedience to elementary economical laws, the cheap money had steadily driven out the dear, and although the Government mint at Osaka, founded in 1871, had struck 80 million *yen* worth of gold and silver coins between that date and 1881, when the policy of which we are now speaking was inaugurated, the customs returns showed that a great part of this metallic currency had flowed out of the country. In these circumstances Japanese financiers decided that only one course remained: the Treasury must play the part of national banker. Produce and manufactures destined for export must be purchased by the State with fiduciary notes, and the metallic proceeds of their sales abroad must be collected and stored in the Treasury. This programme required the establishment of consulates in the chief marts of the Occident, and the organization of a great central bank—the present Bank of Japan—as well as of a secondary bank—the present specie bank of Yokohama—the former to conduct transactions with native producers and manufacturers, the latter to finance the business of exportation. The outcome of these various arrangements was that, by the middle of 1885, the volume of fiduciary notes had been reduced to 119 million *yen*, their depreciation had fallen to 3 per cent., and the metallic reserve of the Treasury had increased to 45 million *yen*. The resumption of specie payments was then announced, and became, in the autumn of that year, an accomplished fact.

Reasons against a foreign loan.

These facts rightly stand at the head of a retrospect of Japanese finance, not merely because they set forth a fine economical feat, indicating clear insight, good organizing capacity, and courageous energy, but also because volumes of adverse foreign criticism were written into the margin of the story during the course of the incidents it embodies. Many onlooking strangers were prepared each with an infallible nostrum of his own, the rejection of which convinced him of Japan's hopeless stupidity. Now she was charged with robbing her own people because she bought their goods with paper money and sold them for specie; again, she was accused of an official conspiracy to ruin the foreign local banks because she purchased exporters' bills on Europe and America at rates that defied ordinary competition; and while some declared that she was plainly without any understanding of her own doings, others, averring that she could not possibly extricate herself from the slough of an inflated and largely depreciated fiat currency without recourse to European capital, predicted that her heroic method of dealing with the problem would paralyse industry, interrupt trade, produce widespread suffering, and, in short, bring about the advent of the proverbial seven other devils. Undoubtedly, to carry the currency of a nation from a discount of 70 or 80 per cent. to par in the course of four years, reducing its volume at the same time from 150 to 119 millions, was a financial enterprise violent and daring almost to rashness. The gentler expedient of a foreign loan would have commended itself to the majority of economists. But it may be here stated, once for all, that until her adoption of gold monometallism in 1897,[1] the foreign money market was practically closed to

[1] This operation should be called more properly a reversion to gold monometallism. The currency system established by Japanese financiers at the beginning of the *Meiji* era was based on the gold standard, the unit being the gold *yen*, a coin worth four shillings in round numbers. But, in the first place, Japan's stock of gold was soon driven out of the country by her depreciated fiat currency, and, in the second, as all the other Oriental nations were silver-using, and as the silver Mexican dollar was the unit of accounts in Far Eastern trade, Japan ultimately drifted into silver monometallism, the silver

Japan. Had she borrowed abroad it must have been on a sterling basis. Receiving a fixed sum in silver, she would have had to discharge her debt in rapidly appreciating gold. Twice, indeed, she had recourse to London for small sums, but when she came to cast up her accounts the cost of the accommodation stood out in deterrent proportions. A 9 per cent. loan, placed in England in 1868 and paid off in 1889, produced $4\frac{3}{4}$ million *yen*, and cost altogether $11\frac{3}{4}$ millions in round figures; and a 7 per cent. loan, made in 1872 and paid off in 1897, produced $10\frac{3}{4}$ millions, and cost 36 millions. These considerations were supplemented by a strong aversion from incurring pecuniary obligations to Western states before the latter had consented to restore Japan's judicial and tariff autonomy, a point which will be fully explained by and by. The example of Egypt showed what kind of fate might overtake a semi-independent state falling into the clutches of foreign bondholders. Japan did not wish to fetter herself with foreign debts while struggling to emerge from the ranks of Oriental Powers. After all, nothing succeeds like success. Japanese financiers made a signal success. Having undertaken to reorganize the administration of an empire, and to inaugurate a vast programme of reform, they met the difficulty of an empty Treasury by issuing fiat notes, and then, fourteen years later, grappling boldly with the problem of this inflated and heavily depreciated currency, they restored its value to par and resumed specie payments in the brief space of four years.

The national debt.

It is advisable at this point to examine the question of the national debt incurred by Japan since the unification of the empire. As already stated, when the fiefs were surrendered to the Sovereign, it was decided to provide for the feudal nobles and the *samurai* in general by the payment of lump sums in commutation, or by handing to them public bonds, the interest on which should constitute a source of income. The result of this transaction, into the details of which we need not enter, was that bonds having a total face value of $191\frac{1}{2}$ million *yen* were issued, and ready-money payments aggregating $21\frac{1}{4}$ million *yen* were made.[1] This was the foundation of Japan's national debt. Indeed, these public bonds may be said to represent the bulk of the State's liabilities during the first twenty-five years of the *Meiji* period. The Government had also to take over the debts of the fiefs, amounting to 41 million *yen*, of which $21\frac{1}{2}$ millions were paid with interest-bearing bonds, the remainder with ready money. If to the above figures we add two foreign loans aggregating $16\frac{1}{2}$ million *yen* (completely repaid by the year 1897); a loan of 15 million *yen* incurred on account of the only serious rebellion that marked the passage from the old to the new régime—the Satsuma revolt of 1877; loans of 33 million *yen* for public works, 13 million *yen* for naval construction, and $14\frac{1}{2}$ millions[2] in connexion with the fiat currency, we have a total of 305 million *yen*, being the whole national debt of Japan during the first twenty-eight years of her new era under Imperial administration.

War expenditures.

The above statements sufficiently explain the liabilities incurred by the country during what may be called the first epoch of her modern financial history. We now pass to the second epoch, dating from the war with China in 1894–95. The direct expenditures on account of the war aggregated 200 million *yen*, of which total 135 millions were added to the national debt, the remainder being defrayed with accumulations of surplus revenue, with a part of the indemnity received from China, and with voluntary contributions from patriotic subjects. As the immediate sequel of the war, the Government elaborated a large programme of armament expansion and public works. The army, at the time of the war, consisted of six divisions and the imperial guards; the peace establishment being 70,000, and the war strength 268,000. The navy comprised 33 vessels—exclusive of 26 torpedo-boats—representing a displacement of 63,000 tons. It was resolved to raise the number of divisions to twelve, with a peace establishment of 145,000 and a war strength of 560,000, and the navy to 67 ships[3] (besides 11 torpedo-catchers and 115 torpedo-boats), with an aggregate displacement of 258,000 tons. The expenditure for these unproductive purposes, as well as for coast fortifications, dockyards, and so on, came to 314 million *yen*, and the total of the productive expenditures included in the programme was 190 million *yen*—namely, 120 millions for railways, telegraphs, and telephones; 20 millions for riparian improvements[4]; 20 millions in aid of industrial and agricultural banks, and so forth—the whole programme thus involving an outlay of 504 million *yen*. To meet this large figure, the Chinese indemnity, surpluses of annual revenue and other assets, furnished 300 millions; and it was decided that the remaining 204 millions should be obtained by domestic loans, the programme to be carried completely into operation—with trifling exceptions—by the year 1905. In practice, however, it was found impossible to obtain money at home without paying a high rate of interest. The Government, therefore, had recourse to the London market in 1899, raising a loan of 10 million pounds sterling at 4 per cent., and selling the £100 bonds at 90. In this matter of raising loans it is of course impossible here to anticipate subsequent events. In 1902 it was not expected that Japan

yen becoming her unit of currency. So soon, however, as the indemnity that she received from China after the war of 1894–95 had placed her in possession of a stock of gold, she determined to revert to the gold standard. Mechanically speaking, the operation was very easy. Gold having appreciated so that its value in terms of silver had exactly doubled during the first thirty years of the *Meiji* era, nothing was necessary except to double the denominations of the gold coins in terms of *yen*, leaving the silver subsidiary coins unchanged. Thus the old 5-*yen* gold piece, weighing 2·22221 *momme* of 900 fineness, became a 10-*yen* piece in the new currency, and a new 5-*yen* piece of half the weight was coined. No change whatever was required in the reckonings of the people. The *yen* continued to be their coin of account, with a fixed sterling value of a little over two shillings, and the denominations of the gold coins were doubled. Gold, however, is little seen in Japan; the whole duty of currency is done by notes.

[1] The amounts include the payments made in connexion with what may be called the disestablishment of the Church. There were 29,805 endowed temples and shrines throughout the empire, and their estates aggregated 354,481 acres, together with $1\frac{3}{4}$ million bushels of rice (representing $2\frac{1}{2}$ millions of *yen*). The Government resumed possession of all these lands and revenues at a total cost to the State of a little less than $2\frac{1}{2}$ million *yen*, paid out in pensions spread over a period of fourteen years. The measure sounds like wholesale confiscation. But some extenuation is found in the fact that the temples and shrines held their lands and revenues under titles which, being derived from the feudal chiefs, depended for their validity on the maintenance of feudalism.

[2] This sum represents interest-bearing bonds issued in exchange for fiat notes, with the idea of reducing the volume of the latter. It was a tentative measure, and proved of no value.

[3] Japan's fleet at the time of the war consisted of comparatively small vessels, the largest being three coast-defence ships of 4278 tons. She captured from China an armour-clad of 7335 tons—the first line-of-battle-ship in her navy. Her *post-bellum* fleet, as planned (1901), included 6 first-class battle-ships, ranging from 12,500 to 15,000 tons approximately; 6 first-class cruisers of 9200 tons; 9 second-class cruisers, ranging from 3700 to 4800 tons; 10 third-class cruisers, ranging from 3300 tons, &c. (See also NAVIES.)

[4] Japan suffers severely from inundations. Many of the rivers have been banked up in the course of centuries until their beds lie considerably above the level of the surrounding country, and a breach of the embankments involves widespread disaster. It has been estimated that the average annual loss from this source does not fall short of 19 million *yen*. In 1887 an extensive scheme of riparian improvement was undertaken. It involved a total expenditure of 26 million *yen*, of which 6 millions had been expended when the war with China broke out.

would need any further immediate recourse to foreign borrowing. According to existing arrangements, Japan's national indebtedness would reach its maximum, namely, 575 million *yen*, in the year 1903, and would thenceforward diminish steadily.[1] It remains to consider briefly the annual revenues and expenditures of the State, and the manner of their growth during recent years.

Budget. The burden of taxation is small, especially compared with the career of vigorous progress upon which the country has embarked. Only 120 million *yen* was raised in 1900 by direct taxes; that is to say, something less than 3 *yen* (6 shillings) per head of population. The sources were these:—

	Millions of Yen.
Land tax	47
Income tax	5
Business tax	6
Sake (rice wine) tax	56
Soy (fish sauce) tax	3
Miscellaneous taxes	3
Total	120

A further sum of 72 million *yen* was obtained by indirect taxation, namely:—

	Millions of Yen.
Customs and tonnage dues	16
State undertakings (railways, posts, telegraphs, tobacco monopoly, and forests)	43
Stamp duties	11
Miscellaneous	2
Total	72

On the other hand, the ordinary expenditure aggregated 149 million *yen*. Thus there was a surplus of 43 million *yen*. For the moment this surplus was absorbed for extraordinary and terminable enterprises forming part of the *post-bellum* programme described above, but in a short time the country might look forward to finding itself with a substantial annual balance on the right side.

Credit. It is remarkable that, in spite of the conclusive evidence furnished by such figures as these, there should have prevailed in Europe and America up till a comparatively recent date an impression that Japan's financial condition was not sound. The misapprehension was mainly due to the fact that the national expenditure grew from 63 million *yen* to 149 millions in the ten years ending 1900. Not unnaturally, such a rate of increase seemed startling. The development of the revenue in the same time from 76 millions to 192 millions appears to have escaped attention, or possibly even accentuated the distrust by suggesting excessive taxation. Looking at the figures without any reference to the past, it is necessary to admit that excellent financial management is required in order that a nation of 43½ million inhabitants, which maintains an army of half a million of men and a fleet of 258,000 tons, may pay its way at a cost of less than fifteen million pounds sterling. Such a feat presents itself in a scarcely credible light to Occidental statesmen. Again, observing that the annual expense of maintaining the army and navy is only 55 million *yen*, whereas the tax on *sake* (rice wine) alone yields 56 millions, and noting that this tax — which falls on a luxury—grew from 4 million *yen* in 1891 to 56 millions in 1900, it seems plain that if the country has greatly increased its armaments, there has been found at the same time a compensatory source of revenue which does not add seriously to the burdens of the people at large. Further, that a large reserve of taxable capacity exists cannot be doubted. It has been shown above that before the fall of the feudal system the farmer paid into the local treasury two-fifths of his whole rice crop. The average annual yield of rice at present is 200 million bushels, and the monetary value of two-fifths of that quantity is 150 million *yen*, in round numbers, whereas the total tax levied on the land is only 47 millions. Thus the difference is more than three to one in favour of the present system. Another factor which has operated injuriously to Japan's credit is that her politicians, by assaults upon the budget in the Diet and by clamouring for a reduction of the land tax as well as of official salaries, greatly misled the foreign public. That this outcry was merely a convenient weapon for attacking the cabinet and courting favour with the constituencies was amply proved in the sequel, when these same agitators voted to increase the land tax and to augment official salaries. But they had sustained the clamour so vigorously and incessantly during session after session of the Diet, that the world ultimately learned to regard Japan as a country crushed by a weight of taxation which the people's representatives were vainly struggling to lighten, and preyed upon by a number of overpaid officials whom the Diet was seeking to deprive of their excessive emoluments. Accepting the estimates made by the Japanese themselves, Europe and America regarded Japan as an embarrassed country, instead of recognizing the abundance and elasticity of her resources.

The wealth of Japan is a subject which has not yet been investigated so thoroughly that an altogether trustworthy statement can be made. The following figures give the closest approximations possible in 1901:—

	Millions of Yen.
Value of lands (agricultural, building, forest, &c.)	3600
Value of buildings	1100
Value of household furniture and utensils	550
Value of cattle, horses, fowls, &c.	60
Value of railways	250
Value of mercantile marine	33
Value of merchandise	430
Gold and silver bullion and coins	250
Miscellaneous	2000
Total	8273

It will be observed that this sum is approximately one-tenth of the accumulated capital of Great Britain and Ireland. That is what might have been expected, for, speaking roughly, money is ten times as valuable in Japan as in the United Kingdom.

With regard to the income derived by Japan from her capital, the following figures are deduced from the best statistics:—

	Millions of Yen.
Products of agriculture, forestry, and fisheries	750
Produce of mines	30
Manufactured articles	400
Land-transport earnings	90
Water-transport earnings	15
House rent	28
Profits on foreign trade	25
Banking profits	27
Profits on business	98
Total	1463

The development of Japan's foreign trade was checked

[1] All Japan's domestic loans are now placed on a uniform basis. They carry 5 per cent. interest, run for a period of 5 years without redemption, and are then redeemed within 50 years at latest. The Treasury has competence to expedite the operation of redemption according to financial convenience, but the sum expended on amortization each year must receive the previous consent of the Diet. Within the limit of that sum redemption is effected either by purchasing the stock of the loans in the open market or by drawing lots to determine the bonds to be paid off. Perhaps a more suggestive idea may be furnished of Japan's finance during the *Meiji* era if we say that, owing to the processes of conversion, consolidation, &c., and to the various requirements of the State's progress, twenty-two different kinds of national bonds were issued from 1870 to 1896; that they aggregated 673,215,500 *yen*; that 269,042,198 *yen* of that total had been paid off at the close of 1897, and that the remainder will be redeemed, according to the present programme, by 1946.

at first not only by the unpopularity attaching to all intercourse with outside nations, but also by embarrassment resulting from the difference between the silver price of gold in Japan and its silver price in Europe, the precious metals being connected in Japan by a ratio of 1 to 5, and in Europe by a ratio of 1 to 15. This latter fact led to some arbitrary and even disgraceful doings on the part of foreign traders, and was also the cause of a sudden and violent appreciation of values; for the Government, seeing the country threatened with loss of all its gold, tried to avert the catastrophe by altering and reducing the weights of the silver coins without altering their denominations, and a corresponding difference exhibited itself, as a matter of course, in the silver quotations of commodities. Another source of difficulty was the attitude of officialdom. During several centuries, Japan's over-sea trade had been under the control of the Government, to whose coffers it contributed a substantial revenue. But when the foreign exporter entered the field under the conditions created by the new system, he diverted to his own pocket the handsome profit previously accruing to the Government; and since the latter could not easily become reconciled to this loss of revenue, or wean itself from its traditional habit of interference in affairs of foreign commerce, and since the foreigner, on his side, not only desired secrecy in order to prevent competition, but was also tormented by inveterate suspicions of Oriental espionage, not a little friction occurred from time to time. Thus the impression suggested by the scanty records of that early epoch is that trade was beset with great difficulties, and that the foreigner had to contend against most adverse circumstances, though in truth his gains amounted to 40 or 50 per cent.

The chief staples of the early trade were tea and silk. It happened that just before Japan's raw silk became available for export, the production of that article in France and Italy had been largely curtailed owing to a novel disease of the silkworm. Thus, when the first bales of Japanese silk appeared in London, and when it was found to possess qualities entitling it to the highest rank, a keen demand sprang up, so that in 1863, the fourth year after the inauguration of the trade, no less than 2¼ million ℔ were shipped. Japanese green tea also, differing radically in flavour and bouquet from the black tea of China, appealed quickly to American taste, so that 6 million ℔ of it were sent across the Pacific in 1863. The corresponding figures for these two staples in 1899 were 14 million ℔ and 46 million ℔ respectively. This remarkable development is typical of the general history of Japan's foreign trade in modern times. Omitting the first decade, the statistics for which are imperfect, the volume of the trade grew from 5¾ millions sterling in 1868 to 43½ millions in 1899. It was not a uniform growth. The period of 32 years divides itself conspicuously into two eras: the first, of 18 years (1868–85), during which the development was from 5¾ millions to 13 millions, a ratio of 1 to 2¼, approximately; the second, of 14 years (1886–99), during which the development was from 13 millions to 42½ millions, a ratio of nearly 1 to 4.

That a commerce which did little more than double itself in the first eighteen years should have nearly quadrupled in the next fourteen is a fact inviting attention. There are two principal causes: one general, the other special. The general cause was that several years necessarily elapsed before the nation's material condition began to respond perceptibly to the improvements effected by the *Meiji* Government in matters of administration, taxation, and transport facilities. Fiscal burdens had been reduced and security of life and property obtained, but railway building and road-making, harbour construction, the advantages of posts, telegraphs, exchanges and banks, and the development of a mercantile marine did not exercise a sensible influence on the nation's prosperity until 1884 or 1885. From that time the country entered a period of steadily growing prosperity, and from that time private enterprise may be said to have finally started upon a career of independent activity. The special cause which, from 1885, contributed to a marked growth of trade was the resumption of specie payments. Up to that time the Treasury's fiat notes had suffered such marked fluctuations of specie value that sound or successful commerce became very difficult. Against the importing merchant the currency trouble worked with double potency. Not only did the gold with which he purchased goods appreciate constantly in terms of the silver for which he sold them, but the silver itself appreciated sharply and rapidly in terms of the fiat notes paid by Japanese consumers. Cursory reflection may suggest that these factors should have operated inversely to stimulate exports as much as they depressed imports. But such was not altogether the case in practice. For the exporter's transactions were always hampered by the possibility that a delay of a week or even a day might increase the purchasing power of his silver in Japanese markets by bringing about a further depreciation of paper, so that he worked timidly and hesitatingly, dividing his operations as minutely as possible in order to take advantage of the downward tendency of the fiat notes. Not till this element of pernicious disturbance was removed did the trade recover a healthy tone and grow so lustily as to tread closely on the heels of the foreign commerce of China, with her 300 million inhabitants and long-established international relations.

Japan's trade with the outer world was built up chiefly by the energy and enterprise of the foreign middleman. He acted the part of an almost ideal agent. As an exporter, his command of cheap capital, his experience, his knowledge of foreign markets, and his connexions enabled him to secure sales such as must have been beyond reach of the Japanese working independently. Moreover, he paid to native consumers ready cash for their staples, taking upon his own shoulders all the risks of finding markets abroad. As an importer, he enjoyed, in centres of supply, credit which the Japanese lacked, and he offered to native consumers foreign produce laid at their doors with a minimum of responsibility on their part. Finally, whether as exporters or importers, foreign middlemen always competed with each other so keenly that their Japanese clients obtained the best possible terms from them. Yet the ambition of the Japanese to oust them cannot be regarded as unnatural. Every nation must desire to carry on its own commerce independently of alien assistance, and it may be added that certain features of the foreigner's methods in Japan have rendered his intervention specially irksome. His practice is openly based on the hypothesis that no Japanese tradesman is trustworthy, and he takes frequent occasion to proclaim his want of confidence. Undoubtedly this distrust has had justification. Social conditions in Japan during feudal centuries were altogether unfavourable to the development of a "commercial conscience," and there has not yet been time for the new order of things to produce a radical improvement in that respect. Japanese publicists themselves frankly recognize this unfortunate fact, but the average tradesman can scarcely be expected to admit it. He resents being preached to about commercial morality by foreigners whom he himself considers arbitrary, exacting, and often unjust. He is jealous, too, of the strangers' manner of life. Their comparatively fine mansions, their carriages and their apparently profuse expenditure, suggest that they derive princely incomes from their business. Thus there are several reasons for wishing to dispense with the alien, and it is plain that these reasons are operative;

for whereas in 1888 native merchants carried on only 12 per cent. of the country's foreign trade without the intervention of foreign middlemen, their share rose to 35 per cent. in 1899. That this rate of increase would be steadily maintained was not, however, an inference to be accepted. The day is still distant when Japanese merchants can hope to establish with the Occident relations of such mutual intimacy and confidence as will enable them to take the place now occupied by foreign middlemen.

Balance of trade. Analysis of Japan's foreign trade during the *Meiji* era (1868 to 1899, inclusive) shows that imports exceeded exports in 17 years and that exports exceeded imports in 15 years. This would suggest a tolerably well balanced trade. But closer examination does not confirm the suggestion. Reckoning from 1872, when returns relating to movements of specie became available for the first time, it is found that imports totalled 218½ millions sterling and exports 186¼ millions, so that the excess of imports was 32¼ millions. On the other hand, the exports of specie for the same time were 38 millions sterling and the imports 33 millions, showing an excess of 5 millions on the side of exports. Obviously Japan cannot have paid for imports worth 32¼ millions sterling by a disbursement of only 5 millions. This apparent anomaly admits of an easy explanation. After the war of 1894–95, Japan received from China an indemnity of 36½ millions of pounds, out of which she brought 18⅝ millions into the country. Further, in 1898 she sold bonds to the value of 4½ millions in the London market and caused the money to be sent to Tôkyô. If these 23 millions be taken into account, the excess of unpaid-for imports is reduced to 4¼ millions sterling, the greater part of which, if not the whole, is accounted for by the expenditures of foreigners resident in the country and of tourists visiting it. There could be no question, however, that Japan's foreign trade was causing an outflow of her specie. Only within the four years 1896 to 1899, however, was the balance seriously against her, the imports for that period totalling 91½ millions sterling and the exports 66 millions. Doubtless the explanation is to be sought in the fact that after 1896 the Government was spending great sums on works connected with the *post-bellum* programme of armament expansion, and that the millions thus scattered among the people have increased their purchasing power to an abnormal extent.

Commercial prospects. It can scarcely be doubted that the future development of Japan's trade will be in the direction of manufactures. She will always be able to send abroad considerable quantities of raw silk and tea and comparatively inconsiderable quantities of marine products,[1] copper, coal,[2] camphor, sulphur, rice and minor staples, but, with regard to these, either her producing capacity is inelastic or her market is limited. It is certain, indeed, that she will by and by have to look abroad for supplies of the necessaries of life. Rice is the staple diet of her people, and she seems almost to have reached the potential maximum of her rice-growing area; for, in spite of her genial climate and seemingly fertile soil, the extent of her arable land is disproportionately small. She has only 11½ millions of acres under crops, and there is no prospect of any large extension, or of the yield being improved by new agricultural processes. The Japanese farmer understands his work thoroughly. His competence is sufficiently proved when we say that, by the skilful use of fertilizers, he has been able to raise good crops of rice on the same land during fifteen or twenty centuries. On the other hand, not only is the population increasing at the rate of half a million annually, but in proportion to the growth of general prosperity and the distribution of wealth, the lower classes of the people, who used formerly to be content with barley and millet, now regard rice as an essential article of food. It cannot be long, therefore, before large supplies of this cereal will have to be drawn from abroad. The same is true of timber, which has already become inconveniently scarce. Further, Japan cannot even grow her own cotton, and nature has not fitted her pastures for sheep, so that much of the material for her people's clothing has to be imported. Her future lies undoubtedly in industrial enterprise. She has an abundance of cheap labour, and her people are exceptionally gifted with intelligence, docility, manual dexterity, and artistic taste. Everything points to a great future for them as manufacturers. This is not a matter of mere conjecture. Striking practical evidence has already been furnished. Cotton-spinning may be specially referred to. As long ago as 1862 the feudal chief of Satsuma started a mill with five thousand spindles. During a whole decade he found only one imitator. In 1882, however, a year which may be regarded as the opening of Japan's industrial era, this enterprise began to attract capital, and in the course of four years 15 mills were established, working 55,000 spindles. By foreign observers this new departure was regarded with contemptuous amusement. The Japanese were declared to be without organizing capacity, incapable of sustained energy, and generally unfitted for factory work. These pessimistic views had soon to be radically modified, for by 1897 the number of mills had increased to 63; the number of spindles, to some 800,000; the capital invested, to 21 million *yen*, and the average annual profit per spindle was 3½ *yen*, or 13½ per cent. on the capital. The rapidity of this development suggests unsoundness, but speed is a marked characteristic of Japan's modern progress. In 1880, for example, a man named Isozaki, of Okayama prefecture, carried to Kobe a specimen of a new kind of floor-mat, the outcome of two years' thought and trial. Briefly described, it was matting with a weft of fine green reeds and a warp of cotton yarn, having a coloured design woven into it. Isozaki found difficulty in getting any one to test the saleability of his invention by sending it abroad. Sixteen years later the "brocade-matting" industry of Okayama prefecture alone occupied 734 weaving establishments, with 9085 stands of looms; gave employment to 9357 artisans, of whom 5335 were females, and turned out 2¼ million *yen* worth of this pretty floor-covering. Meanwhile, the total value of the industry's output throughout the empire had reached nearly 6 million *yen*, and the quantity exported stood at nearly 4 millions approximately in the customs returns. Here, then, is a trade which rose from nothing to a position of importance in sixteen years. Even more remarkable in some respects has been the development of the textile industry. In 1884 the total production of silk and cotton fabrics was 6 million *yen*; in 1898 it had increased to 110 millions.[3] The manufacture of

[1] Japan's fishing industry is doubtless capable of great development. She has 17,602 miles of coast, and 270,000 families devoted to fishing, or more than 15 families to each mile. They employ 330,706 boats and 1,194,408 nets, representing a capital of about 3 millions sterling, and the total value of the annual catch is put at 5 millions sterling, though 10 millions would probably be nearer the truth. The fishermen are sturdy, courageous fellows, but their methods are primitive and virtually no improvements have yet been introduced.

[2] It was at one time supposed that Japan possessed great mineral wealth, but the question remains uncertain. The output of her various mines increases steadily, it is true, but its total annual value does not exceed 3 millions sterling. Recently gold has been discovered in seemingly large quantities in Hokkaido, and kerosene in Echigo as well as in Hokkaido. The practical value of these discoveries remains to be determined.

[3] The Japanese have been skilled weavers for many centuries, but

lucifer matches is another industry of entirely recent growth. A few years ago Japan used to import all the matches she needed, but by 1899 she was able not only to supply her own wants, but also to send abroad 6 million *yen* worth. Without carrying these statistics to wearisome length, it will suffice to note that, in six branches of manufacturing industry which may be said to have been called into active existence by the opening of the country — namely, silk and cotton fabrics, cotton yarns, matches, fancy matting, and straw braid—Japan's exports in 1888 aggregated only $\frac{1}{4}$ million *yen*, whereas the corresponding figure for 1899 was 68 millions. With such results on record, it is impossible to doubt that Japan has a great manufacturing future. The fact has, indeed, been partially recognized and much talked of within the past few years, especially in the United States, where the prospect of Japanese industrial competition was recently presented to the public in almost alarming proportions. On the other hand, among foreigners resident in Japan the general estimate of native manufacturing capacity is low. Doubtless, as is usually the case, the truth lies between the two extremes. Japanese industrial competition will be a formidable fact one of these days, but the time is still distant. Progress is checked by one manifest obstacle, defective integrity. Concerning every industry whose products have found a place in the catalogue of modern Japan's exports, the same story has to be told: just as really substantial development seemed to be visible, fraudulent adulteration or dishonestly careless technique interfered to destroy credit and disgust the foreign consumer. The Japanese deny that the whole responsibility for these disastrous moral *laches* rests with them. The treaty-port middleman, they say, buys so thriftily that high-quality goods cannot be supplied to him. That excuse may be partially valid, but it is certainly not exhaustive. The vital importance of establishing and maintaining the reputation of an article offered newly in markets where it has to compete with rivals of old-established excellence is not yet fully appreciated in Japan. As to organizing capacity, the possession of which by the Japanese has been strenuously doubted by more than one foreign critic, there are proofs more weighty than any theories. In the cotton-spinning industry, for example, the Japanese are brought into direct competition in their own markets with Indian mills employing cheap native labour, organized and managed by Englishmen, and having the raw material at their doors. The victory rests with the Japanese, from which it may fairly be inferred that their organization is not specially defective or their method costly.[1] Yet there is one consideration that must not be lost sight of: it is the inexperience of the Japanese; their lack of standards. Japan is dressing herself in a material civilization that was made to the measure of alien nations, and curious misfits are inevitably developed in the process. If the England of 1837, for example—that is to say, England as she was at the commencement of the Victorian era—could have been suddenly projected forward to 1897, and invited to adapt herself to the moral and material conditions of the latter period, the task, though almost inconceivably difficult, would have been easier than that which Japan set herself in 1870, for England would at least have possessed the preliminary training, the habit of mind, and the trend of intelligence, all of which were wanting to Japan. This essential difference should be easy to remember, yet it is constantly forgotten by observers of Japan's progress. Again and again they make the mistake of measuring her acts by the standards to which they have themselves been educated. Again and again they fall into the error of deducing from her failures and perplexities the same inferences that similar perplexities and failures would suggest in Europe or America. If the citizens of Tôkyô hesitate to spend large sums upon street repair, they are accused of blind parsimony, though the fact is that, never having had any practical knowledge of really fine roadways, they have not yet learned to appreciate them. If Japanese officials do not at once succeed in solving the very difficult problem of Formosan administration, it is concluded that they lack administrative ability, though absolute lack of experience suffices to account for their ill-success. If the people have not yet made any significant contribution to the sum of Occidental scientific knowledge or mechanical contrivances, they are dismissed as imitative, not initiative, which is much as though we should charge a lad with want of originality because, having barely mastered the integral calculus, he did not write some new chapters on quaternions. If they have not yet reduced constitutional government to a smoothly working system, have not yet emerged from a confusion of political coteries into the orderly condition of two great parties, each capable of assuming and discharging administrative responsibilities, they are declared unfit for representative institutions, though they have tried them for only a few years after fifteen centuries of military feudalism or hereditary oligarchy. If they do not carry on their new industries with the minimum of efficient labour, and if they fail to appreciate the economical necessity of bestowing constant care upon the machinery and of seeking to rise above first results instead of regarding them as the *ne plus ultra* of subsequent achievement, they are pronounced radically deficient in the industrial instinct, whereas the truth is that they have not as yet any accurate perception of the standards which experience and competition have established in foreign countries. The condition of their army and of their navy shows that not capacity but practice is what the Japanese lack. These two services are altogether modern creations. There was nothing in the history of Japan to suggest her competence for managing such machines. Yet the excellence of her military organization was fully demonstrated in her campaign against China in 1894–95, and again in the Peking expedition of 1900. In the former she had to undertake the most difficult task that falls to the lot of a belligerent, the task of sending over-sea two *corps d'armée* (aggregating a hundred and twenty thousand men), and maintaining them for several months in widely separated fields—one in eastern and central Manchuria; the other in the Liaotung peninsula, and, subsequently, in Shantung province. The effort did not appear to embarrass her. There was no sign of confusion or perplexity; no breakdown of the commissariat or transport arrangements; no failure of the ambulance or hospital service. Everything worked smoothly, and the public were compelled to recognize that Japan had not only elaborated a very efficient piece of military mechanism,

a great impetus was given to this enterprise by the introduction of improved machinery and the use of aniline dyes, after the opening of the country to foreign intercourse. Indigo has always been the staple dye-stuff of the country. Twenty million *yen* worth is produced annually. But for colours other than blue and its various tones, aniline dyes are now imported to the extent of $1\frac{1}{4}$ million *yen* yearly. The growth of the textile industry has also been greatly stimulated by the introduction of cotton yarns of fine and uniform quality. Formerly all cotton cloths were woven out of coarse, irregular handspun yarns, so that nothing like regularity of weight and texture could be secured. It thus appears that Japan owes the remarkable development of her textile industry to foreign intercourse.

[1] Japanese mills are kept at work twenty-three hours out of the twenty-four, with one shift of operatives, and their production per spindle is 40 per cent. greater than the production at Bombay mills and nearly double the production at English mills.

but had also developed ability to employ it to the best advantage. The same inference was suggested by her navy. Although during two and a half centuries her people had been debarred by arbitrary legislation from navigating the high seas, the twenty-fifth year after the repeal of these crippling laws saw the State in possession of a squadron of thirty-three serviceable ships of war, officered and manned solely by Japanese, constantly manœuvring in distant waters without accident, and evidently possessing all the qualities of a fine fighting force. In the war with China this navy showed its capacity by destroying or capturing, without the loss of a single ship, the whole of the enemy's fleet, whereas the latter's superiority in armour and armament ought to have produced a very different issue. On the other hand, a visit to Japanese factories often shows machinery treated carelessly, employés so numerous that they impede rather than expedite business, and a general lack of the precision, regularity, and earnestness that characterize successful industrial enterprises in Europe and America. Achievement in one direction and comparative failure in another, although the factors making for success are similar in each, indicate, not incapacity in the latter case, but defects of standard and experience. The vast majority of the Japanese have no adequate conception of what is meant by a highly-organized industrial or commercial enterprise.[1] They have never made the practical acquaintance of anything of the kind, nor even breathed a pure business atmosphere.[2] For elaborating their military and naval systems they had close access to foreign models, every detail of which could be carefully scrutinized, and they availed themselves freely of the assistance of foreign experts—French, German, and British. But in the field of manufacture and trade their inspection of foreign models is necessarily superficial, and they are without the co-operation of foreign experts. It may be supposed that, since the foreign middleman plays such an important part in the country's over-sea commerce, his skill and experience must have been equally available for the purposes of industrial enterprise. But two difficulties stood in the way: one legal, the other sentimental. The treaties forbade foreigners to hold real estate or engage in business outside the limits of the settlements, thus rendering it impossible for them either to start factories on their own account or to enter into partnership with native manufacturers; and an almost morbid anxiety to prove their independent competence impelled the Japanese to dispense prematurely with the services of foreign employés. Rapid as has been the country's material progress, it might have been at once quicker and sounder had these restrictive treaties been revised a dozen years earlier, when Japan was still upon the threshold of her manufacturing career, and before repeated failures to obtain considerate treatment at the hands of Western Powers had prejudiced her against foreigners in all capacities. In 1885 she was ready to welcome the Occidental to every part of the country, regarded it as a matter of course that he should own real estate, and would gladly have become his partner in commerce or manufactures. In 1895 she had come to suspect that closer association with him might have dangers and disadvantages, and that the soil of Japan ought to be preserved from falling into his possession. There are clear evidences that this mood, so injurious to her own interests, is being replaced by more liberal sentiments, but in the meanwhile she has been induced to stand aloof from alien aids at a time when they might have profited her immensely, and to struggle without guidance towards standards of which she has as yet only a dim perception. Already, too, some of the advantages of cheap labour and inexpensive living are disappearing, and, on the whole, there seems to be little doubt that though great manufacturing successes lie before her, she will take many years to realize them.

Japan's great difficulty is want of capital. The capital actually engaged in public and private enterprises is 60 million pounds sterling in round numbers, and 79 millions more are pledged though not yet paid up. On the other hand, the volume of circulating media is only 25 millions, of which amount 22 millions consist of convertible notes; the deposits in the banks total 33 millions, and their capitals aggregate 49½ millions.[3] In such circumstances the rate of interest is necessarily high—it averages about 12 per cent. throughout the empire—and many profitable enterprises remain undeveloped. Recourse to cheap foreign capital would be the natural solution of the difficulty. But so long as her currency was on a silver basis Japan hesitated to contract gold debts, and European capitalists would not lend in terms of silver. After she had adopted the gold standard her situation appeared more favourable. Europe and America, however, had still not acquired confidence in her finances or her integrity, and in the meanwhile a great opening for foreign capital vainly offered in the field of industrial enterprises. Recent returns issued

[1] The railways and posts constitute additional examples. The Japanese have long been able to survey, plan, and build their own lines of railways, to run the trains and to manage the traffic. For these achievements they deserve much credit. But their arrangements for handling, forwarding, and delivering goods are very defective, when judged by good Occidental standards, and their provision for the comfort of passengers leaves a great deal to be desired. So, too, their postal service invites criticism in some very important respects, if it merits praise in others. All such defects would soon be corrected if free recourse were had to the assistance of foreign experts, who have the advantage of familiarity with higher standards. It is unfortunate that a people so liberal in their adoption of the best products of Western civilization should hesitate to avail themselves of the best means of learning to utilize them.

[2] Another serious obstacle to the industrial development of the Japanese is their difficulty in deciphering foreign tastes. It results that in fields where their capacity is highest their success is often smallest. They export some two millions of umbrellas at a cost of 10½d. apiece, 30,000 pairs of boots at 11¼d. a pair, and 190,000 dozen pairs of socks at 1s. 3d a dozen. There can be no mistake about the shape and style of these things; a pattern alone suffices for guide. But, on the other hand, take the case of lacquer. In the quality and beauty of their lacquer the Japanese stand easily at the head of all nations. There, if anywhere, they should be able to defy rivalry. Yet what are the facts? Japanese lacquer experts, in their attempts to capture the New York market, have been distanced by Germans, who gauge the taste of the Americans with much greater accuracy, and produce lacquers better appreciated and cheaper than those of the Japanese themselves. Not finer lacquer, indeed, nor anything like as fine, but better suited to the immediate purpose of its manufacturers. Another case in point is the work of the silversmith. As chisellers of metal the Japanese have no superiors. Their skill in that line ought to open a wide and profitable field in Europe and America. But it does not. With the exception of a few fancy articles, objects of art rather than of utility, they sell nothing abroad. They have not yet found the range of Occidental taste, and, judging from past experience, it seems likely that they will continue to waste their strength for a long time upon unfruitful essays. It would appear, in short, that intercourse and interchange of ideas between the East and West must become much closer and less superficial before Japanese manufacturers can adapt themselves to the requirements of the Occident sufficiently to be formidable competitors. In such staples as cotton yarns, textile fabrics, silk handkerchiefs, lucifer matches, boots, umbrellas, and so forth, they find easy guidance, but where independent judgment and the mercantile instinct are needed, they still show themselves backward.

[3] The efficiency of money has greatly increased, of course, during recent years. Thus, whereas in 1873 there were only half-a-dozen banks with a total capital of £6000, and aggregate loans of the same amount, approximately, the number at the close of 1899 was 2296, with a total capital of 49½ millions sterling and loans aggregating 267 millions. In 1873 the sums deposited by individuals in banks amounted to half a million; in 1899 they aggregated 33 millions. In 1887, the year after the establishment of Clearing Houses in Tôkyô and Osaka, the clearances aggregated less than 3 millions sterling; in 1899 they totalled over 129 millions.

by 68 joint-stock companies show that they paid an average annual dividend of $16\frac{1}{2}$ per cent., and it is not to be doubted but that still better results could be attained were foreign business experience and cheap capital available.

Status of foreigners.

It has always been considered expedient, and certainly it is wise, that the subjects and citizens of Occidental Christian states, when visiting or inhabiting Oriental countries which are not Christian, should be exempted from the penalties and procedure prescribed by the criminal law of the latter; that they should continue, in short, to enjoy, even within the territories of such countries, the privilege of being arraigned before tribunals of their own nationality and tried by judges of their own race. In civil cases a division of jurisdiction is arranged, the question being always adjudicated by a tribunal of the defendant's nationality, but in criminal cases jurisdiction is wholly reserved. In pursuance of that principle the various Powers having treaties with Oriental nations establish consular courts within the latter's borders, and the jurisdiction exercised by these courts is called "extra-territorial," to distinguish it from the jurisdiction exercised by native or territorial tribunals. The system was applied to Japan's case, as a matter of course, in 1858. It had been similarly applied in the 16th century, in the days of her first foreign intercourse, and just as it had then been a cause of the Dutch traders' imprisonment within the narrow limits of the island of Deshima at Nagasaki, so in the 19th century it necessitated the confinement of the foreign residents in settlements grouped around the sites of their consular courts; for the plainest principles of prudence forbade that these residents should have free access to provincial districts far remote from the only tribunals competent to control them. The Japanese negotiators in Yedo raised no objection to the embodiment of this system in the treaties. But it was one of the features most vehemently condemned by the conservative statesmen and politicians in Kyôtô, and no sooner had the administration been restored to the Emperor than an embassy was despatched to Europe and America with the object of inducing Occidental Governments to revise the treaties, in the sense of abolishing consular jurisdiction and changing the tariff so as to enable Japan to obtain a larger revenue from customs duties.[1] This embassy sailed in 1871. It had a specific right to raise the question, for the treaties contained a provision declaring them to be subject to revision in that year. As a matter of course the embassy failed. The conditions originally necessitating consular jurisdiction had not undergone any change justifying its abolition. Neither the character of Japan's laws nor the methods of her judicial procedure were such as to warrant foreign Governments in entrusting to her care the lives and properties of their subjects and citizens. It must be confessed, on the other hand, that the consular courts themselves were not beyond reproach. A few of the Powers, notably Great Britain and the United States, had organized competent tribunals and appointed expert judicial officials to preside over them. But a majority of the Treaty States were content to delegate consular duties to merchants, who not only lacked legal training of any kind, but were themselves engaged in the commercial transactions upon which they might at any moment be required to adjudicate in a magisterial capacity. Thus it happened, sometimes, that a Japanese subject desiring to invoke the aid of the law against a foreigner who seemed to have wronged him, found that the defendant in the case would also be the judge. In any circumstances the dual functions of consul and judge could not be discharged by the same official without anomaly, for his *rôle* of consul compelled him to act as advocate in the initiatory stages of complications about which in the position of judge he might ultimately be required to deliver an impartial verdict. It would be an error to suppose, however, that the course of consular jurisdiction in Japan was disfigured by many abuses. On the whole the system worked satisfactorily, and if it hurt patriotic Japanese, it also saved them from innumerable complications into which they would have blundered inevitably had they been entrusted with a jurisdiction which they were not prepared to exercise satisfactorily.

Nevertheless, they determined from the first that no effort should be spared to qualify for the exercise of a right which is among the fundamental attributes of every sovereign state—the right of judicial autonomy. In any circumstances the recasting of their laws and the reorganization of their law courts would have occupied a prominent place in the programme of general reform suggested by contact with the Western world, but the "extra-territorial" question certainly stirred them to special legislative efforts. With the aid of foreign experts they set themselves to elaborate codes of criminal and civil law, excerpting the best features of European jurisprudence, and adapting them to the conditions and usages of Japan. They also remodelled their law courts, and took steps, slower but not less earnest, to educate a judiciary competent to administer the new codes. After twelve years devoted with partial success to these great works, Japan in 1883 renewed her request for the abolition of consular jurisdiction. She asked that all foreigners within her borders, without distinction of nationality, should be subject to her laws and judiciable by her law courts, as foreigners found within the borders of every sovereign state in the Occident were subject to its laws and judiciable by its tribunals of justice, and she supplemented her application by promising that its favourable reception should be followed by complete opening of the country and the removal of all restrictions hitherto imposed on foreign trade, travel, and residence in her realm. From the first it had been the habit of Occidental peoples to upbraid Japan on account of the barriers opposed by her to full and free foreign intercourse, and she was now able to claim that the barriers were no longer created by her intention or maintained by her desire, but that they existed because of a system which theoretically proclaimed her unfitness for free association with Western nations, and practically made it impossible for her to throw open her territories completely for the ingress of strangers.

Negotiations for treaty revision.

A portly volume might be filled with the details of the negotiations that followed Japan's proposal. Never before had an Oriental state sought such recognition, and there was extreme reluctance on the part of Western Powers to try the unprecedented experiment of entrusting the lives and property of their subjects and citizens to the keeping of a "pagan" people. Even the outlines of the story cannot be sketched here, though it abounds with diplomatic curiosities, and though several of its incidents do as much credit to Japan's patience and tact as its issue does to the justice and liberality of Occidental Governments. There is, however, one page of the history that calls for brief notice, since it supplies a key to much which would otherwise be inexplicable. The respect entertained by a nation for its own laws and the confidence it reposes in their administrators are in direct proportion to the efforts it has expended upon the development of the former and the education of the latter. Foreigners residing in Japan

[1] The tariff was fixed originally on a basis of 10 per cent. duty on imports, but in 1865 Japan consented, under heavy pressure and even armed menace, to reduce the rate to 5 per cent. This, too, was only nominal, for the conversion of *ad valorem* duties into specific was managed in such a manner that the sum actually levied on imports did not average as much as $2\frac{1}{4}$ per cent. of their value at the port of shipment.

naturally clung to consular jurisdiction as a privilege of inestimable value. They saw, indeed, that such a system could not be permanently imposed on a country where the conditions justifying it had nominally disappeared. But they saw, also, that the legal and judicial reforms effected by Japan had been crowded into an extraordinarily brief period, and that, as tyros experimenting with alien systems, the Japanese might be betrayed into many errors. A struggle thus ensued between foreign distrust on the one side and Japanese aspirations on the other—a struggle often developing painful phases. For whereas the case for the foreign resident stood solid and rational so long as it rested on the basis of his proper attachment to the laws and the judiciary which the efforts of his countrymen through long generations had rendered worthy of trust and reverence, and on the equally intelligible and reasonable ground that he wanted convincing proofs of Japan's competence to discharge her novel functions with discretion and impartiality before submitting himself to her jurisdiction, it ceased to be a solid and rational case when its champions undertook, not merely to exaggerate the risks of trusting Japan implicitly, but also to demonstrate her radical unworthiness of any trust whatever, and to depict her under aspects so deterrent that submission to her jurisdiction assumed the character of a catastrophe. The struggle lasted eleven years, but its gist is contained in this brief statement. The foreign resident, whose affection for his own systems was measured by the struggle their evolution had cost, and whose practical instincts forbade him to take anything on trust where security of person and property was concerned, would have stood out a wholesomely conservative and justly cautious figure had not his attitude been disfigured by local journalists who, in order to justify his conservatism, allowed themselves to be betrayed into the constant *rôle* of blackening the character of Japan, and suggesting harshly prejudiced interpretations of her acts and motives. It is one thing to hesitate before entering a new house until its fitness for occupation has been ascertained: it is another thing to condemn it without trial as radically and necessarily deficient in this respect. The latter was in effect the line often taken by the noisiest opponents of Japan's claims, and, of course, no little resentment and indignation were aroused on the side of the Japanese, who, chafing against the obvious antipathies of their foreign critics, and growing constantly more impatient of the humiliation to which Japan was internationally condemned, were sometimes prompted to displays of resentment which became new weapons in the hands of their critics. Throughout this struggle the Government and citizens of the United States always showed conspicuous sympathy with Japanese aspirations, and it should also be recorded that, with exceptions so rare as to establish the rule, foreign tourists and publicists discussed the problem liberally and fairly, perhaps because, unlike the foreign communities resident in Japan, they had no direct interest in its solution.

At last,[1] after long years of diplomatic negotiation and public discussion, European Governments conceded the justice of Japan's demands, and it was agreed that from July 1899, subject to the previous fulfilment of certain conditions,[2] Japanese tribunals should assume jurisdiction over every person, of whatever nationality, within the confines of Japan, and the whole country should be thrown open to foreigners, the "settlements" being abolished, and all limitations upon trade, travel, and residence removed throughout the length and breadth of the realm. Great Britain took the lead in thus releasing Japan from the fetters of the old system. The initiative came from her with special grace, for the system and all its irksome consequences had been imposed on Japan originally by a combination of Powers with Great Britain in the van. As a matter of historical sequence the United States dictated the terms of the first treaty providing for consular jurisdiction. But from a very early period the Washington Government showed its willingness to remove all limitations of Japan's sovereignty, whereas Europe, headed by Great Britain, whose preponderating interests entitled her to lead, resolutely refused to make any substantial concession. In Japanese eyes, therefore, British conservatism seemed to be the one serious obstacle, and since the British residents in the settlements far outnumbered all other nationalities, and since they alone had newspaper organs to ventilate their grievances, and exhibited all a Briton's proverbial indifference to the suavities and courtesies of speech and method that count for so much in disarming resentment, it was certainly fortunate for the popularity of her people in the Far East that Great Britain saw her way finally to set a liberal example. Nearly five years were required to bring the other Occidental Powers into line with Great Britain and America. It should be stated, however, that neither reluctance to make the necessary concessions nor want of sympathy with Japan caused the delay. The explanation is that each set of negotiators sought to improve either the terms or the terminology of the treaties already concluded, and that the tariff arrangements for the different countries required elaborate discussion.

Recognition by the Powers.

Until the last of the revised treaties was ratified, voices of protest against revision continued to be vehemently raised by a large section of the foreign community in the settlements. Some were honestly apprehensive as to the issue of the experiment. Others were swayed by racial prejudice pure and simple. A few had fallen into an incurable habit of grumbling, or found their account in professing to champion foreign interests; and all were naturally reluctant to forfeit the immunity from taxation hitherto enjoyed. It seemed as though the inauguration of the new system would find the foreign community in a mood which must greatly diminish the chances of a happy result, for where a captious and aggrieved disposition exists, opportunities to discover causes of complaint cannot be wanting. But at the eleventh hour this unfavourable demeanour underwent a marked change. So soon as it became evident that the old system was hopelessly doomed, the sound common-sense of the European and American business man asserted itself. The foreign residents let it be

[1] It would be incorrect to suppose that the responsibility for the delay can be thrown entirely on the foreign side. More than once an agreement had reached the verge of conclusion, when Japanese public opinion, partly incited by political intrigues, rebelled vehemently against the guarantees demanded of Japan, and the negotiations were interrupted in consequence, not to be again resumed until a considerable interval had elapsed. This point will easily be understood when we say that whereas, at the outset of the discussion, Japanese officialdom had the matter entirely in its own hands, and might have settled it on any basis, however liberal to foreigners, without provoking, for the moment at all events, seriously hostile criticism on the part of the nation, there gradually grew up among the people, *pari passu* with journalistic development, with the study of international law, and with the organization of political parties, a strong sense of what an independent state has a right to expect, and thus the longer the negotiations were protracted the keener became the popular scrutiny to which they were subjected, and the greater the general reluctance to endorse any irksome concessions. Had foreign diplomacy recognized the growth of that sentiment, and been content to take moderate advantage of the Japanese negotiator's mood, the issue might have been comparatively satisfactory to foreigners. But by asking too much and haggling too long, Western statesmen lost their opportunity of obtaining any substantial guarantees, and had ultimately to hand over their compatriots to Japanese jurisdiction on pure trust.

[2] The main, indeed the only notable condition was that the whole of the new Japanese codes of law must have been in operation for a period of at least one year before the abolition of consular jurisdiction.

seen that they intended to bow cheerfully to the inevitable, and that no obstacles would be willingly placed by them in the path of Japanese jurisdiction. The Japanese, on their side, took some striking steps. An Imperial rescript declared in unequivocal terms that it was the Sovereign's policy and desire to abolish all distinctions between natives and foreigners, and that by fully carrying out the friendly purpose of the treaties his people would best consult his wishes, maintain the character of the nation, and promote its prestige. The Premier and other Ministers of State issued instructions to the effect that the responsibility now devolved on the Government, and the duty on the people, of enabling foreigners to reside confidently and contentedly in every part of the country. Even the chief Buddhist prelates addressed to the priests and parishioners in their dioceses injunctions pointing out that, freedom of conscience being now guaranteed by the Constitution, men professing alien creeds must be treated as courteously as the followers of Buddhism, and must enjoy the same rights and privileges.

Thus the great change was effected in circumstances of happy augury. Its results were successful on the whole. Difficulties, it is true, were not altogether absent. The Japanese made some mistakes, and the novelty of the experiment predisposes the conservative foreigner to be hypercritical of its working. Never before since the crown of civilization was placed upon the head of the Occident had Western Christians passed under the jurisdiction of Oriental "pagans." This unprecedented act of trust on the part of Occidental Governments did not signify a corresponding access of confidence on the part of Occidental subjects and citizens. The average European or American approaches the contemplation of all the acts of the Japanese people in a spirit of condemnation or condescension, and considers that he practises praiseworthy self-denial when he pays to Japanese laws or their guardians even a moiety of the deference that he would intuitively render in similar circumstances in a Western country. Administration can never achieve more than a success of sufferance when the ruled stand upon a plane higher than that conceded to the rulers. But it has been shown, at all events, that the measure of tolerance which foreigners are prepared to display is sufficient for the working of the novel system, and that all the sinister predictions once so freely uttered about the vindictive advantage which the Japanese would certainly take of their newly-acquired power were baseless. Foreigners residing in Japan now enjoy immunity of domicile, personal and religious liberty, freedom from official interference, and security of life and property as fully as though they were living in their own country.

Freedom of the Press.

No sooner did the Diet commence its sittings in 1891 than a Bill was introduced for removing all restrictions upon freedom of speech. Already (1887) the Government had voluntarily made a great step in advance by divesting itself of the right to imprison or fine editors by executive order. But it reserved the power of suppressing or suspending a newspaper, and against that reservation a majority of the Lower House voted, session after session, only to see the Bill rejected by the peers, who shared the Government's opinion that to grant a larger measure of liberty would certainly encourage license. Not until 1897 was this opposition overcome. A new law, passed by both Houses and confirmed by the Emperor, took from the executive all power over journals, except in cases of lese-majesty, and nothing now remains of the former arbitrary system. The result has falsified all sinister forebodings. A much more moderate tone pervades the writings of the Press since restrictions were entirely removed, and although there are now 829 journals and periodicals published throughout the empire, with a total annual circulation of 463 million copies, intemperance such as in former times would have provoked official interference is practically unknown to-day.

The quality of journalistic writing in Japan is marred by extreme and pedantic classicism. There has not yet been any real escape from the trammels of a tradition which assigned the crown of scholarship to whatever author drew most largely upon the resources of the Chinese language. A pernicious example in this respect is set by the Imperial court. The Sovereign, whether he speaks by rescript or by edict, never addresses the bulk of his subjects. His words are taken from sources so classical as to be intelligible only to the highly-educated minority. Several of the newspapers affect a similar style. They sacrifice their audience to their erudition, and prefer classicism to circulation. Their columns are a sealed book to the whole of the lower middle classes and to the entire female population. Others, taking a more rational view of the purposes of journalism, aim with success at simplicity and intelligibility, and thus not only reach an extended circle of readers, but also are hastening incidentally the advent of a great reform, the assimilation of the written and spoken languages, which will probably prelude that still greater desideratum, abolition of the ideographic script. Apart from this pedantic defect, the best Japanese editors have caught with remarkable aptitude the spirit of modern journalism. But a few years ago they used to compile laborious essays, in which the construction was involved, the ideas were trivial, the inspiration was drawn from Occidental text-books, and the alien character of the source was hidden under a veneer of Chinese aphorisms. To-day they write terse, succinct, closely-reasoned articles, seldom diffuse, often witty, and generally free from extravagance of thought or diction. Yet, with few exceptions, the profession of journalism is not remunerative. Very low rates of subscription, and almost prohibitory high charges for advertising, are chiefly to blame.[1] The vicissitudes of the enterprise may be gathered from the facts that whereas 2767 journals and periodicals were started between 1889 and 1894 (inclusive), no less than 2465 ceased publishing. The largest circulation recorded in 1901 was about 30,000 copies daily.

Foreign wars.

Since the abolition of feudalism Japan has been engaged in three over-sea wars. The first, in 1874, was an expedition to Formosa. This has already been spoken of. It was insignificant from a military point of view, but it derived vicarious interest from its effect upon the relations between China and Japan, and upon the question of the ownership of the Riukiu Islands. These islands, which lie at a little distance south of Japan, had for centuries been regarded as an appanage of the Satsuma fief. The language and customs of their inhabitants showed unmistakable traces of relationship to the Japanese, and the possibility of the islands being included among the dominions of China had probably never occurred to any Japanese statesman. When, therefore, in 1873, the crew of a wrecked Riukiuan junk were barbarously treated by the inhabitants of northern Formosa, the Japanese Government unhesitatingly assumed the responsibility of seeking redress for this outrage. Formosa being a part of the Chinese empire, complaint was duly preferred in Peking. But the Chinese authorities showed such resolute indifference to Japan's representations that she finally took the law into her own hands, and sent a small force to

[1] The highest rate of subscription to a daily journal is twelve shillings per annum, and the usual charge for advertisements is from 7d. to one shilling per line of 22 ideographs (about nine words).

punish the Formosan murderers, who, of course, were found quite unable to offer any serious resistance. The Chinese Government, now recognizing the fact that its territories had been invaded, lodged a protest which threatened for a moment to involve the two empires in war, and might not have been amicably settled but for the intervention of the British minister in Peking. The final terms of arrangement were that, in consideration of Japan's withdrawing her troops from Formosa, China should indemnify her to the extent of half a million dollars (about £100,000) on account of the expenses of the expedition.

The Riukiu question.

Had Japan needed any confirmation of her belief that the Riukiu Islands belonged to her, this incident would have furnished it. Thus, in 1876, she did not hesitate to extend her newly organized system of prefectural government to Riukiu, which thenceforth became "Okinawa Prefecture," the former ruler of the islands being pensioned, according to the system followed in the case of the feudal chiefs in Japan proper. China entered an objection immediately. She claimed that Riukiu had always been a tributary of the Middle Kingdom, and she was doubtless perfectly sincere in the contention. But China's interpretation of tribute did not seem reducible to a working theory. So long as her own advantage could be promoted, she regarded as a token of vassalage the presents periodically carried to her court from neighbouring states. But so soon as there arose any question of discharging a suzerain's duties, she classed those offerings as insignificant interchanges of neighbourly courtesy. It was true that Riukiu had followed the custom of despatching gift-bearing envoys to China from time to time, just as Japan herself had done, though with less regularity. But it was also true that Riukiu had been subdued by Satsuma without China's stretching out a hand to help her; that for two centuries the islands had been included in the Satsuma fief, and that China had recently made a practical acknowledgment of Japan's superior title to protect the islanders. Each empire asserted its claims positively; but whereas Japan put hers into practice, China confined herself to remonstrances. Things remained in that state until 1880, when General Grant, visiting the East, suggested the advisability of a compromise. A conference met in Peking, and the plenipotentiaries agreed that the islands should be divided, Japan taking the northern group, China the southern. But on the eve of signature the Chinese plenipotentiary drew back, pleading that he had no authority to conclude an agreement without previously referring it to certain other dignitaries. Japan, sensible that she had been flouted, withdrew from the discussion and retained the islands, China's share in them being reduced to a grievance.

The Korean question.

From time immemorial China's policy towards the petty states on her frontiers had been to utilize them as buffers for softening the shock of foreign contact, while contriving, at the same time, that her relations with them should involve no inconvenient responsibilities to herself. The aggressive impulses of the outside world were to be checked by an unproclaimed understanding that the territories of these states partook of the inviolability of the Middle Kingdom itself, while the states, on their side, must never expect their suzerain to bear the consequences of their acts. This arrangement, depending largely on sentiment and prestige, retained its validity in the atmosphere of Oriental seclusion, but quickly failed to endure the test of modern Occidental practicality. Tongking, Annam, Siam, and Burma were withdrawn, one by one, from the circle of buffers and from the fiction of dependence on China and independence towards all other countries. But with regard to Korea, China proved more tenacious. The possession of the peninsula by a foreign Power would have threatened the maritime route to the Chinese capital and given easy access to Manchuria, the cradle of the dynasty which ruled China. Therefore Peking statesmen endeavoured to preserve the old-time relations with the little kingdom. But they never could persuade themselves to modify the indirect methods sanctioned by tradition. Instead of boldly declaring the peninsula a dependency of the Middle Kingdom, they sought to keep up the romance of ultimate dependency and intermediate sovereignty. Thus, in 1876, Korea was suffered to conclude with Japan a treaty of which the first article declared her "an independent state enjoying the same rights as Japan," and subsequently to make with the United States (1882), Great Britain (1883), and other Powers, treaties in which her independence was constructively admitted. China, however, did not intend that Korea should exercise the independence thus conventionally recognized. A Chinese Resident was placed in Seoul, and a system of steady though covert interference in Korea's domestic and foreign affairs was inaugurated. The chief sufferer from these anomalous conditions was Japan. In all her dealings with Korea, in all complications that arose out of her comparatively large trade with the peninsula, in all questions connected with her numerous settlers there, she found herself negotiating with a dependency of China, and with officials who took their orders from the Chinese representative. China had long entertained a rooted apprehension of Japanese aggression in the peninsula—an apprehension not unwarranted by history—and that distrust tinged all the influence exerted by her agents there. Much space would be required to recapitulate the occasions upon which Japan was made sensible of the discrimination thus exercised against her. Little by little the consciousness roused her indignation, and although no single instance constituted a ground for strong international protest, the Japanese people gradually acquired a consciousness of being perpetually baffled, thwarted, and humiliated by China's interference in the peninsular kingdom's affairs. To appreciate the bitterness of such conditions, it has to be remembered that for the previous thirty years China had treated Japan as a contemptible deserter from the Oriental standard, and had regarded her progressive efforts with openly disdainful aversion; while Japan, on her side, had chafed more and more to furnish some striking evidence of the wisdom of her preference for Western civilization. In the breast of each nation there had been smouldering a sentiment of umbrage which could scarcely fail to be translated into hostile action sooner or later, unless either Japan reverted to conservatism or China became progressive. Even more serious were the consequences of Chinese interference when considered from the point of view of Korean administration. The rulers of the country lost all sense of national responsibility, and gave unrestrained sway to selfish ambition. The functions of the judiciary and of the executive alike came to be discharged by bribery only. Family interests predominated over those of the State. Taxes were imposed in proportion to the greed of local officials. No thought whatever was taken for the welfare of the people or for the development of the country's resources. Among the upper classes faction struggles, among the lower, insurrections, began to be more and more frequent. Personal responsibility was unknown among officials, family influence overshadowing everything. To be a member of the Bin family, to which the queen belonged, was to possess a passport to office and an indemnity against the consequences of abuse of power, however flagrant. From time to time the advocates of progress or the victims of oppression rose in arms. They effected nothing except to recall to the world's

recollection the miserable condition into which the peninsula had fallen. Chinese military aid was always furnished readily for the suppression of these *émeutes*, and thus the Bin family learned to base its tenure of power on ability to conciliate the Middle Kingdom, and on readiness to obey Chinese dictation, while the people at large fell into the apathetic condition of men that possess neither the blessing of security of property nor the incentive of national ambition.

As a matter of State policy the Korean problem caused much anxiety to Japan. Her own security being deeply concerned in preserving Korea from the grasp of a Western Power, she could not suffer the little kingdom to drift into a condition of such administrative incompetence and national debility that a strong aggressor might find at any moment a pretext for interference. On two occasions, namely, in 1882 and 1884, when China's armed intervention was employed in the interests of the Bin to suppress movements of reform, the partisans of the victors, regarding Japan as the fountain of progressive tendencies, attacked and destroyed her legation in Seoul and compelled its inmates to fly from the city. Japan behaved with forbearance at these crises, but in the consequent negotiations she acquired conventional titles that touched the core of China's alleged suzerainty. For in 1882 her right to maintain troops in Seoul for the protection of her legation was admitted, and in 1885 she concluded with China a convention by which each Power pledged itself not to send troops to the peninsula without notifying the other, the two empires being thus placed on an equal military footing with regard to the peninsular kingdom.

The rupture with China.

In the spring of 1894 a serious insurrection broke out in Korea, and the insurgents proving themselves superior to the ill-disciplined, ill-equipped troops of the Government, the Bin family had recourse to its familiar expedient, appeal to China's aid. The appeal elicited a prompt response. On the 6th of July 2500 Chinese troops embarked at Tientsin and were transported to the peninsula, where they went into camp at Ya-shan, on the south-west coast, notice of the measure being given by the Chinese Government to the Japanese representative at Peking, according to treaty. During the interval immediately preceding these events, Japan had been rendered acutely sensible of China's arbitrary and unfriendly interference in the peninsula. Twice the efforts of the Japanese Government to obtain redress for unlawful and ruinous trade prohibitions issued by the Korean authorities had been thwarted by the action of the Chinese representative in Seoul; and once an ultimatum addressed from Tôkyô to the Korean Government, as the sequel of long and vexatious delay, had elicited from the Viceroy Li in Tientsin an insolent threat of Chinese armed opposition. Still more strikingly provocative of national indignation was China's procedure with regard to the murder of Kim Ok-kyün, the leader of progress in Korea, who had been for some years a refugee in Japan. Inveigled from Japan to China by fellow-countrymen sent from Seoul to assassinate him, Kim was shot in a Japanese hotel in Shanghai; and China, instead of punishing the murderer, conveyed him, together with the corpse of his victim, in a warship of her own to Korea, the assassin to be publicly honoured, the body to be savagely mutilated. When, therefore, the insurrection of 1894 in Korea induced the Bin family again to solicit China's armed intervention, the Tôkyô Government concluded that, in the interests of Japan's security and of civilization in the Orient, steps must be taken to put an end finally to the barbarous corruption and misrule which rendered Korea a scene of constant disturbance, offered incessant invitations to foreign aggression, and checked the country's capacity to maintain its own independence. Japan did not claim for herself any rights or interests in the peninsula superior to those possessed there by China. She was always ready to work hand in hand with the Middle Kingdom in inaugurating and carrying out a system of reform. But there was not the remotest probability that China, whose face had been contemptuously set against all the progressive measures adopted by Japan during the preceding twenty-five years, would join in forcing upon a neighbouring kingdom the very reforms she herself despised and abhorred, were her co-operation invited through ordinary diplomatic channels only. It was necessary to contrive a situation which would not only furnish clear proof of Japan's resolution, but also enable her to pursue her programme independently of Chinese endorsement, should the latter be finally unobtainable. She therefore met China's notice of a despatch of troops with a corresponding notice of her own, and the month of July 1894 found a Chinese force assembled at Ya-shan and a Japanese force occupying positions in the neighbourhood of Seoul. China's motive for sending troops was nominally to quell the Tonghak insurrection, but really to reaffirm her own domination in the peninsula, and to reseat in the administrative saddle men under whose guidance the country was losing all capacity for independence. Japan's motive was to secure a position such as would enable her to insist upon the radically curative treatment of Korea's malady. Up to this point the two empires were strictly within their conventional rights. Each was entitled by treaty to send troops to the peninsula, provided that notice was given to the other. But China, in giving notice, described Korea as her "tributary state," thus thrusting into the forefront of the discussion a contention which Japan, from conciliatory motives, would have kept out of sight. Once formally advanced, however, the claim had to be challenged. In the treaty of amity and commerce concluded many years previously between Japan and Korea, the two high contracting parties were explicitly declared to possess the same national status. Japan could not agree that a Power which for two decades she had acknowledged and treated as her equal should be openly classed as a tributary of the Middle Kingdom. She protested, but the Chinese statesmen took no notice of her protest. They continued to apply the disputed appellation to Korea, and they further asserted their assumption of sovereignty in the peninsula by seeking to set limits to the number of troops sent by Japan, as well as to the sphere of their employment. Japan then proposed that the two empires should unite their efforts for the suppression of the disturbances in Korea, and for the subsequent improvement of that kingdom's administration, the latter purpose to be pursued by the despatch of a joint commission of investigation. That was an important stage in the dispute. It rested then with China to avert all danger of war by joining hands with Japan for the regeneration of a nation in whose prosperity and independence the two empires were equally interested. But she refused everything. Ready at all times to interfere by force of arms between the Korean people and the dominant political faction, she declined to interfere in any way for the promotion of reform. Ready at all times to crush the little kingdom into submission to a corrupt and demoralizing administration, she refused to aid in rescuing it from the suffering and enervation entailed by the sway of such an oligarchy. She even expressed superciliously an insolent surprise that Japan, while asserting Korea's independence, should suggest the idea of peremptorily reforming its administration. In short, for Chinese purposes the Peking statesmen openly declared Korea a tributary of the Middle Kingdom, and denied Japan's assertion of its independence; but for Japanese purposes

they insisted that it must be held independent, and that Japan must abide strictly by her assertion of its independence. The Tôkyô cabinet now declared their resolve not to withdraw the Japanese troops without "some understanding that would guarantee the future peace, order, and good government of Korea," and since China still declined to come to such an understanding, Japan undertook the work of reform single-handed.

The Chinese representative in Seoul threw the whole weight of his influence into the scale against the success of these reforms. Still, nothing immediately occurred to drive the two empires into open warfare. The determining cause of rupture was in itself a belligerent operation. China's troops, as already stated, had been sent originally for the purpose of quelling the Tonghak rebellion. But the rebellion having died of inanition before the landing of the troops, their services were not required or employed. Nevertheless they were not withdrawn. China kept them in the peninsula, her declared reason for doing so being the presence of a Japanese military force. Thus, throughout the subsequent negotiations the Chinese forces lay in an entrenched camp at Ya-shan, while the Japanese occupied Seoul. The trend of events did not import any character of direct mutual hostility to these little armies. But when it became evident that all hope of friendly co-operation between the two empires must be abandoned, and when Japan, single-handed, had embarked upon her scheme of regenerating Korea, not only did the continued presence of a Chinese military force in the peninsula assume special significance, but any attempt on China's part to send reinforcements could be construed in one sense only, namely, as an unequivocal declaration of resolve to oppose Japan's proceedings by force of arms. Seeing, then, that China was preparing to send reinforcements, Japan warned the Peking Government of the construction she must place upon any act of the kind. Nevertheless China not only despatched troops by sea to strengthen the camp at Ya-shan, but also sent an army overland across Korea's northern frontier. It was at this stage that an act of war occurred. Three Chinese men-of-war, convoying a transport with 1200 men, encountered and fired on three Japanese cruisers. One of the Chinese ships was taken; another was so shattered that she had to be beached and abandoned; the third escaped in a dilapidated condition, and the transport, refusing to surrender, was sunk. This happened on 25th July, and an open declaration of war was made by each empire six days later.

The narrative set down above represents the last chapter only of a history having its beginnings a quarter of a century earlier. From the moment that Japan applied herself to break away from Oriental traditions, and to tear from her limbs the fetters of Eastern conservatism, it was inevitable that a widening gulf should gradually grow between herself and China, the inveterate representative of those traditions and that conservatism. Thus the struggle that occurred in 1894 was rather a contest between Japanese progress and Chinese stagnation than a fight to determine China's suzerainty or Korea's independence. To secure Korean immunity from foreign—especially Russian—aggression was of capital importance to both empires. Japan believed that such security could be attained by introducing into the peninsula the civilization which had contributed so signally to the development of her own strength and resources. China thought that she could guarantee it without any departure from old-fashioned methods, and by the same process of capricious protection which had failed so signally in the cases of Annam, Tongking, Burma, and Siam. The issue really at stake was whether Japan should be suffered to act as the Eastern propagandist of Western progress, or whether her efforts in that cause should be held in check by Chinese conservatism.

Events of the war.

The war itself was a succession of triumphs for Japan. Four days after the first naval encounter she sent from Seoul a column of troops who attacked the Chinese entrenched at Ya-shan and routed them without difficulty. Many of the fugitives effected their escape to Phyong-yang, a town on the Tai-dong river, offering excellent facilities for defence, and historically interesting as the place where a Japanese army of invasion had been defeated by Chinese and Korean troops at the close of the 16th century. There the Chinese assembled a force of 17,000 men, and made full preparations for a decisive contest. They had ample leisure. A period of forty days elapsed before the Japanese columns, one moving due north from Seoul, the other striking west from Yuen-san, converged upon Phyong-yang, and that interval was utilized by the Chinese to throw up parapets, mount Krupp guns, and otherwise strengthen their position. Moreover, they were armed with repeating rifles, whereas the Japanese had only single-shooters, and the ground offered little cover for an attacking force. In such circumstances, the advantages possessed by the defence ought to have been well-nigh insuperable; yet a day's fighting sufficed to carry all the positions, the assailants' casualties amounting to less than 700, and the defenders losing 6000 in killed and wounded. It was a brilliant victory, and it proved to be the prelude of another equally conspicuous success at sea. For on the 17th September, the very day after the battle at Phyong-yang, a great naval fight took place near the mouth of the Yalu river, which forms the northern boundary of Korea. Fourteen Chinese warships and six torpedo-boats were returning to home ports after convoying a fleet of transports to the Yalu, when they encountered eleven Japanese men-of-war cruising in the Yellow Sea. Hitherto the Chinese had sedulously avoided a contest at sea. Their fleet was the stronger, since it included two armoured line-of-battle ships of over 7000 tons displacement, whereas the biggest vessels on the Japanese side were belted cruisers of only 4000 tons. In the hands of an admiral appreciating the value of sea power, China's naval force would certainly have been led against Japan's maritime communications, for a successful blow struck there must have put an end to the Korean campaign. History had already demonstrated that fact, for on two occasions in former ages attempts made by Japan to conquer the peninsula were rendered abortive by the superior maritime strength of the Koreans and Chinese. On land her soldiers proved invincible, but her sea-route being severed, she had to abandon the enterprise. The Chinese, however, failed to read history. They employed their war-vessels as convoys only, and when not using them for that purpose, hid them in port. Everything goes to show that they would have avoided the battle off the Yalu had choice been possible, though when forced to fight they fought bravely. Four of their ships were sunk, and the remainder escaped to Wei-hai-wei, the vigour of the Japanese pursuit being greatly impaired by the presence of torpedo-boats in the retreating squadron.

The Yalu victory opened the over-sea route to China. Japan could now strike at Talienwan, Port Arthur, and Wei-hai-wei, naval stations on the Liaotung and Shantung peninsulas, where the powerful permanent fortifications, built after plans prepared by European experts and armed with the best modern weapons, were regarded as almost impregnable. They fell before the assaults of the Japanese troops as easily as the comparatively

rude fortifications at Phyong-yang had fallen. The only resistance of a stubborn character was made by the Chinese fleet at Wei-hai-wei; but after the whole squadron of torpedo-craft had been destroyed or captured as they attempted to escape, and after three of the largest vessels had been sunk at their moorings by Japanese torpedoes, and one by shot and shell, the remaining four ships and five gunboats surrendered, and their brave commander, Admiral Ting, committed suicide. This ended the war. It had lasted seven and a half months, during which time Japan put into the field five columns, aggregating about 120,000 of all arms. One of these columns marched northwards from Seoul, won the battle of Phyong-yang, advanced to the Yalu, forced its way into Manchuria, and moved towards Mukden *viâ* Feng-hwan, fighting several minor engagements, and conducting the greater part of its operations amid deep snow in mid-winter. The second column diverged westwards from the Yalu, and, marching through southern Manchuria, reached Hai-cheng, whence it advanced to the capture of Newchwang and Ying-kow. The third landed on the Liaotung peninsula, and, turning southwards, carried Talienwan and Port Arthur by assault. The fourth moved up the Liaotung peninsula, and, having seized Kaiping, advanced against Ying-kow, where it joined hands with the second column. The fifth crossed from Port Arthur to Wei-hai-wei, and captured the latter. In all these operations the total Japanese casualties were 1005 killed and 4922 wounded —figures which sufficiently indicate the inefficiency of the Chinese fighting. The deaths from disease totalled 16,866, and the total monetary expenditure was £20,000,000 sterling.

The Chinese Government sent Li Hung-chang, Viceroy of Pechili and senior Grand Secretary of State, and Li Ching-fong, to discuss terms of peace with Japan, the latter being represented by Marquis Ito and Count Mutsu, Prime Minister and Minister for Foreign Affairs respectively. A treaty was signed at Shimonoseki on the 17th of April 1895, and subsequently ratified by the Sovereigns of the two empires. It declared the absolute independence of Korea; ceded to Japan the part of Manchuria lying south of a line drawn from the mouth of the river Anping to the mouth of the Liao, *viâ* Feng-hwan, Hai-cheng, and Ying-kow, as well as the islands of Formosa and the Pescadores; pledged China to pay an indemnity of 200,000,000 taels; provided for the occupation of Wei-hai-wei by Japan pending payment of the indemnity; secured some additional commercial privileges, as the opening of four new places to foreign trade, and the right of foreigners to engage in manufacturing enterprises in China, and provided for the conclusion of a treaty of commerce and amity between the two empires, based on the lines of China's treaties with Occidental Powers.

Foreign interference.

No sooner did this agreement receive ratification at the hands of the Sovereigns of Japan and China, than three of the great European Powers—Russia, Germany, and France—stepped forward, and presented a joint note to the Tôkyô Government, recommending that the territories ceded to Japan on the mainland of China should not be permanently occupied, as such a proceeding would be detrimental to the lasting peace of the Orient. The recommendation was couched in the usual terms of diplomatic courtesy, but everything indicated that its signatories were prepared to enforce their advice by an appeal to arms. Japan found herself compelled to comply. Exhausted by the Chinese campaign, which had drained her treasury, consumed her supplies of warlike material, and kept her squadrons constantly at sea for eight months, she had no residue of strength to oppose such a coalition. Her resolve was quickly taken. The day that saw the publication of the ratified treaty saw also the issue of an Imperial rescript in which the Mikado, avowing his unalterable devotion to the cause of peace, and recognizing that the counsel offered by the European States was prompted by the same sentiment, "yielded to the dictates of magnanimity, and accepted the advice of the three Powers." The Japanese were shocked by this incident. They could understand the motives influencing Russia and France, for it was evidently natural that the former should desire to exclude warlike and progressive people like the Japanese from territories contiguous to her borders, and it was also natural that France in the East should remain true to her alliance with Russia in the West. But Germany, wholly uninterested in the ownership of Manchuria, and by profession a warm friend of Japan, seemed to have joined in robbing the latter of the fruits of her victory simply for the sake of establishing some shadowy title to Russia's good-will. It was not known until a later period that the emperor of Germany entertained profound apprehensions about an irruption of Oriental hordes into the Occident, and held it a sacred duty to prevent Japan from gaining a position which might enable her to construct an immense military machine out of the countless millions of the Chinese nation. When his Majesty's mood came to be understood, much of the resentment provoked by his seemingly reckless unfriendliness in the Manchurian affair was softened by the mirth which his chimera excited.

Chinese crisis of 1900.

Japan's third expedition over-sea in the *Meiji* era had its origin in causes which belong to the history of China (*q.v.*). It will suffice to say here that in the second half of 1900 an anti-foreign and anti-dynastic rebellion, breaking out in Shantung, spread to the neighbouring metropolitan province of Pechili, and resulted in a situation of extreme peril for the foreign communities of Tientsin and Peking. It was impossible for any European Power, or for the United States of America, to organize sufficiently prompt measures of relief. Thus the eyes of the world turned to Japan, whose proximity to the scene of disturbance rendered intervention comparatively easy for her. But Japan hesitated. Knowing now with what suspicion and distrust the development of her resources and the growth of her military strength were regarded by some European peoples, and aware that she had been admitted to the comity of Western nations on sufferance, she shrank, on the one hand, from seeming to grasp at an opportunity for armed display, and on the other, from the solecism of obtrusiveness in the society of strangers. Not until Europe and America made it quite plain that they needed and desired her aid did she send a division (21,000 men) to Pechili. Her troops acted a fine part in the subsequent expedition for the relief of Peking, which had to be approached in mid-summer under very trying conditions. Fighting side by side with European and American soldiers, and under the eyes of competent military critics, the Japanese acquitted themselves in such a manner as to establish a high military reputation. Further, after the relief of Peking they withdrew a moiety of their forces, and that step, as well as their unequivocal co-operation with Western Powers in the subsequent negotiations, helped to show the injustice of the suspicions with which they had been regarded.

The final stage in the recognition of Japan as one of the Great Powers was accomplished in February 1902, when an offensive and defensive treaty of alliance was signed between her and Great Britain, on terms which were published to the world at large. From that moment the British and Japanese Powers were united to maintain the *status quo* in the Far East. (F. BY.)

III. The Japanese Army.

Originally the Japanese nation consisted entirely of soldiers. The Sovereign was the commander-in-chief; the *O-omi* and *Omuraji* were his lieutenants. The duty of serving in the ranks devolved on all subjects alike, the great nobles forming a patriarchal council of generals. But at the close of the 7th century of the Christian era, when the Empress Jito sat upon the throne, the social system of the Tang dynasty of China commended itself for adoption. The civil and military were then divided for the first time. Certain officers received commissions appointing them to special posts—as the generals of the left and of the right, the brigadiers of the left and of the right, the captains of the left and of the right, and so on; a war office (*hyobu-sho*) was organized, as were also cavalry departments of the left and of the right, and each important district throughout the empire had its military division (*gundan*). All having been originally soldiers, no hereditary claim to carry arms could be set up. Physical qualifications alone received consideration. One-third of the nation's able-bodied males constituted the army, and these being divided into three equal parts, one part served in the capital as palace guards, one had its headquarters in Kiushiu, forming a legion for the protection of the southern coasts against Korean raiders or for service abroad, and the third part garrisoned the provincial posts. As to tactical formation, 5 men made a section, 2 sections a company, 5 companies a battalion, 2 battalions a regiment, and 10 regiments a division. Six horses were assigned to a company, the best riders and archers being selected for cavalry duty. A division consequently consisted of 600 mounted men and 400 foot soldiers. Service was for a period only, and during that period taxes were remitted, so that military duties always found men ready to discharge them. Thus the hereditary soldier—afterwards known as the *samurai* or *bushi*—did not yet exist, nor was there any such thing as an exclusive right to carry arms. Weapons of war were the property of the State, stored away in times of peace, and served out periodically when required for fighting or for training purposes. The next stage of development had its origin in the assumption of high offices of State by great families, who encroached upon the Imperial prerogatives, and appropriated as hereditary perquisites posts which should have remained in the gift of the Sovereign. The Fujiwara clan, taking all the civil offices, resided in the capital, whereas the military posts fell to the lot of the Taira and the Minamoto, who, settling in the provinces, and being thus required to guard the outlying districts and to quell rebellions, found it expedient to surround themselves with men who made soldiering a profession. These latter, in their turn, copying the customs of their superiors, transmitted their functions to their sons, so that there grew up in the shadow of the great houses a number of military families devoted to maintaining the power and promoting the interests of their masters, from whom they derived their own privileges and emoluments. At the close of the 8th century stubborn insurrections on the part of the autochthons gave new importance to the soldier. The conscription list had to be greatly increased, and it came to be a recognized principle that every stalwart man should bear arms, every weakling become a bread-winner. Thus, for the first time, the distinction between "soldier" and "working man"[1] received official recognition, and in consequence of the circumstances attending the distinction a measure of contempt attached to the latter as compared with the former. History reveals that the continuous growth of the great provincial nobles tended to deepen this line of cleavage, so that, from the middle of the 10th century, the terms *samurai* and *bushi* acquired a special significance, being applied to themselves and their followers by the local magnates, whose power tended more and more to eclipse even that of the Throne. Finally, in the 12th century, when the Minamoto brought the whole country under the sway of military organization, the privilege of bearing arms was restricted to the *samurai*. Thenceforth the military class entered upon a period of administrative and social superiority which lasted, without serious interruption, until the middle of the 19th century. But it is to be observed that the distinction between soldier and civilian, *samurai* and commoner, was not of ancient existence, nor did it arise from any question of race or caste, victor or vanquished, as is often supposed and stated. It was an outcome wholly of ambitious usurpations, which, relying for success on force of arms, gave practical importance to the soldier, and invested his profession with factitious honour.

History.

The *bow* was always the chief weapon of the fighting-man in Japan. "War" and "bow-and-arrow" were synonymous terms. History tells how Tametomo shot an arrow through the crest of his brother's helmet, in order to recall his allegiance, without injuring him; how Nasuno Minetaka discharged a shaft that severed the stem of a fan swayed by the wind; how Mutsuru, ordered by an emperor to rescue a fish from the talons of an osprey without killing bird or fish, cut the osprey's legs with an arrow so that the fish dropped into the palace lake and the bird continued its flight; and there are many similar records of Japanese skill with the weapon. Still more suggestive and better authenticated were the feats performed at the "thirty-three-span halls" in Kyôtô and Yedo, where the archer had to shoot an arrow through the whole length of a corridor 128 yards long and only 16 feet high. Wada Daihachi, in the 17th century, succeeded in sending 8133 arrows from end to end of the corridor in 24 consecutive hours, being an average of over 5 shafts per minute; and Matatoki, in 1852, made 5383 successful shots in 20 hours, or more than 4 a minute. The lengths of the bow and arrow were determined with reference to the capacity of the archer. In the case of the bow, the unit of measurement was the distance between the tips of the thumb and the little finger with the hand fully stretched. Fifteen of these units gave the length of the bow, or about 7½ feet. The unit for the arrow was from 12 to 15 hand-breadths, or from 3 feet to 3¾ feet. Originally the bow was of unvarnished boxwood or zelkowa; but subsequently bamboo alone came to be employed. Binding with cord or rattan served to strengthen the bow, and for precision of flight the arrow had three feathers, an eagle's wing being most esteemed for that purpose, and after it, in order, that of the copper pheasant, the crane, the adjutant, the snipe.

Weapons.

Next in importance to the bow came the *sword*, which is often spoken of as the *samurai's* chief weapon, though there can be no doubt that during long ages it ranked after the bow. It was a single-edged weapon remarkable for its three exactly similar curves—edge, face-line, and back; its almost imperceptibly convexed blade; its admirable tempering; its beautiful and consummately skilled forging; its razor-like sharpness, and its cunning distribution of weight, giving a maximum effect of stroke. The

[1] The term (*hyaku-sho*) here translated "working man" means literally "one engaged in any of the various callings" apart from military service. In a later age a further distinction was established between the agriculturist, the artisan, and the trader, and the word *hyaku-sho* then came to carry the signification of "husbandman" only, which sense it now possesses.

10th century saw this unequalled weapon carried to completion, and it has been inferred that only from that epoch did the *samurai* begin to esteem his sword the greatest treasure he possessed, and to rely on it as his best instrument of attack and defence. But it is evident that the evolution of such a blade must have been due to an urgent, long-existing demand, and that the *katana* came as the sequel of innumerable efforts on the part of the swordsmith and generous encouragement on that of the soldier. Many pages of Japanese annals and household traditions are associated with its use. In every age numbers of men devoted their whole lives to acquiring novel skill in swordsmanship. Many of them invented systems of their own, differing from one another in some subtle details unknown to any save the master himself and his favourite pupils. Not merely the method of handling the weapon had to be studied. Associated with sword-play was an art variously known as *shinobi*, *yawara*, and *jiujutsu*, names which imply the exertion of muscular force in such a manner as to produce a maximum of effect with a minimum of effort, by directing an adversary's strength so as to become auxiliary to one's own. It was an essential element of the expert's art not only that he should be competent to defend himself with any object that happened to be within reach, but also that without an orthodox weapon he should be capable of inflicting fatal injury on an assailant, or, at any rate, of disabling him. In the many records of great swordsmen instances are related of men seizing a piece of firewood, a brazier-iron, or a druggist's pestle as a weapon of offence, while, on the other side, an umbrella, an iron fan, or even a pot-lid served for protection. In short, the *samurai* had to be prepared for every emergency. Were he caught weaponless by a number of assailants, his art of *yawara* was supposed to supply him with expedients for emerging unscathed. Nothing counted save the issue. The methods of gaining victory or the circumstances attending defeat were scarcely taken into consideration. The true *samurai* had to rise superior to all contingencies. Out of this perpetual effort on the part of hundreds of experts to discover and perfect novel developments of swordsmanship, there grew a habit which held its vogue down to modern times, namely, that when a man had mastered one style of sword-play in the school of a teacher, he set himself to study all others, and for that purpose undertook a tour throughout the provinces, fencing whenever he found an expert, and, in the event of defeat, constituting himself the victor's pupil. It may indeed be said that the sword exercised a potent influence on the life of the Japanese nation. The distinction of wearing it, the rights that it conferred, the deeds wrought with it, the fame attaching to special skill in its use, the superstitions connected with it, the incredible value set upon a fine blade, the honours bestowed on an expert sword-smith, the traditions that had grown up around celebrated weapons, the profound study needed to be a competent judge of a sword's qualities—all these things conspired to give to the *katana* an importance beyond the limits of ordinary comprehension. A *samurai* carried at least two swords, a long and a short. Their scabbards of lacquered wood were thrust into his girdle, not slung from it, being fastened in their place by cords of plaited silk. Sometimes he increased the number of swords to three, four, or even five, before going into battle, and this array was supplemented by a dagger carried in the bosom. The short sword was not employed in the actual combat. Its use was to cut off an enemy's head after overthrowing him, and it also served a defeated soldier in his last resort—suicide. In general the long sword did not measure more than 3 feet, including the hilt; but some were 5 feet long, and some were 7. Considering that the scabbard, being fastened to the girdle, had no play, the feat of drawing one of these very long swords demanded extraordinary aptitude.[1]

Spear and *halberd* were among the weapons of the ancient Japanese as well as sword and bow. The oldest form of spear was derived from China. Its handle measured about 6 feet and its blade 8 inches, and it had sickle-shaped horns at the junction of blade and hilt. This weapon served almost exclusively for guarding palisades and gates. In the 14th century a true lance came into use. Its length varied greatly, and it had a hog-backed blade tempered almost as finely as the sword itself. This, too, was a Chinese type, as was also the halberd. The term "halberd" is a defective translation of the word *naginata* (long-sword), which was really a scimitar-like blade, some 3 feet in length, fixed on a slightly longer haft. Originally the warlike monks alone employed this weapon, but from the 12th century it found much favour among military men. Ultimately, however, its use may be said to have been limited to women and priests.

Armour.

Speaking broadly, Japanese *armour* may be described as plate armour, but the essential difference between it and the Norman type was that, whereas the latter took its shape from the costume of the period, the former bore no resemblance and never was designed to bear any resemblance to ordinary garments. Hence the only changes that occurred in Japanese armour from generation to generation had their origin in improved methods of construction. In general appearance it differed from the panoply of all other nations, so that, although to its essential parts we may apply with propriety the European terms—helmet, corselet, taches, épaulières, brassart, cuissart, and greaves—individually and in combination these parts were not at all like the originals of those names. Perhaps the easiest way of describing the difference is to say that whereas a Norman knight seemed to be clad in a suit of metal clothes, a Japanese *samurai* looked as if he wore protective curtains. The Japanese armour was, in fact, suspended from, rather than fitted to, the person. It had only one element counterparted in the European suit, namely, a tabard, which, in the case of men of rank, was made of the richest brocade. Iron and leather were the chief materials, and as the laminæ were strung together with a vast number of coloured cords—silk or leather—an appearance of considerable brilliancy was produced. Ornamentation did not stop there. Plating and inlaying with gold and silver were freely resorted to, and finely-wrought decoration in chiselled, inlaid, and *repoussé* work was profusely applied to the helmet and its appendages, to the corselet, the épaulières, and the brassarts. On the whole, however, despite the highly artistic character of its ornamentation, the loose, pendulous nature of Japanese armour detracted greatly from its workmanlike aspect, especially when the *horo* was added—a curious appendage in the shape of a curtain of fine transparent silk, which was either stretched in front between the horns of the helmet and the tip of the bow, or worn on the shoulders and back, the purpose in either case being to turn the point of an arrow. A true *samurai* observed the strict rules of etiquette with regard even to the garments worn under his armour, and it was part of his soldierly capacity to be able to bear the great weight of the whole without loss of activity, a feat impossible to any untrained man of modern days. Common soldiers, of course, who went on foot, wore much scantier protection; a comparatively light helmet and a corselet generally constituted their panoply.

[1] A Chinese historian, speaking of the Japanese invasion of Korea at the close of the 16th century, says of the *samurai* in action, that "he brandished a 5-foot blade with such rapidity that nothing could be seen except a white sheen of steel, the soldier himself being altogether invisible."

War-horses. The Japanese never had a war-horse worthy to be so called. The mis-shapen ponies which carried them to battle showed qualities of hardiness and endurance, but were so deficient in stature and massiveness that when mounted by a man in voluminous armour they looked painfully puny. Nothing is known of the early Japanese saddle, but at the beginning of historic times it approximated closely to the Chinese type. Subsequently a purely Japanese shape was designed. It consisted of a wooden frame so constructed that a padded numnah could be fastened to it. Galled backs or withers were unknown with such a saddle: it fitted any horse. The stirrup, originally a simple affair resembling that of China and Europe, afterwards took the form of a shoe-sole with upturned toe. Both stirrups and saddle-frame were often of beautiful workmanship, the former covered with rich gold lacquer, the latter inlaid with gold or silver. In the latter part of the military epoch chain armour was adopted for the horse, and its head was protected by a monster-faced mask of iron.

Early strategy and tactics. Flags were used in battle as well as on ceremonial occasions. Some were monochrome, as the red and white flags of the Taira and the Minamoto clans in their celebrated struggle during the 12th century; and some were streamers emblazoned with figures of the sun, the moon, a dragon, a tiger, and so forth, or with religious legends, as *Namu Amida Butsu* (the common invocation to Buddha), *Namu Horenkyo* (the formula of the Nichiren sect), or *Hachiman Daibosatsu* (the name of the god of battles). Fans with iron ribs were carried by commanding officers, and signals to advance or retreat were given by beating drums and metal gongs and blowing conches. During the military epoch it was considered proper that a campaign should be opened or a contest preluded by a human sacrifice to the god of war, the victim at this rite of blood (*chi-matsuri*) being generally a prisoner or a condemned criminal. Other preliminaries also had to be respected. Men went about the business of killing each other in an orderly and punctilious manner. Ambuscades and surprises played a large part in all strategy, but pitched battles were the general rule, and it was *de rigueur* that notice of an intention to attack should be given by discharging a "singing arrow." Thereafter the assaulting army, taking the word from its commander, raised a shout of "Ei! Ei!" to which the other side replied, and the formalities having been thus satisfied, the fight commenced. In early mediæval days tactics were of the crudest description. An army consisted of a congeries of little bands, each under the order of a chief who considered himself independent, and instead of subordinating his movements to a general plan, struck a blow wherever he pleased, thinking much more of his own reputation as a warrior than of the interests of the cause for which he fought. From time immemorial a romantic value has attached in Japan to the "first" of anything: the first snow of winter; the first water drawn from the well on New Year's Day; the first blossom of the spring; the first note of the nightingale. So in war the first to ride up to the foe or the wielder of the first spear was held in high honour, and the *samurai* strove for that distinction as his principal duty. It necessarily resulted, too, not only from the nature of the weapons employed, but also from the immense labour devoted by the true *samurai* to perfecting himself in their use, that displays of individual prowess were deemed the chief object in a battle. Some tactical formations borrowed from China were familiar in Japan, but their intelligent use and their modification to suit the circumstances of the time were inaugurated only by the great captains of the 15th and 16th centuries. Prior to that epoch a battle resembled a monster fencing match. Men fought as individuals, not as units of a tactical formation, and the engagement consisted of a number of personal duels, all in simultaneous progress. It was the *samurai's* habit to proclaim his name and titles in the presence of the enemy, sometimes adding from his own record or his father's any details that might tend to dispirit his hearers. Then some one advancing to cross weapons with him would perform the same ceremony of self-introduction, and if either found anything to upbraid in the other's antecedents or family history, he did not fail to make loud reference to it, such a device being counted efficacious as a means of disturbing an adversary's *sang-froid*. The duellists could reckon on finishing their fight undisturbed, but the victor frequently had to endure the combined assault of a number of the comrades or retainers of the vanquished. Of course a skilled swordsman did not necessarily seek a single combat; he was equally ready to ride into the thick of the fight without discrimination, and a group of common soldiers never hesitated to make a united attack upon a mounted officer if they found him disengaged. But the general feature of a battle was individual contests, and when the fighting had ceased, each *samurai* proceeded to the tent[1] of the commanding officer and submitted for inspection the heads of those whom he had killed.

Change of tactics. The disadvantage of such a mode of fighting was demonstrated for the first time when the Mongols invaded Japan in 1274. The invaders moved in phalanx, guarding themselves with pavises, and covering their advance with a host of archers shooting clouds of poisoned arrows.[2] When a Japanese *samurai* advanced singly and challenged one of them to combat, they opened their ranks, enclosed the challenger, and cut him to pieces. Many Japanese were thus slain, and it was not until they made a concerted movement of attack that they succeeded in driving back the enemy. Seven years later the Mongols, coming a second time, had a different reception. They were never suffered to land or to form their favourite phalanx. The Japanese, in small open boats, without any protection for the rowers, rushed again and again to the assault of the invaders' immense fleet, which consisted of comparatively large vessels, decked, protected by bulwarks of timber, matting, and shields, and equipped with artillery to which the Japanese could oppose only bow and arrow. When, however, the *samurai* succeeded in boarding a Chinese vessel, their swords did such terrible execution that the vessels of the huge flotilla, huddling together for mutual protection, abandoned their offensive *rôle*, and while vainly seeking a safe landing, were shattered by a tempest. But although the advantage of preventing an enemy from massing his strength was thus recognized, the Japanese themselves did not adopt the formation which the Mongols had shown to be so formidable. Individual prowess continued to be the prominent factor in battles down to a comparatively recent period. The great captains, Takeda Shingen and Uyesugi Kenshin, who flourished during the first half of the 16th century, are supposed to have been Japan's pioneer tacticians. They certainly appreciated the value of a formation in which the action of the individual should be subordinated to the unity of the whole. But when it is remembered that firearms had already been in the hands of the Japanese for several years, and that they had means of acquainting themselves with the tactics of Europe through their intercourse with the Dutch, it is remarkable that the changes attributed to Takeda and Uyesugi were not more drastic. Speaking broadly, what they did was to organize

[1] A tent was simply a space enclosed with strips of cloth or silk, on which was emblazoned the crest of the commander. It had no covering.

[2] The Japanese never at any time of their history used poisoned arrows; they despised them as depraved and inhuman weapons.

a column with the musqueteers and archers in front; the spearmen, halberdiers, and swordsmen in the second line; the cavalry in the third line; the commanding officer in the rear, and the drums and standards in the centre. At close quarters the spear proved a highly effective weapon, and in the days of Hideyoshi, the *Taikô*, combined flank and front attacks by bands of spearmen became a favourite device. The importance of a strong reserve also received recognition, and in theory, at all events, a tolerably intelligent system of tactics was adopted. Not until the close of the 17th century did the doctrine of strictly disciplined action obtain practical vogue. Yamaga Soko is said to have been the successful inculcator of this principle, and from his time the most approved tactical formation was known as the *Yamaga-ryu* (Yamaga style), though it showed no innovation other than strict subordination of each unit to the general plan.

Military principles.

Although, tactically speaking, the *samurai* was everything and the system nothing prior to the second half of the 17th century, and although strategy was chiefly a matter of deception, surprises, and ambushes, it must not be supposed that there were no "classical principles." The student of European military history searches in vain for the "rules and maxims of war" so often invoked by glib critics, but the student of Japanese history is more successful. Here, as in virtually every field of things Japanese, retrospect discovers the ubiquitous Chinaman. Sung and 'Ng—called in Japan "Son" and "Go"—Chinese generals of the third century after Christ, were the Jomini and the Hamley of their era, and their treatises continued to be the classics of Far Eastern captains through all generations. Yoshitsune, in the 12th century, deceived a loving girl to obtain a copy of Sung's work which her father had in his possession, and Yamaga, in the 17th century, when he set himself to compose a book on tactics, derived his materials almost entirely from the monographs of the two Chinese generals. There is proof that these treatises came into the hands of the Japanese in the 8th century, when the celebrated Kibi no Mabi went to study civilization in the Middle Kingdom, just as his successors of the 19th century went to study a new civilization in Europe and America. Thenceforth "Son" and "Go" became household words among Japanese soldiers. Their volumes were to the *samurai* what the *Mâhâyana sutra* was to the Buddhist. They were believed to have collected whatever of good had preceded them, and to have forecast whatever of good the future might produce. Something of that credit they certainly deserved, for their principles are not yet out of date:—

An army undertaking an offensive campaign must be twice as numerous as the enemy. A force investing a fortress should be numerically ten times the garrison. Troops for escalade should muster five for every one of their foes. When the adversary holds high ground, turn his flank; do not deliver a frontal attack. When he has a mountain or a river behind him, cut his lines of communication. If he deliberately assumes a position from which victory is his only escape, hold him there, but do not molest him. If you can surround him, leave one route open for his escape, since desperate men fight fiercely. Be warned of an ambush when you see birds soaring in alarm, and if animals break cover in your direction look out for a pending onset. When you have to cross a river, put your advance-guard and your rear-guard at a distance from the banks, and never approach with the bulk of your troops. When the enemy has to cross a river, let him get well engaged in the operation before you strike at him. If a march has to be traversed, make celerity your first object. Pass no copse, enter no ravine, nor approach any thicket until your scouts have explored it fully.

Such precepts are multiplied, and there is much about stratagems, deceptions and, above all, the employment of spies; but when those ancient authors discuss tactical formations, they do not seem to have contemplated anything like rapid, well-ordered changes of mobile, highly trained masses of men from one formation to another, or their quick transfer from point to point of a battlefield. The basis of their tactics is the *Book of Changes.* Here again is encountered the superstition that underlies nearly all Chinese and Japanese institutions: the superstition that took captive even the great mind of Confucius. The male and the female principles; the sympathetic and the antipathetic elements; cosmos growing out of chaos; chaos reabsorbing cosmos — on such phantasies they founded their tactical system. The result was a phalanx of complicated organization, difficult to manœuvre and liable to be easily thrown into confusion. Yet when Yamaga in the 17th century interpreted these ancient Chinese treatises, he detected in them suggestions for a very shrewd use of the principle of echelon, and applied it to devise formations which combined much of the frontal expansion of the line with the solidity of the column. More than that cannot be said for Japanese tactical genius. The *samurai* was the best fighting unit in the Orient—probably one of the best fighting units the world ever produced. It was perhaps because of that excellence that his captains remained indifferent tacticians.

Ethics of the samurai.

In estimating the military capacity of the Japanese, it is essential to know something of the ethical code of the *samurai*, the *bushi-do* ("way of the warrior") as it was called. The first source of information that presents itself is the rules of conduct prescribed by feudal chieftains, and of these a typical example is furnished in the code of Kato Kiyomasa, a celebrated general of the 16th century:—

Regulations for Samurai of every Rank; the Highest and Lowest alike.

1. The routine of service must be strictly observed. From 6 a.m. military exercises shall be practised. Archery, gunnery, and equestrianism must not be neglected. If any man shows exceptional proficiency he shall receive extra pay.
2. Those that desire recreation may engage in hawking, deer-hunting, or wrestling.
3. With regard to dress, garments of cotton or pongee shall be worn. Any man incurring debts owing to extravagance of costume or living shall be considered a law-breaker. If, however, being zealous in the practice of military arts suitable to his rank, he desires to hire instructors, an allowance may be granted to him for that purpose.
4. The staple of diet shall be unhulled rice. At social entertainments one guest for one host is the proper limit. Only when men are assembled for military exercises shall many dine together.
5. It is the duty of every *samurai* to make himself acquainted with the principles of his craft. Extravagant displays of adornment are forbidden in battle.
6. Dancing or organizing dances is unlawful; it is likely to betray sword-carrying men into acts of violence. Whatever a man does should be done with his heart. Therefore for the soldier military amusements alone are suitable. The penalty for violating this provision is death by suicide.
7. Learning shall be encouraged. Military books must be read. The spirit of loyalty and filial piety must be educated before all things. Poem-composing pastimes are not to be engaged in by *samurai*. To be addicted to such amusements is to resemble a woman. A man born a *samurai* should live and die sword in hand. Unless he is thus trained in time of peace he will be useless in the hour of stress. To be brave and warlike must be his invariable condition.
8. Whosoever finds these rules too severe shall be relieved from service. Should investigation show that any one is so unfortunate as to lack manly qualities, he shall be singled out and dismissed forthwith. The imperative character of these instructions must not be doubted.

The plainly paramount purpose of these rules was to draw a sharp line of demarcation between the *samurai* and the courtiers living in Kyôtô. The dancing, the couplet-composing, the sumptuous living, and the fine costumes of the officials frequenting the Imperial capital were strictly interdicted by the feudatories. Frugality, fealty, and filial piety—these may be called the fundamental virtues of the *samurai*. Owing to the circumstances out of which his caste had grown, he regarded all bread-winning pursuits with contempt, and despised money. To be swayed in the smallest degree by mercenary motives was despicable in his eyes.

Essentially a stoic, he made self-control the ideal of his existence, and practised the courageous endurance of suffering so thoroughly that he could without hesitation inflict on his own body pain of the most horrible description. The power of surrendering life with heroic calmness has been attained by men in all ages, and is regarded by philosophers as an elementary form of human virtue, practised with most success in an uncivilized state of society, before the finer appreciations of the imaginative and intellectual faculties have been developed by education. But the courage of the *samurai* cannot justly be ascribed to bluntness of moral sensibility resulting from semi-savage conditions of life. From the 8th century onwards the current of existence in Japan set with general steadiness in the direction of artistic refinement and voluptuous luxury, amidst which men could scarcely fail to acquire habits and tastes inconsistent with acts of high courage and great endurance. The *samurai's* mood was not a product of semi-barbarism, but rather a protest against emasculating civilization. He schooled himself to regard death by his own hand as a normal eventuality. The story of other nations shows epochs when death was welcomed as a relief and deliberately invited as a refuge from the mere weariness of living. But wherever there has been liberty to choose, and leisure to employ, a painless mode of exit from the world, men have invariably selected it. The *samurai*, however, adopted in *harakairi* (disembowelment) a mode of suicide so painful and so shocking that to school the mind to regard it with indifference and practise it without flinching was a feat not easy to conceive. Assistance was often rendered by a friend who stood ready to decapitate the victim immediately after the stomach had been gashed; but there were innumerable examples of men who consummated the tragedy without aid, especially when the sacrifice of life was by way of protest against the excesses of a feudal chief or the crimes of a ruler, or when some motive for secrecy existed. It must be observed that the suicide of the *samurai* was never inspired by any doctrine like that of Hegesias. Death did not present itself to him as a legitimate means of escaping from the cares and disappointments of life. Self-destruction had only one consolatory aspect, that it was the soldier's privilege to expiate a crime with his own sword, not under the hand of the executioner. It rested with his feudal chief to determine his guilt, and his peremptory duty was never to question the justice of an order to commit suicide, but to obey without murmur or protest. For the rest, the general motives for suicide were to escape falling into the hands of a victorious enemy, to remonstrate against some official abuse which no ordinary complaint could reach, or, by means of a dying protest, to turn a liege lord from pursuing courses injurious to his reputation and his fortune. This last was the noblest and by no means the most infrequent reason for suicide. Scores of examples are recorded of men who, with everything to make existence desirable, deliberately laid down their lives at the prompting of loyalty. Thus the *samurai* rose to a remarkable height of moral nobility. He had no assurance that his death might not be wholly fruitless, as indeed it often proved. If the sacrifice achieved its purpose, if it turned a liege lord from evil courses, the *samurai* could hope that his memory would be honoured. But if the lord resented such a violent and conspicuous mode of reproving his excesses, then the faithful vassal's retribution would be an execrated memory and, perhaps, suffering for his family and relatives. Yet the deed was perpetrated again and again. It remains to be noted that the *samurai* entertained a high respect for the obligations of truth; "A *bushi* has no second word," was one of his favourite mottoes. However, a reservation is necessary here. The *samurai's* doctrine was not truth for truth's sake, but truth for the sake of the spirit of uncompromising manliness on which he based all his code of morality. A pledge or a promise must never be broken, but the duty of veracity did not override the interests or the welfare of others.

Religious influence. Something more, however, than a profound conception of duty was needed to nerve the *samurai* for sacrifices such as he seems to have been always ready to make. It is true that Japanese parents of the military class took pains to familiarize their children of both sexes from very tender years with the idea of self-destruction at any time. The little boy was taught how the sword should be directed against his bosom; the little girl, how the dagger must be held to pierce the throat; and both grew up in constant fellowship with the conviction that suicide must be reckoned among the natural incidents of everyday existence. But superadded to the force of education and the incentive of tradition there was a transcendental influence. Buddhism supplied it. The tenets of that creed divided themselves, broadly speaking, into two doctrines, salvation by faith and salvation by works, and the chief exponent of the latter principle is the sect which prescribes "meditation" as the vehicle of enlightenment. Whatever be the mental processes induced by this rite, those who have practised it insist that it leads finally to a state of "absorption" in which the mind is flooded by an illumination revealing the universe in a new aspect, absolutely free from all traces of passion, interest, or affection, and showing, written across everything in flaming letters, the truth that for him who has found Buddha there is neither birth nor death, growth nor decay. Lifted high above his surroundings, he is prepared to meet every fate with indifference. The attainment of that state seems to have been a fact in the case both of the *samurai* of the military epoch, and of the Japanese soldier to-day, producing in the former readiness to look calmly in the face of any form of death, and in the latter a high type of patriotic courage.

Conscription. In 1873, after the transfer of the administrative authority from the Shogun to the Emperor had been completely consummated, the conscription system was re-introduced by the new Government. So far as concerned quality of material for organizing a national army, the *samurai* would have been unique. But since they were essentially an outgrowth of military feudalism, the abolition of the latter involved the disappearance of the former as a distinct class. Many persons viewed this hazardous experiment with deep misgiving. They feared that it would not only alienate the *samurai*, but also entrust the duty of defending the country to men unfitted by tradition and custom for such a task, namely, the farmers, artisans, and tradespeople, who, after centuries of exclusion from the military pale, might be expected to have lost all martial spirit. The Government, however, did not suffer itself to be deterred by these apprehensions. It argued that since the distinction of *samurai* and commoner had not originally existed, and since the former was a product, not of natural selection, but of accidental conditions, there was no valid reason to doubt the military capacity of the people at large. The justice of this reasoning was put to a speedy test. For, some three years after the introduction of the new system, an army of conscripts had to take the field against the *élite* of the *samurai*, and the result showed that the peasant, the mechanic, and the tradesman might safely be trusted to fight their country's battles. At 20 years of age every subject, of whatever status, becomes liable for conscription. There exists an accurate system of registration which places the authorities in possession of full information about each unit of the population, and effectually prevents any successful attempts to evade conscription. Conscripts are selected by lot after medical examination. The minimum height for the infantry, cavalry, and army service corps is 5·2 feet; that for the artillery and engineers, 5·4 feet. It rests with the Minister of War, under sanction of the Emperor, to determine what number of conscripts shall be taken each year. There are four principal kinds of service, namely, service with the colours (*genyeki*), for three years; service with the first reserves (*yobi*), for 4⅓ years; service with the second reserves (*gobi*), for 5 years; and service with the territorial troops (*kokuminhei*) up to the age of forty. There are also two bodies of supernumeraries (*hoju*). The first consists of men who, though liable for conscription and medically qualified, have escaped the lot for service with the colours. The second consists of those similarly liable and qualified, who have escaped not only the lot for service with the colours, but also the lot for service with the first supernumeraries. The period for the first supernumeraries is 7⅓ years, and that for the second, 1⅓ years, after which both pass into the territorial army. Their purpose is to fill vacancies in the troops with the colours, but in time of peace that liability devolves upon the first supernumeraries alone, and during the first year after conscription only. The full period of training for the first supernumeraries is 150 days, which may be divided according to convenience, but, in general, 90 days' training is given during the first year. The

second supernumeraries do not, in ordinary circumstances, receive any training during the interval of $1\frac{1}{3}$ years prior to their enrolment in the territorial army. As for the first reserves and the second reserves, each is called out twice during its full term, the first reserves for three or four weeks at a time, the second reserves for two weeks approximately. After reaching the territorial army a man is relieved from all further training. The total number of youths eligible for conscription each year is 427,000, and 60,000 are taken for service with the colours, 131,300 being drafted into the supernumeraries. A recruit upon whom the lot falls for service with the colours may be discharged before the expiration of three years if his conduct and aptitude are exceptional. Hitherto this privilege has never been granted earlier than the close of the second year of service.

A youth is exempted from liability to conscription if it be clearly established that his absence from home would deprive his family of the means of subsistence.[1] Rejection by medical examiners does not confer final immunity unless the cause is found to exist in two consecutive years.[2] Men who have been convicted of crime are disqualified, but those who have been temporarily deprived of civil rights on account of some offence must present themselves for conscription at the termination of their sentence. One of the chief exemptions is in connexion with education. Any youth attending the course of study at an officially recognized school or college of sufficiently high grade is exempted up to the age of 28, provided that in the meanwhile he volunteers for military training according to a system which will be presently explained. If he passes the age of 28 without volunteering, then he is taken for service with the colours, his chance of escaping by lot like an ordinary conscript being forfeited. After 28, if he has duly complied with the regulation as to volunteering, he passes into the territorial forces. Residence in a foreign country also secures exemption up to the age of 32—provided that official permission to go abroad has been obtained. A man returning after the age of 32 is drafted into the territorial army, but if he returns before that age he must volunteer to receive training, otherwise he is taken without lot for service with the colours. The system of volunteering is largely resorted to by persons of the better classes. Any youth who possesses certain educational qualifications, indicated by a diploma from an officially recognized school or college, or determined by passing a special examination, and who has not been guilty of any offence against the law, is entitled to volunteer for training. If accepted after medical inspection, he serves with the colours for one year, three months of which time must be passed in barracks like a common soldier—unless a special permit be granted by the colonel commanding the battalion—but for the remaining nine months attendance at drills alone is required. A volunteer serving with the infantry pays 62 *yen* on account of his clothing and equipments, and 38 *yen* on account of his food, and a cavalry volunteer has to defray an additional charge of 75 *yen* for the maintenance of a horse.[3] At the conclusion of a year's training the volunteer is drafted into the first reserve for $6\frac{1}{4}$ years, and then into the second reserve for 5 years, so that his total period ($12\frac{1}{4}$ years) of service before passing into the territorial army is the same as that of an ordinary conscript. Graduates of duly accredited normal schools and teachers in public elementary schools are exempted from more than six weeks' service with the colours, after which they pass at once into the territorial army, the Government defraying their expenses during the period of training. But if a teacher abandons that calling before the age of 28, he becomes liable, without lot,[4] to two years with the colours, unless he adopts the alternative of volunteering.

Officers.

Officers are obtained in two ways. There are six local preparatory schools (*yonen-gakko*) in various parts of the empire, where lads of from 13 to 15 are received as cadets if they can show—either by certificate or by examination—that they possess a certain degree of general education.[5] After three years at one of these schools, a graduate passes to the central preparatory school (*chuo-yonen-gakko*) in Tôkyô, where he spends twenty-one months. If he graduates with sufficient distinction at the latter institution he becomes eligible for admission to the officers' college (*shikan-gakko*) without further test of proficiency. The second method of obtaining officers is by competitive examination for admission to the officers' college. Graduates from officially recognized middle schools or higher educational institutions are only required to pass in mathematics and foreign languages, but all other candidates have to submit to a severe test. Each class of cadet, whether a graduate of the central preparatory school or a direct candidate by competitive examination, is sent to serve with the colours for a year, or at least six months, before commencing his course at the officers' college. During that time he is treated as a common soldier, except that his promotion to non-commissioned rank is rapid. The period of study at the officers' college is one year, and after graduating successfully the cadet is drafted for six months' service with the branch to which it is proposed that he shall be finally attached. At the end of that period his name is submitted to a council of staff officers who have watched his progress, and if they report favourably he receives a commission as a sub-lieutenant. Cadets for the scientific branches—engineers and artillery—are then sent to a special college where they receive a year's training, theoretical and practical.

Promotion and ranks.

There are three grades of privates, upper soldiers (*joto-hei*), first-class soldiers (*itto-sotsu*), and second-class soldiers (*nito-sotsu*). A private on joining is a second-class soldier. For proficiency and good conduct he is raised to the rank of first-class soldier, and ultimately to that of upper soldier. His pay, his duties, and the number of stripes on his arm vary with his grade. Non-commissioned officers are obtained from the ranks, or from special candidates. Their grades are corporal (*gocho*), sergeant (*gunso*), sergeant-major (*socho*), and special sergeant-major (*tokumu-socho*). If a soldier undertakes the duties of sergeant he must serve at least four years with the colours. He may, if he pleases, continue to serve in that capacity up to the age of 25, but

[1] This privilege led to great abuses originally. It became a common thing to employ some aged and indigent person, set him up as the head of a "branch family," and give him for adopted son a youth liable to conscription. The law is now framed so as to prevent all such frauds.

[2] This does not apply, of course, to permanent deformities.

[3] These payments are not final. If they prove insufficient the volunteer must be prepared to make good the deficiency. If they are found to be excessive the surplus is returned. In the case of youths who, though otherwise entitled to be volunteers, are in such straitened circumstances that they cannot defray the whole of the prescribed charges, the Government contributes a part.

[4] Conscription without lot is the punishment for all failures to comply with the military laws, or for any attempt to evade them by malingering or by fraudulent representations.

[5] Sons of officers' widows, or of officers in reduced circumstances, are educated at these schools either as free cadets or at half charges. In the latter case the payments are 10 *yen* yearly for clothes and 3·25 *yen* monthly for rations. In the case of the ordinary cadet the corresponding payments are 30 *yen* and 6·50 *yen* respectively. If a free, or half-free, cadet leaves school without graduating, he is required to pay up the total sum that he would have defrayed as an ordinary cadet.

a period of four years is compulsory. His service with the reserves is correspondingly reduced. Acceptance of the post of special sergeant-major entails the obligation of serving up to the age of 37, with the option of remaining until the age of 45. All the promotion in the non-commissioned ranks is by merit. Officers' ranks are the same as in the British army, but the nomenclature is much simpler. The terms, with their English equivalents, are *shoi* (second lieutenant), *chiui* (first lieutenant), *taii* (captain), *shosa* (major), *chiusa* (lieut.-colonel), *taisa* (colonel), *shosho* (major-general), *chiujo* (lieut.-general), *taisho* (general), *gensui* (field-marshal).[1] Promotion for officers in the junior grades is by seniority and merit. Two-thirds of the second lieutenants attain the rank of first lieutenant by seniority and one-third by merit. One-half of the first lieutenants are promoted to be captains by merit and one-half by seniority. After the rank of captain all promotion is by merit, and it results that many officers never rise higher than captain, in which case retirement is compulsory at the age of 48. It is necessary that a second lieutenant should have served at least two years before promotion to the rank of first lieutenant; the corresponding term for a first lieutenant being two years; for a captain, four years; for a major, three years; for a lieutenant-colonel, two years; and for a major-general, three years. Above the rank of lieutenant-general promotion is not governed by any rule.

The pay of non-commissioned officers and privates is as follows:—

	Per month. Yen.	s.	d.
First-class Special Sergeant-Major	14·10	28	6
Second-class Special Sergeant-Major	12·90	26	1
First-class Sergeant-Major	8·61	17	5
Second-class Sergeant-Major	8·01	16	2¼
First-class Sergeant	6·42	12	11½
Second-class Sergeant	5·85	11	10¼
First-class Corporal	5·07	10	3
Second-class Corporal	4·53	9	2
Upper Soldier	1·50	3	0½
First-class Private	1·20	2	5
Second-class Private	0·90	1	10

Rations and uniforms are also furnished. The men are paid weekly, and all have quarters within the barracks.

The officers' pay is as follows:—

	Yen.	Annually.
General	6000	£600
Lieutenant-General	4000	400
Major-General	3150	315
Colonel	2352	238
Lieutenant-Colonel	1752	175
Major	1152	115
Captain	708	71
First Lieutenant	468	47
Second Lieutenant	336	34[2]

There is also a carefully graduated system of retiring allowances, for which officers and non-commissioned officers become eligible after eleven years' full service with the colours. The figures, freed from confusing details, are these:—

	Yearly.
General—retiring allowance	£150 to £223
Lieutenant-General	120 ,, 175
Major-General	105 ,, 156
Colonel	75 ,, 112
Lieutenant-Colonel	60 ,, 89
Major	45 ,, 67
Captain	30 ,, 45
First Lieutenant	23 ,, 34
Second Lieutenant	18 ,, 26
Special Sergeant-Major	15 ,, 23

[1] The same terms are applied to the ranks of officers in the navy (with the exception of *gensui*), and thus all confusion about questions of relative rank is avoided.

[2] The pay is not uniform in the case of captains and lieutenants, but further details are unnecessary. When an officer is not actually serving, his pay is reduced by one-half approximately.

The army consists of 12 divisions, numbered from 1 to 12, and a division of Guards, making 13 divisions in all. Each division is under the command of a lieutenant-general, and is permanently stationed in a certain district. It is organized as a complete fighting unit, its composition being 4 regiments of infantry, 1 regiment of cavalry, 1 regiment of field artillery, 1 battalion of engineers, and 1 battalion of army service. A regiment of infantry consists of 4 battalions, and a battalion consists of 3 companies. A regiment of cavalry consists of either 3 or 4 squadrons, each squadron being 100 sabres. A regiment of field artillery consists of 6 batteries, and a battery has 6 guns. A battalion of engineers consists of 3 companies, or 600 men, and a battalion of army service numbers 300 men. It will thus be seen that the composition of a division—with the exception of the Guards division, which is somewhat smaller—is, infantry, 9600; cavalry, 300; artillery, 36 guns; engineers, 600; army service, 300. There are also 6 regiments of mountain artillery, or 216 guns in all. The total force of field artillery is 17 regiments, or 612 guns, and the total force of cavalry is 15 regiments, or about 5000 sabres. It is impossible to give absolutely accurate figures, as a certain reserve is exercised by the War Department. In addition to the above, the following divisions include extra corps, namely:—

Organization.

The Guards division has a brigade (2 regiments) of cavalry, a brigade (3 regiments) of field artillery, and a battalion of railway engineers.

The first division has a brigade (2 regiments) of cavalry, a brigade (3 regiments) of field artillery, and 1 regiment of garrison artillery for service in the Tôkyô Bay forts.

The fourth division has 1 regiment of garrison artillery for the Yura forts.

The fifth division has 1 regiment of garrison artillery for the Kure forts, and 1 battalion of garrison artillery for the Geiyo forts.

The sixth division has 1 regiment of garrison artillery for the Saseho forts, and 1 battalion of garrison artillery, together with 1 battalion of garrison infantry, for the Tsushima forts.

The seventh division has 1 battalion of garrison artillery for the Hakodate forts.

The tenth division has 1 battalion of garrison artillery for the Maizuru forts.

The twelfth division has 1 regiment of garrison artillery for the Shimonoseki forts.

When the scheme of army organization, adopted in 1896 after the war with China, is completed in 1905, the strength of the army on a peace footing will be 150,000 of all ranks, with 30,000 horses, and the strength on a war footing, 500,000 men, with 100,000 horses. It is impossible to state the exact strength, but a peace footing of 100,000 will be a very close approximation. Recruits for the Guards are taken from every part of the empire, but those for a division are taken from its district, each divisional district being divided for recruiting purposes into four regimental districts, each of which supplies recruits for a particular regiment. The garrisoning of Formosa is effected by a mixed brigade[3] furnished by the divisions in turn.

The Emperor is the Commander-in-Chief of the army, and theoretically the sole source of military authority, which he exercises through a general staff and a war department, with the assistance of a board of field-marshals (*gensuifu*).

[3] The term "mixed brigade" is used to indicate a brigade having the tactical units of a division, though proportionately smaller; namely, 2 regiments of infantry, 2 squadrons of cavalry, 3 batteries of field artillery, half a battalion of engineers, and half a battalion of army service.

The General Staff has for chief a field-marshal, and for vice-chief a general or lieutenant-general. It includes five offices for the transaction of ordinary business, as well as a survey bureau, a trigonometrical section, a cartographic section, and a topographic section, and the military college is under its direction. The War Department is presided over by a general officer whose name is borne on the active list, and who is a member of the cabinet without being necessarily affected by ministerial changes. A Tôkyô defence office, presided over by a lieutenant-general, superintends the defences of Tôkyô Bay; the same duty with regard to the other fortifications throughout the empire is entrusted to three major-generals, who have their headquarters in Yokohama, Shimonoseki, and Yura respectively; and the whole empire is divided into three military districts, the eastern, the central, and the western, each under the command of a general or lieutenant-general. There are, further, an artillery committee and an engineering committee, composed of experts from these two branches of the service, who consider all questions relating to the manufacture of arms and ammunition, and there is a remount office.

Medical service. The medical service is exceptionally well organized. It received unstinted praise from European and American experts who observed it closely during the wars of 1894–95 and of 1900. The fixed establishment of surgeons to each division is 100 approximately, and arrangements complete in every detail are made for affording relief to men in the fighting line, for bandaging stations, for field hospitals, for standing hospitals in the enemy's territory, and for special hospitals at home. Much assistance is rendered in this department of military affairs by the Red Cross Society of Japan, which has an income of two million *yen* annually, a fine hospital in Tôkyô, a large staff of trained nurses of both sexes, and two hospital ships specially built and equipped for the transport of wounded men. During the early part of the campaign in Pechili in 1900 the French column entrusted its wounded to the care of the Japanese.

Provisions. The staple article of commissariat for a Japanese army in the field is *hoshii* (dried rice), prepared by boiling rice and drying it in the sun or by artificial heat. Thus treated the rice shrinks into a small compass, and three days' supply can easily be carried in a bag by the soldier. When required for use the rice, being placed for a few moments in boiling water —cold water serves on emergency—swells to its original bulk, and is eaten with a relish of salted fish, dried sea-weed, or pickled plums. The task of provisioning an army on these lines is comparatively simple. The Japanese soldier, though low in stature, is well set up, muscular, and hardy. He has great powers of endurance, and one of his strong points is that he manœuvres with remarkable celerity, doing everything at the run, if necessary, and continuing to run without distress for a length of time astonishing to Occidental observers. He is much subject, however, to attacks of *kakke* (beri-beri), and if he has recourse to meat diet, which appears to be the best preventive, he will probably lose something of his capacity for prolonged rapid movement. He attacks with apparent indifference to danger, preserves his cheerfulness amid hardships, and has always shown himself thoroughly amenable to discipline.

Military schools. There are several schools for the special education of officers, non-commissioned officers, and military mechanics. The most important of these institutions is the *Rikugun Daigakko,* or Army College, where officers are prepared for service in the upper ranks and for staff appointments. A first or second lieutenant is eligible for admission after two years' service with the colours, provided that he is recommended by his commanding officer and passes a written examination in subjects indicated by the chief of the General Staff through the War Department, the examination papers being sent to the headquarters of the division to which the officer belongs. The course of study at the college extends over three years, and embraces scientific training of a high character. An officer's future promotion depends largely on the record he establishes at this college and on the place he obtains in the final examination. The Toyama School—so called because it is situated in the Toyama suburb of Tôkyô—stands next in importance to the Army College. The courses pursued there are in strategy and tactics, musketry, gymnastics, and fencing, and officers up to the rank of captain are admitted from the infantry, garrison artillery, or engineers, non-commissioned officers also being allowed to take the musketry course. The term of training is five months, and two batches of students graduate annually. For this school officers are selected by the commanders of the corps with which they are serving. Officers of the scientific branches are instructed at the *Hôkôgakko* (School of Artillery and Engineers), as already stated. While studying at any of these institutions an officer receives full pay, and all expenses connected with education or training are defrayed by the Government. There are, further, two special schools of gunnery—one for field artillery, the other for garrison artillery. The course at the Field Artillery School is for three months; admission is by recommendation of a commanding officer, and, as a general rule, first lieutenants and captains study there, though second lieutenants may be admitted on special recommendation. The Garrison Artillery School receives officers of similar rank belonging to that branch of the service, but it also receives sergeants and candidates for non-commissioned officers. The course for officers extends to four months, and the course for non-commissioned-officer candidates to eighteen months. The other educational institutions are—the Cavalry Practical School, the Army Service School, the Army Medical School, the Veterinary School, the Arsenal School, and the School of Military Music. Officers obtain admittance to these various schools by recommendation of divisional or regimental commanders, while in the Veterinary School and the Arsenal School common soldiers are trained to be farriers and armourers. There is an inspection department of military education, the inspector-general being an officer of the rank of lieut.-general, under whom are fifteen officers, ranking from lieut.-colonel to major-general, who act as inspectors not only of the various schools and colleges, but also of all educational matters connected with the different branches of the service.

Efficiency. The Japanese officer is one of the strongest features of the army. His pay is small according to European standards, but his mode of life is frugal. Quarters are not assigned to him in barracks. He lives outside, frequently with his own family, and when duty requires him to take his meals in barracks, food is brought to him in a luncheon-box. His uniform is plain and inexpensive,[1] and he has no desire to exchange it for "mufti," as so many Occidental officers have. Being thus without mess expenses, contribution to a band, or luxuries of any kind, and nearly always without private means to supplement his pay, his habits are thoroughly economical, and a campaign involves comparatively few privations for him. He devotes himself absolutely to his profession, living for nothing else, and since he is strongly imbued with an effective conception of the honour of his cloth, instances of his incurring disgrace by debts or dissipation are exceptional. The *samurai* as a distinctive class were abolished simultaneously with the feudal system, but they may be said to have been revived again in the officers of the modern army, who preserve and act up to all the old traditions. The system of promotion has evidently much to do with this good result, for no Japanese officer can hope to rise above the rank of captain unless, by showing himself really zealous and capable, he obtains from his commanding officer the recommendation without which all higher educational opportunities are closed to him. It might be supposed that under such a system favouritism would prevail more or less, but no scandal of that kind has come to public knowledge since the modern army was organized. Corruption also appears to be virtually absent. In the stormiest days of parliamentary warfare, when charges of dishonesty were freely preferred by party politicians against all departments of officialdom, no whisper ever impeached the integrity of army officers, and when the test of war has been applied, all the equipments of the service have been found complete and in good order. It is evident, indeed, that when an army of such magnitude is maintained at an annual outlay of 37,000,000 *yen* (£3,700,000), there cannot be very much opportunity for peculation.

The time devoted daily to the training of a soldier is from four to six hours, and the courses are theoretical and practical. In the practical course the subjects are—

[1] Uniform does not vary according to regiments or divisions. There is only one type for the whole of the infantry, one for the cavalry, and so on.

marching, movements in the ranks, gymnastics (to which special attention is paid), musketry or gunnery, artisanship, swimming, riding, movements against obstacles, making and taking cover, and constructing temporary bridges. In the theoretical course the subjects are—morality, distinctions of various arms of the service and their interactions, principles of tactical formation, duties of units of a body of troops, and duties in the field. With regard to exercises in the field there is no fixed limit of time. The captain of a company, using his own discretion, takes his men out for half a day, or a whole day, or for two or three days together, as often as he deems expedient. Generally these exercises in the case of a company take place twice a month, after the men have been a few months with the colours. A similar system holds with regard to field exercises for a battalion, a regiment, a brigade, or a division. The officer in command chooses the occasions and regulates the time. Every autumn manœuvres are organized on a large scale, two or more divisions taking part, and every second year there are special manœuvres for cavalry, artillery (field and garrison), and engineers. Rifle and gun practice is of three kinds—instruction practice, fighting practice, and test practice. The number of rounds of ball cartridge fired by the infantry soldier during the first year is 205, and the number during the second and third years, 185 rounds. The artillery fires 130 rounds per gun annually. There is no fixed rule as to the number of rounds fired at each practice; it varies according to the capacity shown by the individual soldier.

The articles carried by an infantry soldier in the field weigh altogether $43\frac{1}{2}$ ℔ (exclusive of the clothes he is actually wearing)—namely, arms, water-bottle, and accoutrements, $22\frac{1}{2}$ ℔; knapsack and contents, $20\frac{5}{8}$ ℔. The weight of a cavalry trooper's arms, &c., stands thus—carbine and ammunition, $10\frac{3}{8}$ ℔; sword, $3\frac{1}{2}$ ℔; clothes, $14\frac{1}{4}$ ℔; saddle and equipments, &c., 74 ℔; the total being $7\frac{1}{3}$ stone approximately. As the average weight of the trooper himself is 10 stone, the weight carried by the horse is $17\frac{1}{3}$ stone. The infantry soldier carries a repeating rifle of Japanese design (the Arisaka pattern), and the field and horse artillery have two patterns of guns, field and mountain, each having the same calibre (7·5 c.m., 2·955 inches), and each firing the same ammunition, of which the common shell weighs 4·28 kilo. (9·435 ℔). The field gun itself weighs 298 kilo. (nearly 6 cwt.), and the mountain gun, $103\frac{1}{2}$ kilo. (228 ℔); but these are being changed for a weapon designed by Colonel Arisaka. An arsenal in Tôkyô, another in Osaka, and a third in Taipeh (Formosa) are intended to supply arms and ammunition, but they have not hitherto been able fully to meet the requirements of the service. One difficulty has been that metal for dockyard and arsenal purposes has to be imported. An iron-foundry constructed at Wakamatsu in Kiushiu, however, will remedy this defect. Small arms are manufactured successfully and in sufficient quantities.

Arms.

Manufacture of arms, &c.

Originally the Government engaged French officers to assist in organizing the army and elaborating its system of tactics and strategy, and during several years a *mission militaire*, composed of competent experts, resided in Tôkyô and rendered valuable aid to the Japanese. Afterwards German officers were employed, but ultimately the services of foreigners were dispensed with altogether, and Japan now adopts the plan of sending picked men to complete their studies in Europe. She has followed her usual eclectic course in this matter, not modelling herself on any one foreign system, but choosing from each whatever seemed most desirable. (F. BY.)

IV. JAPANESE ART.

Since the article by Sir Rutherford Alcock in the ninth edition of this work, a great amount of historical, technical, and critical information has been brought to light, and the art-workers of New Japan have been by no means idle. It is now known that Japan can show a long and sustained history of artistic culture of which any nation might be proud. Absorbing Chinese civilization, when that was perhaps the worthiest and most complete in the world, Japan gave a royal welcome to all that her great neighbour could offer. Chinese religion, literature, art, and science were as swiftly assimilated in the 7th and 8th centuries of our era as European science and militarism in the latter part of the 19th century. In the middle of the 7th century even the Government was entirely remodelled on the Chinese bureaucratic plan, and a department of art was not forgotten. The emperors, then and for over 300 years later, devoted their energies to the cultivation of poetry, painting, sculpture, music, and many another art of refinement, leaving the cares of government in the hands of ambitious vassals. China was the fountain-head of all their knowledge and accomplishments, and nearly all that was not Chinese was regarded as barbaric and effete. Japanese art based on Chinese models attained a level during this era that it has scarcely since surpassed and, in some respects, has failed to equal. In following out its development it will be convenient to outline first the history of pictorial art, to which all other branches owe their most striking features.

Historic importance.

Pictorial Art.

The development of Japanese painting may be divided into six periods, each signalized by a wave of progress. *First Period.*—From the middle of the 6th century to the middle of the 9th century: the naturalization of Chinese and Chino-Buddhist art. *Second Period.*—From the middle of the 9th century to the middle of the 15th century: the establishment of great native schools under Kosé no Kanaoka and his descendants and followers, the pure Chinese school gradually falling into neglect. *Third Period.*—From the middle of the 15th century to the latter part of the 17th century: the revival of the Chinese style. *Fourth Period.*—From the latter part of the 17th to the latter part of the 18th century: the establishment of a popular school. *Fifth Period.*—From the latter part of the 18th to the latter part of the 19th century: the foundation of a naturalistic school, and the first introduction of European influence into Japanese painting; the acme and decline of the popular school. *Sixth Period.*—From about 1875 to the present time: a period of transition.

First Period.—Tradition refers to the advent of a Chinese artist named Nanriu, invited to Japan in the 5th century as a painter of the imperial banners, but of the labours and influence of this man and of his descendants we have no record. The real beginnings of the study of painting and sculpture in their higher branches must be dated from the introduction of Buddhism from China in the middle of the 6th century, and for three centuries after this event there is evidence that the practice of the arts was carried on mainly by or under the instruction of Korean and Chinese immigrants. The paintings of which we have any mention were almost limited to representations of Buddhist motives executed in the style of the Chinese masters of the T'ang dynasty (A.D. 618–905), notably Wu Tao-tsz' (8th century), of whose genius romantic stories are related. The oldest existing work of this period is a mural decoration in the hall of the

temple of Horiūji, Nara, attributed to a Korean priest named Donchô, who lived in Japan in the 6th century; and this painting, in spite of the destructive effects of time and exposure, shows traces of the same power of line, colour, and composition that stamps the best of the later examples of Buddhist art.

Second Period.—The native artist who crested the first great wave of Japanese painting was a court noble named Kosé no Kanaoka, living under the patronage of the Emperor Seiwa (850–59) and his successors down to about the end of the 9th century, in the midst of a long term of peace and culture. Of his own work few, if any, examples have reached us; and those attributed with more or less probability to his hand are all representations of Buddhist divinities, showing a somewhat formal and conventional design, with a masterly caligraphic touch and perfect harmony of colouring. Tradition credits him with an especial genius for the delineation of animals and landscape, and commemorates his skill by a curious anecdote of a painted horse which left its frame to ravage the fields, and was reduced to pictorial stability only by the sacrifice of its eyes. He left a line of descendants extending far into the 15th century, all famous for Buddhist pictures, and some engaged in establishing a native style, the "Wa-gwa riu."

At the end of the 9th century there were two exotic styles of painting, the Chinese and the Buddhist, and the beginning of a native style founded upon these. All three were practised by the same artists, and it was not until a later period that such became the badge of a school.

Chinese style.

The Chinese style (Kara riu), the fundamental essence of all Japanese art, had a fairly distinct history, dating back to the introduction of Buddhism into China (A.D. 62), and it is said to have been chiefly from the works of Wu Tao-tsz', the master of the 8th century, that Kanaoka drew his inspiration. This early Chinese manner, which lasted without sign of failure in the parent country down to the end of the 13th century, was characterized by a virile grace of line, a grave dignity of composition, striking simplicity of technique, and a strong but incomplete naturalistic ideal. The colouring, harmonious but subdued in tone, held a place altogether secondary to that of the outline, and was frequently omitted altogether, even in the most famous works. Shadows and reflexions were ignored, and perspective, approximately correct for landscape distances, was isometrical for near objects, while the introduction of a symbolic sun or moon lent the sole distinction between a day and a night scene. The art was one of imperfect evolution, but for thirteen centuries it was the only living pictorial art in the world, and the Chinese deserve the honour of having created landscape painting. The materials used were water colours, brushes, usually of deer-hair, and a surface of unsized paper, translucent silk, or wooden panel. Its chief motives were landscapes of a peculiarly wild and romantic type, animal life, trees and flowers, and figure compositions drawn from Chinese and Buddhist history and Taoist legend; and these, together with the grand aims and strange shortcomings of its principles and the limited range of its methods, were adopted almost without change by Japan. It was a noble art, but unfortunately the rivalry of the Buddhist and later native styles permitted it to fall into comparative neglect, and it was left for a few of the faithful, the most famous of whom was a priest of the 14th century named Kawô, to preserve it from inanition till the great Chinese "renaissance" that lent its stamp to the next period. The reputed founder of Japanese caricature may also be added to this list. He was a priest named Kakuyu, but better known as the Abbot of Toba, who lived in the 12th century. An accomplished artist in the Chinese manner, he amused himself and his friends by burlesque sketches, marked by a grace and humour that his imitators never equalled. Later, the motive of the "Toba pictures," as such caricatures were called, tended to degenerate, and the elegant figures of Kakuyu were replaced by scrawls that often substituted indecency and ugliness for art and wit. Some of the old masters of the Yamato school were, however, admirable in their rendering of the burlesque, and in modern times Kiôsai, the last of the Hokusai school, outdid all his predecessors in the riotous originality of his weird and comic fancies. A new phase of the art now lives in the pages of the *Maru-maru Chimbun*, the Tôkyô *Punch*.

Buddhist style.

The Buddhist style was probably even more ancient than the last, for the scheme of colouring distinctive of the Buddhist picture was almost certainly of Indian origin; brilliant and decorative, and heightened by a lavish use of gold, it was an essential to the effect of a picture destined for the dim light of the Buddhist temple. The style was applied only to the representations of sacred personages and scenes, and as the traditional forms and attributes of the Brahmanic and Buddhist divinities were mutable only within narrow limits, the subjects seldom afforded scope for originality of design or observation of nature. The principal Buddhist painters down to the 14th century were members of the Kosé, Takuma, and Kasuga lines, the first descended from Kanaoka, the second from Takuma Taméuji (ending 10th century), and the third from Fujiwara no Motomitsu (11th century). The last and greatest master of the school was a priest named Meichô, better known as Chô Densu, the Japanese Fra Angelico. It is to him Japan owes the possession of some of the most stately and most original works in Japanese art, sublime in conception, line, and colour, and deeply instinct with the religious spirit. He died in 1427, at the age of 76, in the seclusion of the temple where he had passed the whole of his days.

Native style.

The native style, Yamāto or Wa-gwa riu, was an adaptation of Chinese art canons to motives drawn from the Court life, poetry, and stories of old Japan. It was undoubtedly practised by the Kosé line, and perhaps by their predecessors, but it did not take shape as a school until the beginning of the 11th century under Fujiwara no Motomitsu, who was a pupil of Kosé no Kinmochi; it then became known as "Yamato riu," a title which two centuries later was changed to that of "Tosa," on the occasion of one of its masters, Fujiwara no Tsunétaka, assuming that appellation as a family name. The Yamato-Tosa artists painted in all styles, but that which was the speciality of the school, to be found in nearly all the historical rolls bequeathed to us by their leaders, was a lightly touched outline filled in with flat and bright body colours, in which a verdigris green played a great part. The originality of the motive did not prevent the adoption of all the Chinese conventionalities, and of some new ones of the artist's own. The curious expedient of spiriting away the roof of any building of which the artist wished to show the interior was one of the most remarkable of these. Amongst the foremost names of the school are those of Motomitsu (11th century), Nobuzané (13th century), Tsunétaka (13th century), Mitsunobu (15th and 16th centuries), his son Mitsushigé, and Mitsuōki (17th century). The long struggle between the Taira and Minamoto clans for the power that had long been practically abandoned by the Imperial line lasted through the 11th and the greater part of the 12th centuries, ending only with the rise of Generalissimo Yoritomo to supreme power in 1185. These internecine disturbances had been

unfavourable to any new departure in art, except those appertaining to arms and armour, and the strife between two puppet emperors for a shadow of authority in the 14th century brought another distracting element. It was not until the peace following the triumph of the northern dynasty was achieved through the prowess of an interested champion of the Ashikaga clan that the culture of ancient Japan revived. The palace of the Ashikaga Shoguns then replaced the Imperial Court as the centre of patronage of art and literature, and established a new era in art history.

Third Period.—It was towards the close of the Ashikaga Shogunate that painting entered a new phase. Talented representatives of the Kosé, Takuma, and Tosa lines maintained the reputation of the native and Buddhist schools, and the long-neglected Chinese school was destined to undergo a vigorous revival. The initiation of the new movement is attributed to a priest named Jôsetsu, who lived in the early part of the 15th century, and of whom little else is known. It is not even certain whether he was of Chinese or Japanese birth; he is, however, believed by some authorities to have been the teacher of three great artists—Shiūbun, Sesshiū, and Kano Masanobu—who became the leaders of three schools: Shiūbun, that of the pure Chinese art of the Sung and Yuen dynasties (10th and 13th centuries); Sesshiū, that of a modified school bearing his name; and Masanobu, of the great Kano school, which has reached to the present day. The qualities of the new Chinese schools were essentially those of the older dynasties: breadth, simplicity, a daringly caligraphic play of brush that strongly recalled the accomplishment of the famous scribes, and a colouring that varied between sparing washes of flat local tints and a strength and brilliancy of decorative effort that rivalled even that of the Buddhist pictures. The motives remained almost identical with those of the Chinese masters, and so imbued with the foreign spirit were many of the Japanese disciples, that it is said they found it difficult to avoid introducing Chinese accessories even into pictures of native scenery.

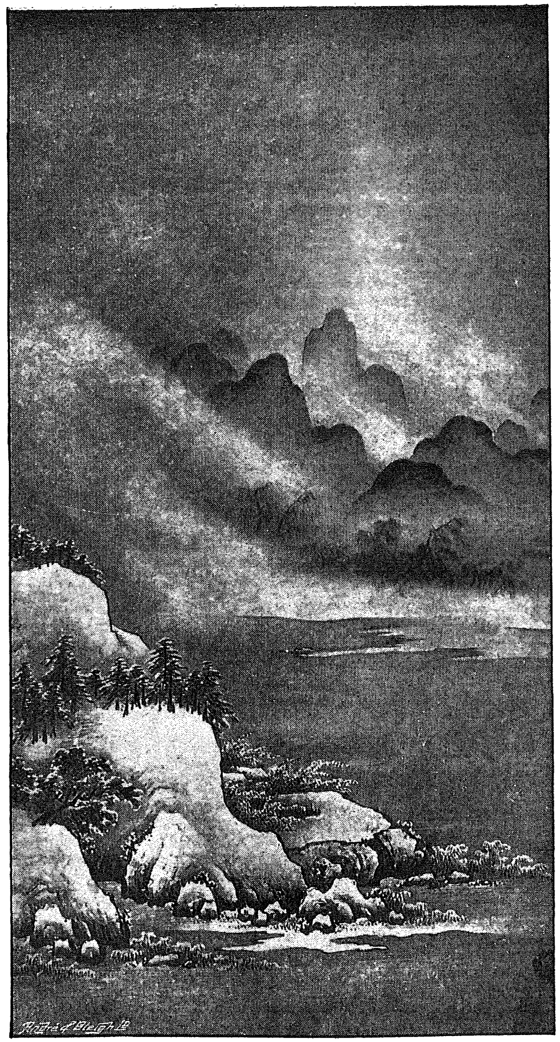
Sesshiū (1421–1507) was a priest who, after passing his meridian, visited China and studied painting there for several years, at length returning in 1469, disappointed with the living Chinese artists, and resolved to strike out a style of his own, based upon that of the old masters. He was the boldest and most original of Japanese landscape artists, leaving powerful and poetic records of the scenery of his own land as well as that of China, and trusting more to the sure and sweeping stroke of the brush than to colour. Shiūbun was an artist of little less power, but he followed more closely his exemplars, the Chinese masters of the 12th and 13th centuries; while Kano Masanobu (1424–1520), trained in the love of Chinese art, departed little from the canons he had learned from Jôsetsu or Oguri Sôtan. It was left to his more famous son, Motonobu, to establish the school which bears the family name. Kano Motonobu (1477–1559) is esteemed one of the greatest of Japanese painters, an eclectic of genius, who excelled in every style and every branch of his art. His variety was inexhaustible, and he remains to this day a model whom the most distinguished artists are proud to imitate. The names of the celebrated members of this long line are too many to quote here, but the most accomplished of his descendants was Tanyū, who died in 1674, at the age of seventy-three. The close of this long period brought a new style of art, that of the Kôrin school. Ogata Kôrin (1653–1710) is claimed by both the Tosa and Kano schools, but his work bears more resemblance to that of an erratic offshoot of the Kano line named Sotatsu than to the typical work of the academies. He was an artist of eccentric originality, who achieved wonders in bold decorative effects in spite of a studied contempt for detail. It is difficult to know whether he was more genius or charlatan, for he was a sort of Cagliostro in art. As a lacquer painter, however, he left a strong mark upon the work of his contemporaries and successors. His brother and pupil, Kenzan, adopted his style, and left a reputation as a decorator of pottery hardly less brilliant than Kôrin's in that of lacquer; and a later follower, Hôitsu (1762–1828), greatly excelled the master in delicacy and refinement, although inferior to him in vigour and invention.

Down to the end of this era painting was entirely in the hands of a patrician caste—courtiers, priests, feudal nobles and their military retainers, all men of high education, gentle birth, living in a polished circle. It was practised more as a phase of æsthetic culture than with any utilitarian views. It was a labour of love or loving service, untouched by the spirit of material gain, conferring, in its result, upon the work of the older masters a dignity and poetic feeling which we vainly seek in much of the later work. Unhappily, but almost inevitably, over-culture led to a gradual falling-off from the old virility. The strength of Meichô, Sesshiū, Motonobu, and Tanyū gave place to a more or less slavish imitation of the old Japanese painters and their Chinese exemplars, till the heirs to the splendid traditions of the great masters of the past preserved little more than their conventions and shortcomings. It was time for a new departure, but there seemed to be no sufficient strength left within the charmed circle of the orthodox schools, and the new movement was fated to come from the masses, whose voice had hitherto been silent in the art world.

Fourth Period.—A new era in art began in the latter half of the 17th century with the establishment of a popular school under an embroiderer's draughtsman named Hishigawa Moronobu (*circa* 1646–1713). Perhaps no great change is ever entirely a novelty. The old painters of the Yamato-Tosa line had frequently shown something of the daily life around them, and one of the later scions of the school, named Iwasa Matahei, had even made a speciality of this class of motive; but so little is known of Matahei and his work, that even his period is a matter of dispute, and the few pictures attributed to his pencil are open to question on grounds of authenticity. He probably worked some two generations before the time of Moronobu, but there is no reason to believe that his labours had any material share in determining the creation and trend of the new school. Moronobu was a consummate artist, with all the delicacy and caligraphic force of the best of the Tosa masters, whom he undoubtedly strove to emulate in style; and his pictures are not only the most beautiful but the most trustworthy records of the life of his time. It was not to his paintings, however, that he owed his greatest influence, but to the powerful impulse he gave to the illustration of books and broadsides by wood-engravings. It is true that illustrated books were known as early as 1608, if not before, but they were few and unattractive, and did little to inaugurate the great stream of *Ēhon*, or picture books, that were to take so large a share in the education of his own class. It is to him, and to him only, that Japan owes the first development and popularization of artistic wood-engraving, for there was nothing before his series of xylographic albums that approached his best work in strength and beauty, and nothing since that has surpassed it. Later there came abundant aid to the good cause of popular art, partly from pupils of the Kano and Tosa schools, but mainly from the artisan class. Most of these artists were designers for books and broadsides by calling,

Popular school.

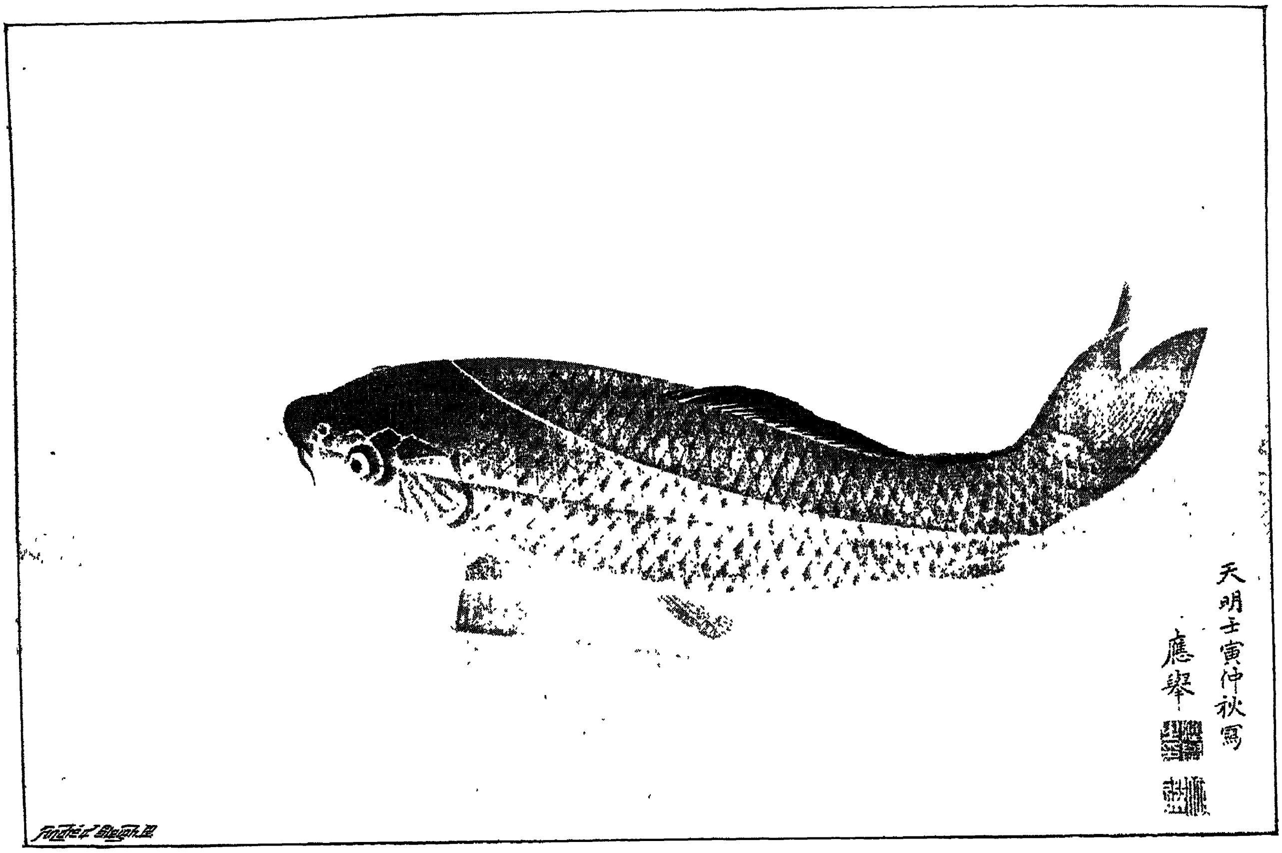
Morning Mists on the River Yodo, Osaka. By Shiwo-Kawa Bunrin (Shijō School).



Dual Landscape. By Kanō Moto-Nōbu.

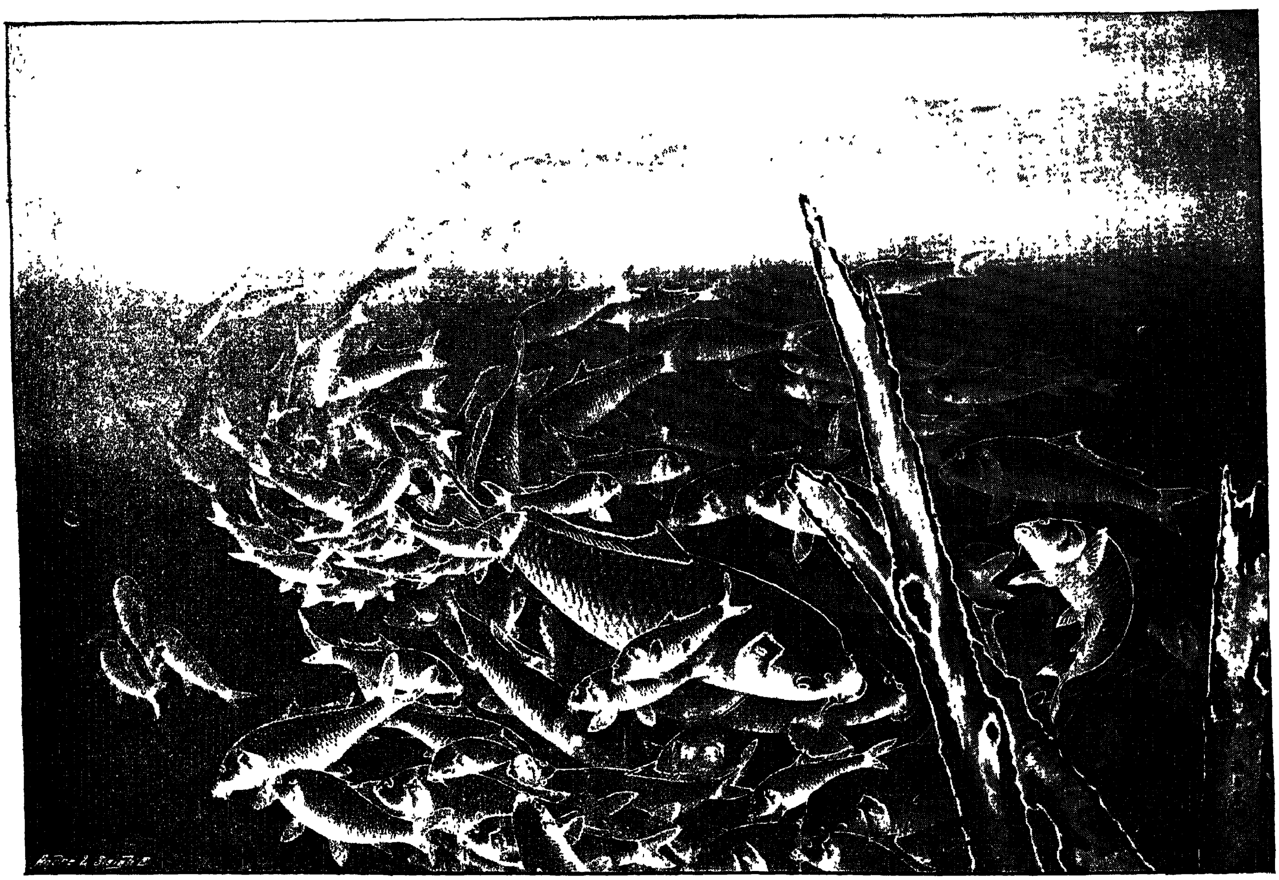
Combining (1) the raining night of the Hsiao-Hsiang district with (2) evening snow-fall over the lake.

Chinese Landscape (in the Manshuin Temple, Kyôtô). By Sesshiū.



Carp in Stream. By Moru-yama Ōkio, 1782 (Shijō School). (*By permission of M. Tomkinson, Esq.*)

(*On silk in colours.*)



The Thousand Carp. By Inagaki.

(*From a picture on silk painted in monochrome.*)

painters only on occasion, but a few of them did nothing for the engravers. The story of these men will be told elsewhere—how engraving in black and white and in colours prospered in their hands down to the present day. Throughout the whole of this period, embracing about a hundred years, there still continued to work, altogether apart from the men who were making the success of popular art, a large number of able painters of the Kano, Tosa, and Chinese schools, who multiplied pictures that had every merit except that of originality. These men, living in the past, paid little attention to the great popular movement, which seemed to be quite outside their social and artistic sphere and scarcely worthy of cultured criticism. It was in the middle of the 18th century that the decorative, but relatively feeble, Chinese art of the later Ming period found favour in Japan and a clever exponent in a painter named Riūrikiô. It must be regarded as a sad decadence from the old Chinese ideals, which was further hastened, from about 1765, by the popularity of the southern Chinese style. This was a weak affectation that found its chief votaries amongst literary men ambitious of an easily-earned artistic reputation. The principal Japanese supporter of this school was Taigadô (1722–1775), but the volume of copies of his sketches, *Taigadô sansui juséki*, published about 1870, is one of the least attractive albums ever printed in Japan.

The *fifth period* was introduced by a movement as momentous as that which stamped its predecessor—the foundation of a naturalistic school under a group of men outside the orthodox academical circles. The naturalistic principle was by no means a new one; some of the old Chinese masters were naturalistic in a broad and noble manner, and their Japanese followers could be admirably and minutely accurate when they pleased, but too many of the latter were content to construct their pictures out of fragmentary reminiscences of ancient Chinese masterpieces, not presuming to see a rock, a tree, an ox, or a human figure, except through Chinese spectacles. It was a farmer's son named Okiô, trained in his youth to paint in the Chinese manner, who was first bold enough to adopt as a canon what his predecessors had only admitted under rare exceptions, the principle of an exact imitation of nature. Unfortunately, even he had not all the courage of his creed, and while he would paint a bird or a fish with perfect realism, he no more dared to trust his eyes in larger motives than did the most devout follower of Shiūbun or Motonobu. He was essentially a painter of the classical schools, with the speciality of elaborate reproduction of detail in certain sections of animal life, but fortunately this partial concession to truth, emphasized as it was by a rare sense of beauty, did large service. Okiô rose into notice about 1775, and a number of pupils flocked to his *atelier* in Shijô Street, Kyôtô (whence the name "Shijô school"). Amongst these the most famous were Goshun (1742–1811), who is sometimes regarded as one of the founders of the school; Sosen (1757–1821), an animal painter of remarkable power, but especially celebrated for pictures of monkey life; Shiūhô, the younger brother of the last, also an animal painter; Rôsetsu (1755–1799), the best landscape painter of his school; Keibun, a younger brother of Goshun, and some later followers of scarcely less fame, notably Hoyen, a pupil of Keibun; Tessan, an adopted son of Sosen; Ippô and Yôsai (1788–1878), well known for a remarkable set of volumes, the *Zenken Kojitsu*, containing a long series of portraits of ancient Japanese celebrities. Ozui and Ojiu, the sons of Okiô, painted in the style of their father, but failed to attain great eminence. Lastly, amongst the associates of the Shijô master was the celebrated Ganku (1798–1837), who developed a special style of his own, and is sometimes regarded as the founder of a distinct school. He was, however, greatly influenced by Okiô's example, and his sons, Gantai, Ganrio, and Gantoku or Renzan, drifted into a manner almost indistinguishable from that of the Shijô school.

Naturalistic school.

It remains only to allude to the European school, if school it can be called, founded by Kokan and Denkichi, two contemporaries of Okiô. These artists, at first educated in one of the native schools, obtained from a Hollander in Nagasaki some training in the methods and principles of European painting, and left a few oil paintings in which the laws of light and shade and perspective were correctly observed. They were not, however, artists of sufficient capacity to render the adopted manner more than a subject of curiosity, except to a few followers who have reached down to the present generation. It is possible that the essays in perspective found in the pictures of Hokusai, Hiroshigé, and some of the popular artists of the 19th century, were suggested by the Kokan's drawings and writings.

European school.

The *sixth period* began about 1875, when an Italian artist was engaged by the Government as a professor of painting in the Engineering College at Tôkyô. Since that time some distinguished European artists have visited Japan, and several Japanese students have made a pilgrimage to Europe to see for themselves what lessons may be gained from Western art, but it is a noteworthy fact that the pictures painted in the foreign style have as yet found little patronage either from native connoisseurs or foreign admirers of Japanese art. The Government, however, has instituted a department of art, and has done invaluable service in protecting the priceless treasures still lying in the temples of Japan. The Emperor extends his personal patronage to living artists who display special ability. Fine-art schools in Tôkyô and Kyôtô are well organized and conducted by talented native professors, and a Society of Oil Painters, *Hakuba Kuwai*, is doing good work. Art exhibitions are held at frequent intervals, and show that the old power both of painting and sculpture is still alive. Two good art magazines, with admirable reproductions of ancient and modern works, are now in course of publication, and two volumes of a large and important collection of copies by photographic and other processes of old masterpieces, edited by some of the leading connoisseurs of the country, appeared in 1901. The future of Japanese art is still "on the knees of the gods," but the art of the past has never found a higher appreciation than at present. The time has not yet come for the almost inevitable revolution, but the change awaits only the man, and it is to be devoutly hoped that when it is accomplished it will preserve all that we most admire in the splendid but incomplete art of the old masters.

(W. AN.)

Glyptic and Applied Art.

Historical Sketch.—The principal forms of modern glyptic art have been referred to in the earlier article, but more recent historical research has shown that sculpture in wood and metal is of ancient date in Japan, and claims a prominent position in the history of the world's art. Its antiquity is not, indeed, comparable to that of ancient Egypt or Greece, but no country in the world besides Japan can boast a living and highly-developed art that has numbered upwards of twelve hundred years of unbroken and brilliant productiveness. Setting aside prehistoric and rudimentary essays in stone and metal, which have their special interest for the antiquary, we have examples of sculpture in wood and metal, magnificent in conception and technique, dating from the earliest periods of what

we may term historical Japan, that is, from near the beginning of the great Buddhist propaganda under the Emperor Kimmei (A.D. 540 to 571) and the princely hierarch, Shôtoku Taishi (573 to 621). It may be here mentioned that stone has never been in favour in Japan as a material for the higher expression of the sculptor's art.

The *first historical period* of glyptic art in Japan reaches from the end of the 6th to the end of the 12th century, culminating in the work of the great Nara sculptors, Unkei and his pupil Kwaikei. Happily, there are still preserved in the great temples of Japan, chiefly in the ancient capital of Nara, many noble relics of these six hundred years, but only a few of the number need be noticed here. The place of honour in the selection may perhaps be conferred upon sculptures in wood, representing the Indian Buddhists, Asangha and Vasabandhu, preserved in the Golden Hall of Kofukuji, Nara. These are attributed to a Kamakura sculptor of the 8th or 9th century, and in simple and realistic dignity of pose and grand lines of composition are not unworthy of comparison with some of the works of ancient Greece. With these may be named the vigorous demon lantern-bearers, so perfect in the grotesque treatment of the diabolical heads and the accurate anatomical forms of the sturdy body and limbs; the colossal Temple Guardians of the great gate of Tôdaiji, by Unkei and Kwaikei (11th century), somewhat conventionalized, but still bearing evidence of direct study from nature, and inspired with intense energy of action; and the smaller but more accurately modelled Temple Guardians in the Saikondo, Nara, which almost compare with the "Fighting Gladiator" in their realization of menacing strength. The "Goddess of Art" of Akishino-dera, Nara, attributed to the 8th century, may be named as the most graceful and least conventional of the female sculptures in Japan, but infinitely remote from the feminine conception of the Greeks. The wooden portrait of Vimalakirtti, attributed to Unkei, at Kofukuji, Nara, has some of the qualities of the images of the two Indian Buddhists. The sculptures attributed to Jôchô, the founder of the Nara school, although powerful in pose and masterly in execution, lack the truth of observation seen in some of the earlier and later masterpieces.

The most perfect of the ancient bronzes is the great image of Bhaichadjyaguru in the temple of Yakushiji, Nara, attributed to a Korean monk of the 7th century, named Giogi. The bronze image of the same divinity at Hôriuji, said to have been cast at the beginning of the 7th century by Tori Busshi, the grandson of a Chinese immigrant, is of good technical quality, but much inferior in design to the former. The colossal Nara Daibutsu (Vairotchana) at Tôdaiji, cast in 749 by a workman of Korean descent, is the largest of the great bronzes in Japan, but ranks far below the Yakushiji image in artistic qualities. The present head, however, is a later substitute for the original, which was destroyed by fire.

The great Nara school of sculpture in wood was founded in the early part of the 11th century by a sculptor of Imperial descent named Jôchô, who is said to have modelled his style upon that of the Chinese wood-carvers of the T'ang dynasty, and his traditions were maintained by his descendants and followers down to the beginning of the 13th century. It is to be noticed that all the artists of this period were men of aristocratic rank and origin, and were held distinct from the carpenter architects of the imposing temples which were to contain their works.

Sacred images were not the only specimens of glyptic art produced in these six centuries; reliquaries, bells, vases, incense-burners, candlesticks, lanterns, decorated arms and armour, and many other objects, showing no less mastery of design and execution, have reached us. Gold and silver had been applied to the adornment of helmets and breastplates from the 7th century, but it was in the 12th century that the decoration reached the high degree of elaboration shown us in the armour of the Japanese Bayard, Yoshitsuné, which is still preserved at Kasuga, Nara.

Wooden masks employed in the ancient theatrical performances were made from the 7th century, and offer a distinct and often grotesque phase of wood-carving. We do not know by what class of sculptors these were executed, but their designs have been carefully preserved and imitated down to the present day.

The *second period* in Japanese glyptic art extends from the beginning of the 13th to the early part of the 17th century. The great struggle between the Taira and Minamoto clans had ended, but the militant spirit was still strong, and brought work for the artists who made and ornamented arms and armour. The Miôchins, a line that claimed ancestry from the 7th century A.D., were at the head of their calling, and their work in iron breastplates and helmets, chiefly in repoussé, is still unrivalled. It was not until the latter half of the 15th century that there came into vogue the elaborate decoration of the sword, a fashion that was to last four hundred years. The metal guard (*tsuba*), made of iron or precious alloy, was adorned with engraved designs, often inlaid with gold and silver. The free end of the hilt was crowned with a metallic cap or pommel (*kashira*), the other extremity next the *tsuba* was embraced by an oval ring (*fuchi*), and in the middle was affixed on each side a special ornament called the *mênuki*, all adapted in material and workmanship to harmonize with the guard. The *kodzuka* or handle of a little knife implanted into the sheath of the short sword or dagger was also of metal and engraved with like care. The founder of the first great line of *tsuba* and *mênuki* artists was Gotô Yûjô (1440–1512), a friend of the painter Kano Motonobu, whose designs he adopted. Many families of sword artists sprang up at a later period, the Nara, Hirata, Hamano, Omori, and Umétada lines furnishing treasures for the collector even down to the present day, and their labours reached a level of technical mastery and refined artistic judgment almost without parallel in the art industries of Europe. The men by whom these beautiful works were executed, like the makers of the blade, were members of the military caste. Buddhist sculpture was by no means neglected during this period, but there are few works that call for special notice. The most noteworthy effort was the casting by Ono Goroyémon in 1252 of the well-known bronze image, the Kamakura "Daibutsu."

The *third period* includes the 17th, 18th, and the greater part of the 19th centuries. It was the era of the artisan artist. The makers of Buddhist images and of sword ornaments carried on their work with undiminished industry and success, and some famous schools of the latter, notably the Nara, Hirata, Hamano, and Omori lines, arose during this period. The Buddhist sculptors, however, tended to grow more conventional and the metal-workers more naturalistic as the 18th century began to wane. It was in connexion with architecture that the great artisan movement began. The initiator was Hidari Jingoro (1594–1652), at first a simple carpenter, afterwards one of the most famous sculptors in a land of great artists. The gorgeous decoration of the mausoleum of Iyéyasu at Nikkô, and of the gateway of the Nishi Hongwanji temple at Kyôtô, are the most striking instances of his handiwork or direction. The pillars, architraves, ceilings, panels, and almost every available part of the structure, are covered with arabesques and sculptured figures of dragons, lions, tigers, birds, flowers, and even pictorial compositions with landscape and figures, deeply carved in solid or open work—the wood

Vadrapâni. By Kwaikei.

(*Sculpture in wood.*)

Two Sages. By Kanō Masa-Nōbu (1424-1520)

(*Collection of Viscount Ikimoto, Tôkyô.*)

Asanga. By an 8th-century Kamakura Sculptor.

(*Sculpture in wood.*)

sometimes plain, sometimes overlaid with pigment and gilding, as in the panelled ceiling of the chapel of Iyéyasu in Tôkyô. The designs for these decorations, like those of the sword ornaments, were adopted from the masters of the great schools of painting, but the invention of the sculptor was by no means idle. It was from this time that the temple carvers, although still attached to the carpenters' guild, took a place apart from the rest of their craft, and the genius of Hidari Jingoro secured for one important section of the artisan world a recognition like that which Hishigawa Moronobu, the painter and book illustrator, a few generations afterwards won for another.

A little later arose another art industry, also emanating from the masses. The use of tobacco, which became prevalent in the 17th century, necessitated the pouch. In order to suspend this from the girdle there was employed a kind of button or toggle—the *nêtsukê*. The metallic bowl and mouthpiece of the pipe offered a tempting surface for embellishment, as well as the clasp of the pouch; and the *nêtsukê*, being made of wood, ivory, or other material susceptible of carving, also gave occasion for art and ingenuity. The *nêtsukê*, indeed, was not entirely new, for it had been employed as a pendant to the *inro*, or medicine-box, from the time of Ashikaga Yoshimasa (1444–1473), but it had not come into general use. The carver, a clever artisan, did not feel bound to follow traditional models as the temple sculptors did, but, light-hearted fellow as he was, he liked to produce comic and cheery images, or simple objects that daily familiarity had endeared to him; and when he took up classical or religious themes he treated them in his own manner, never fearing to sacrifice dignity to humour. The engravers of pipes, pouch clasps, and the metallic discs (*kagami-buta*) attached to certain *nêtsukês*, sprang from the same class, and were little more serious and not less original. They worked, too, with a skill little inferior to that of the Gotôs, Naras, and other aristocratic sculptors of sword ornaments, and often with a refinement which their relative disadvantages in education and associations render especially remarkable. The *nétsuké* and the pipe, with all that pertained to it, were for the commoners what the sword hilt and guard were for the gentry. Neither class cared to bestow jewels upon their persons, but neither spared thought or expense in the embellishment of the object they most loved. The most honoured names amongst *nétsuké*-carvers are those of Shiūzan and Démé-Uman.

The final manifestation of popular glyptic art was the *okimono*, an ornament pure and simple, or one in which utility was altogether secondary in intention to decorative effect. The manufacture as a special branch of art work dates from the rise of the naturalistic school of painting and the great expansion of the popular school under the Katsugawas, but the *okimono* was not altogether a modern innovation, for it formed an occasional amusement of the older glyptic artists from remote times. Some of the most exquisite and most ingenious of these earlier productions, such as the magnificent iron eagle in the South Kensington Museum, the wonderful articulated models of crayfish, dragons, serpents, birds, that are found in many European collections, came from the *ateliers* of the Miôchins; but these were the play of giants, and were not made as articles of commerce. The new artisan makers of the *okimono* struck out a line for themselves, one influenced more by the naturalistic and popular schools than by the classical art, and the quails of Kaméjo, the tortoises of Seimin, the dragons of Tôün and Tôriū, and in recent years the falcons and the peacocks of Susuki Chôkichi, are the joy of the European collector. These are usually modelled in wax and cast in bronze and various other alloys, and sometimes in pure silver, and finished, if necessary, with the chisel and graver; they are sometimes fashioned in *repoussé* with the hammer. The best of these are exquisite in workmanship, graceful in design, often strikingly original in conception, and usually naturalistic in ideal. They constitute a phase of art in which Japan has few rivals.

The present generation is more systematically commercial in its glyptic produce than any previous age. Millions of *articles de commerce* in metal work, wood, and ivory flood the European markets, and may be bought in any street in Europe at a small price, but they offer a variety of design and an excellence of workmanship which place them almost beyond Western competition. Above all this, however, the Japanese sculptor is a force in art. He is nearly as thorough as his forefathers, and maintains the same love of all things beautiful; and if he cannot show any epoch-making novelty, he is at any rate doing his best to support unsurpassed the decorative traditions of the past.

(W. AN.)

Modern Developments of Applied Art.

Metal Work.—There is a radical difference between the point of view of the Japanese connoisseur and the point of view of the Western connoisseur in estimating the merits of sculpture on metal. The quality of the chiselling is the first feature to which the Japanese directs his attention; the decorative design is the prime object of the Occidental's attention. With very rare exceptions, the decorative methods of Japanese sword furniture were always supplied by painters. Hence it is that the Japanese connoisseur draws a clear line of distinction between the decorative design and its technical execution, crediting the former to the pictorial artist and the latter to the sculptor. He detects in the stroke of a chisel and the lines of a graving tool subjective beauties which appear to be hidden from the great majority of Western dilettanti. He estimates the rank of a specimen by the quality of the chisel work. The Japanese *kinzoku-shi* (metal sculptor) used thirty-six principal classes of chisel, each with its distinctive name, and as most of these classes comprised from five to ten sub-varieties, his cutting and graving tools aggregated about two hundred and fifty.

The field for sculptured decoration.

Scarcely less important in Japanese eyes than the chiselling of the decorative design itself is the preparation of the field to which it is applied. There used to be a strict canon with reference to this in former times. *Namako* (fish-roe) grounds were counted *de rigueur* for the mountings of swords worn on ceremonial occasions, the *ishime* (stone-pitting) or *jimigaki* (polished) styles being considered less aristocratic. As a broad definition, it may be said that *namako* is obtained by punching the whole surface—except the portion carrying the decorative design—into a texture of microscopic dots. The first makers of *namako* did not aim at regularity in the distribution of these dots; they were content to produce the effect of millet-seed sifted haphazard over the surface. But from the 15th century the punching of the dots in rigidly straight lines came to be considered essential, and the difficulty involved in this *tour de force* was so great that *namako*-making took its place among the highest achievements of the sculptor. When it is remembered that the punching tool was guided solely by the hand and eye, and that three or more blows of the mallet had to be struck for every dot, some conception may be formed of the patience and accuracy needed to produce these tiny protuberances in perfectly straight lines, at exactly equal intervals and of absolutely uniform size. *Namako* disposed in straight parallel lines originally ranked at the head of this kind of work. But a new kind was intro-

duced in the 16th century. It was obtained by punching the dots into intersecting lines, so arranged that the dots fell uniformly into diamond-shaped groups of five each. This is called *go-no-me namako*, because of its resemblance to the disposition of chequers in the Japanese game of *go*. A century later, the *daimyo namako* was invented, in which lines of dots alternated with lines of polished ground. As for *ishime*, it may be briefly described as diapering. There is scarcely any limit to the ingenuity and skill of the Japanese expert in diapering a metal surface. A Tôkyô collector possesses a silver teapot having its surface recessed in forty leaf-shaped panels, each filled with a different diaper of extraordinarily minute and delicate workmanship. It is not possible to enumerate here even the principal styles of *ishime*, but mention may be made of the *zara-maki* (broad-cast), in which the surface is finely but irregularly pitted after the manner of the face of a stone; the *nashiji* (pear-ground), in which we have a surface like the rind of a pear; the *hari-ishime* (needle *ishime*), where the indentations are so minute that they seem to have been made with the point of a needle; the *gama-ishime*, which is intended to imitate the skin of a toad (*gama*); the *tsuya-ishime*, produced with a chisel sharpened so that its traces have a lustrous (*tsuya*) appearance; the *ore-kuchi* (broken tool), a peculiar kind obtained with a jagged tool; and the *gozamê*, which resembles the plaited surface of a fine straw mat.

Great importance has always been attached by Japanese experts to the patina of metal used for artistic chiselling. It was mainly for the sake of their patina that value attached to the remarkable alloys *shakudo* (3 parts of gold to 97 of copper) and *shibuichi* (1 part of silver to 3 of copper). Neither metal, when it emerges from the furnace, has any beauty, *shakudo* being simply dark-coloured copper, and *shibuichi* pale gun-metal. But after proper treatment[1] the former develops a glossy black patina with violet sheen, and the latter shows beautiful shades of gray with silvery lustre. Both these compounds afford delicate, unobtrusive, and effective grounds for inlaying with gold, silver, and other metals, as well as for sculpture, whether incised or in relief. Copper, too, by patina-producing treatment, is made to show not merely a rich golden sheen with pleasing limpidity, but also red of various hues, from deep coral to light vermilion, several shades of gray, and browns of numerous tones from dead-leaf to chocolate. Even greater value has always been set upon the patina of iron, and many secret recipes were preserved in artist families for producing the fine, satin-like texture so much admired by all connoisseurs.

Patina.

In Japan, as in Europe, three varieties of relief carving are distinguished—*alto* (*taka-bori*), *mezzo* (*chiuniku-bori*), and *basso* (*usuniku-bori*). But it may be added that, in the opinion of the Japanese expert, these styles hold the same respective rank as that occupied by the three kinds of ideographic script in the realm of caligraphy. High relief carving corresponds to the *kaisho*, or most classical form of writing; medium relief to the *gyosho*, or semi-cursive style; and low relief to the *sosho* or grass character. With regard to incised chiselling, the commonest form is "hair-carving" (*kebori*), which may be called engraving, the lines being of uniform thickness and depth. Very beautiful results are obtained by the *kebori* method, but incomparably the finest work in the incised class is that known as *kata-kiri-bori*. In this kind of chiselling the Japanese artist can claim to be unique as well as unrivalled. Evidently the idea of the great Yokoya experts, the originators of the style, was to break away from the somewhat formal monotony of ordinary engraving, where each line performs exactly the same function, and to convert the chisel into an artist's brush instead of using it as a common cutting tool. They succeeded admirably. In the *kata-kiri-bori* every line has its proper value in the pictorial design, and strength and directness become cardinal elements in the strokes of the burin just as they do in the brushwork of the picture painter. The same fundamental rule applied, too, whether the field of the decoration was silk, paper, or metal. The artist's tool, be it brush or burin, must perform its task by one effort. There must be no appearance of subsequent deepening, or extending, or recutting, or finishing. *Kata-kiri-bori* by a great expert is a delight. One is lost in astonishment at the nervous yet perfectly regulated force and the unerring fidelity of every trace of the chisel. Another variety of carving much affected by artists of the 17th century, and now largely used, is called *shishi-ai-bori*, or *niku-ai-bori*. In this style the surface of the design is not raised above the general plane of the field, but an effect of projection is obtained either by recessing the whole space immediately surrounding the design, or by enclosing the latter in a scarped frame. Yet another and a very favourite method, giving beautiful results, is to model the design on both faces of the metal so as to give a sculpture in the round. This fashion is always accompanied by chiselling *à jour* (*sukashi-bori*), so that the sculptured portions stand out in their entirety.

Methods of chiselling.

Inlaying with gold or silver was among the early forms of decoration in Japan, but the skill developed in modern times is at least equal to anything which the past can show, and the results produced are much more imposing. There are two principal kinds of inlaying: the first called *hon-zogan* (true inlaying), the second *nunome-zogan* (linen-mesh inlaying). As to the former, the Japanese method does not differ from that seen in the beautiful iron censers and vases inlaid with gold which the Chinese produced from the *Shuntieh* era (1426–36). In the surface of the metal the workman cuts grooves wider at the base than at the top, and then hammers into them gold or silver wire. Such a process presents no remarkable features, except that it has been carried by the Japanese to an extraordinary degree of elaborateness. The *nunome-zogan* is more interesting. Suppose, for example, that the artist desires to produce an inlaid diaper. His first business is to chisel the surface in lines forming the basic pattern of the design. Thus, for a diamond-petal diaper the chisel is carried across the face of the metal horizontally, tracing a number of parallel bands divided at fixed intervals by ribs which are obtained by merely straightening the chisel and striking it a heavy blow. The same process is then repeated in another direction, so that the new bands cross the old at an angle adapted to the nature of the design. Several independent chisellings may be necessary before the lines of the diaper emerge clearly, but throughout the whole operation no measurement of any kind is taken, the artist being guided entirely by his hand and eye. The metal is then heated, not to redness, but sufficiently to develop a certain degree of softness, and the workman, taking a very thin sheet of gold (or silver), hammers portions of it into the salient points of the design. In ordinary cases this is the sixth process. The seventh is to hammer gold into the outlines of the diaper: the eighth, to hammer it into the pattern filling the spaces between the lines, and the ninth and tenth to complete the details. Of course the more intricate the design the more numerous the processes. It is scarcely possible to imagine a higher effort of hand and

Inlaying.

[1] It is first boiled in a lye obtained by lixiviating wood ashes; it is next polished with charcoal powder; then immersed in plum vinegar and salt; then washed with weak lye and placed in a tub of water to remove all traces of alkali, the final step being to digest in a boiling solution of copper sulphate, verdigris, and water.

eye than this *nunome-zogan* displays, for while intricacy and elaborateness are carried to the very extreme, absolute mechanical accuracy is obtained. Sometimes in the same design we see gold of three different hues, obtained by varying the alloy. A third kind of inlaying, peculiar to Japan, is *sumi-zogon* (ink-inlaying), so called because the inlaid design gives the impression of having been painted with Indian ink beneath the transparent surface of the metal. The difference between this process and ordinary inlaying is that for *sumi-zogan* the design to be inlaid is fully chiselled out of an independent block of metal with sides sloping so as to be broader at the base than at the top. The object which is to receive the decoration is then channelled in dimensions corresponding to those of the design block, and the latter having been fixed in the channel, the surface is ground and polished until absolute intimacy seems to be obtained between the inlaid design and the metal forming its field. Very beautiful effects are thus produced, for the design seems to have grown up to the surface of the metal field rather than to have been planted in it. *Shibuichi* inlaid with *shakudo* used to be the commonest combination of metals in this class of decoration, and the objects usually depicted were bamboos, crows, wild-fowl under the moon, peony sprays, and so forth.

Wood-grained grounds.

A variety of decoration much practised by early experts and carried to a high degree of excellence in modern times, is called *mokume-ji*, or wood-grained ground. The process in this case is to take a thin plate of iron—if iron is the metal to be treated—and beat it into another plate of similar metal, so that the two, though welded together, retain their separate forms. The mass, while still hot, is coated with *hena-tsuchi* (a kind of marl) and rolled in straw ash, in which state it is roasted over a charcoal fire raised to glowing heat with the bellows. The clay having been removed, another plate of metal is beaten in, and the same process is repeated. This is done several times, the number depending on the quality of graining that the expert desires to produce. The manifold plate is then heavily punched from one side, so that the opposite face protrudes in broken blisters, which are then hammered down until each becomes a centre of wave propagation. In fine work the apex of the blister is ground off before the final hammering. Iron was the metal used exclusively for work of this kind down to the 16th century, but various metals began thenceforth to be combined. Perhaps the choicest variety is gold graining in a *shakudo* field. By repeated hammering and polishing the expert obtains such control of the wood-grain pattern that its sinuosities and eddies seem to have developed symmetry without losing anything of their fantastic grace. There are other methods of producing *mokume-ji*, but their details may be omitted here.

Modern and ancient skill.

It has been frequently asserted by Western critics that the year (1876) which witnessed the abolition of sword-wearing in Japan, witnessed also the end of her artistic metal work. That is a great mistake. The art has merely developed new phases in modern times. Not only are its masters as skilled now as they were in the days of the Gotô, the Nara, the Yokoya, and the Yanagawa celebrities, but also their productions must be called greater in many respects and more interesting than those of their renowned predecessors. They no longer devote themselves to the manufacture of sword ornaments, but work rather at vases, censers, statuettes, plaques, boxes, and other objects of a serviceable or ornamental nature. All the processes described above are practised by them with full success, and they have added others quite as remarkable. Of these, one of the most interesting is called *kiribame* (insertion). The decorative design having been completely chiselled in the round, is then fixed in a field of a different metal, in which a design of exactly similar outline has been cut out *en bloc*. The result is that the picture has no blank reverse. For example, on the surface of a *shibuichi* box-lid we see the backs of a flock of geese chiselled in silver, and when the lid is opened, their breasts and the undersides of their pinions appear. The difficulty of such work is plain. Microscopic accuracy has to be attained in cutting out the space for the insertion of the design, and while the latter must be soldered firmly in its place, not the slightest trace of solder or the least sign of junction must be discernible between the metal of the inserted picture and that of the field in which it is inserted. Suzuki Gensuke is the inventor of this method. He belongs to a class of experts called *uchimono-shi* (hammerers) who perform preparatory work for glyptic artists in metal. The skill of these men is often wonderful. Using the hammer only, some of them can beat out an intricate shape as truly and delicately as a sculptor could carve it with his chisels. Ohori Masatoshi, an *uchimono-shi* of Aizu (died 1897), made a silver cake-box in the form of a sixteen-petalled chrysanthemum. The shapes of the body and lid corresponded so intimately that whereas the lid could be slipped on easily and smoothly without any attempt to adjust its curves to those of the body, it always fitted so closely that the box could be lifted by grasping the lid only. Another feat of his was to apply a lining of silver to a *shakudo* box by shaping and hammering only, the fit being so perfect that the lining clung like paper to every part of the box. Suzuki Gensuke and Hirata Sôkô are scarcely less expert. The latter once exhibited in Tôkyô a silver game-cock with soft plumage and surface modelling of the most delicate character. It had been made by means of the hammer only. Suzuki's *kiribame* process is not to be confounded with the *kiribame-zogan* (inserted inlaying) of Tôyôda Kokô, also a modern artist. The gist of the latter method is that a design chiselled *à jour* has its outlines veneered with other metal which serves to emphasize them. Thus, having pierced a spray of flowers in a thin sheet of *shibuichi*, the artist fits a slender rim of gold, silver, or *shakudo* into the petals, leaves, and stalks, so that an effect is produced of transparent blossoms outlined in gold, silver, or purple. Another modern achievement—also due to Suzuki Gensuke—is designated *maze-gane* (mixed metals). It is a singular conception, and the results obtained depend largely on chance. *Shibuichi* and *shakudo* are melted separately, and when they have cooled just enough not to mingle too intimately, they are cast into a bar which is subsequently beaten flat. The plate thus obtained shows accidental clouding, or massing of dark tones, and these patches are taken as the basis of a pictorial design to which final character is given by inlaying with gold and silver, and by *katakiri* sculpture. Such pictures partake largely of the impressionist character, but they attain much beauty in the hands of the Japanese artist with his extensive repertoire of suggestive symbols. A process resembling *maze-gane*, but less fortuitous, is *shibuichi-dôshi* (combined *shibuichi*), which involves beating together two kinds of *shibuichi* and then adding a third variety, after which the details of the picture are worked in as in the case of *maze-gane*. The charm of these methods is that certain parts of the decorative design seem to float, not on the surface of the metal, but actually within it, an admirable effect of depth and atmosphere being thus produced. Mention must also be made of an extraordinarily elaborate and troublesome process invented by Kajima Ippu, a really great artist of the present day. It is called *togi-dashi-zogan* (ground-out inlaying). In this exquisite and in-

genious kind of work—the technical details of which are too complicated to set down here—the design appears to be growing up from the depths of the metal, and a delightful impression of atmosphere and water is obtained. All these processes, as well as that of *repoussé*, in which the Japanese have excelled from a remote period, are now practised with the greatest skill in Tôkyô, Kyôtô, Osaka, and Kaga. At the art exhibitions held semi-annually in the principal cities there may be seen specimens of statuettes, alcove ornaments, and household utensils which reach a strikingly high level of ability, and show that the Japanese worker in metals stands more indisputably than ever at the head of the world's artists in that field. The Occident does not yet appear to have fully realized the existence of such talent in Japan, partly perhaps because its displays in former times were limited chiefly to sword-furniture, insignificant objects possessing little interest for the average European or American; and partly because the Japanese have not yet learned to adapt their skill to foreign requirements. They confine themselves at present to decorating plaques, boxes and cases for cigars or cigarettes, and an occasional tea or coffee service, but the whole domain of salvers, dessert-services, race-cups, and so on remains virtually unexplored. Only within the past few years have stores been established in the foreign settlements for the sale of silver utensils, and already the workmanship on these objects displays palpable signs of the deterioration which all branches of Japanese art have undergone in the attempt to cater for foreign taste. In the general sense the European or American is a much less exacting connoisseur than the Japanese. Broad effects of richness and splendour captivate the former, whereas the latter looks for delicacy of finish, accuracy of detail, and, above all, evidences of artistic competence. It is nothing to a Japanese that a vase should be covered with profuse decoration of flowers and foliage: he requires that every blossom and every leaf shall be instinct with vitality, and the comparative costliness of fine workmanship does not influence his choice. But if the Japanese sculptor adopted such standards in working for the *clientèle* which he finds in the foreign settlements, his market would be reduced to very narrow dimensions. He therefore adapts himself to his circumstances, and using the mould rather than the chisel, produces specimens which show tawdry handsomeness and are attractively cheap. It must be admitted, however, that even though the appreciative faculty were sufficiently educated on the foreign side, the Japanese artist in metals would still labour under a great difficulty, that of devising shapes to take the place of those which Europe and America have learned to consider classical.

Bronze casting. Bronze is called by the Japanese *kara-kane*, a term signifying "Chinese metal" and showing clearly the source from which knowledge of the alloy was obtained. It is a copper-lead-tin compound, the proportions of its constituents varying from 72 to 88 per cent. of copper, from 4 to 20 per cent. of lead, and from 2 to 8 per cent. of tin. There are also present small quantities of arsenic and antimony, and zinc is found generally as a mere trace, but sometimes reaching to 6 per cent. Gold is supposed to have found a place in ancient bronzes, but its presence has never been detected by analysis, and of silver not more than 2 per cent. seems to have been admitted at any time. Mr W. Gowland has shown that, whatever may have been the practice of Japanese bronze-makers in ancient and mediæval eras, their successors in later days deliberately introduced arsenic and antimony into the compound in order to harden the bronze without impairing its fusibility, so that it took a sharper impression of the mould. Japanese bronze is well suited for castings, not only because of its low melting-point, great fluidity, and capacity for taking sharp impressions, but also because it has a particularly smooth surface and readily develops a fine patina. One variety deserves special mention. It is a golden yellow bronze, called *sentoku*—this being the Japanese pronunciation of Shuntieh, the era of the Ming dynasty when this compound was invented. Copper, tin, lead, and zinc, mixed in various proportions by different experts, are the ingredients, and the beautiful golden hues and glossy texture of the surface are obtained by patina-producing processes, in which branch of metal work the Japanese show altogether unique skill.

From the time when they began to cast bronze statues, Japanese experts understood how to employ a hollow, removable core round which the metal was run in a skin just thick enough for strength without waste of material; and they also understood the use of wax for modelling purposes. In ordinary circumstances, a casting thus obtained took the form of a shell without any break of continuity. But for very large castings the process had to be modified. The great image of Lochana Buddha at Nara, for example, would measure 138 feet in height were it standing erect, and its weight is about 550 tons. The colossal Amida at Kamakura has a height only 3 feet less. It would have been scarcely possible to cast such statues in one piece *in situ*, or, if cast elsewhere, to transport them and elevate them on their pedestals. The plan pursued was to build them up gradually in their places by casting segment after segment. Thus, for the Nara *Dai Butsu*, the mould was constructed in a series of steps ascending 12 inches at a time, until the head and neck were reached, which, of course, had to be cast in one shell, 12 feet high.

The term "parlour bronzes" serves to designate objects for domestic use, as flower-vases, incense-burners, and alcove ornaments. To the manufacture of these objects bronze-casters began to turn their attention about the middle of the 17th century. Not until that epoch did the art of casting bronze become so refined and delicate that its products could rank with the forged and chiselled works of earlier eras, and it is generally supposed to have reached its culmination in the hands of a group of great experts—Seimin, Tôun, Masatune, Teijô, Sômin, Keisai, Takusai, Gido, Zenriusai, and Hotokusai—who flourished during the second half of the 18th century and the first half of the 19th. Many brilliant specimens of these men's work survive, their general features being that the motives are naturalistic, that the quality of the metal is exceptionally fine, that in addition to beautifully clear casting obtained by highly skilled use of the *cera-perduta* process, the chisel was employed to impart delicacy and finish to the design, and that modelling in high relief is most successfully introduced. But it is a mistake to assert, as many have asserted, that after the era of the above ten masters—the latest of whom, Sômin, ceased to work in 1871—no bronzes comparable with theirs were cast. Between 1875 and 1879 some of the finest bronzes, probably the very finest of their kind ever produced in Japan, were turned out by a group of experts working in combination under the firm name of "Sanseisha." Started by two brothers, Oshima Katsujiro (art-name Jôun), and Oshima Yasutaro (art-name Shôkaku), this association secured the services of a number of skilled chisellers of sword-furniture, who had lost their *métier* owing to the abandonment of the sword-wearing custom. Nothing could surpass the delicacy of the works executed at the Sanseisha's atelier in Tôkyô, but unfortunately such productions were above the standard of the customers for whom they were intended. Foreign buyers, who alone stood in the market at that time, failed to distinguish the

fine and costly bronzes of Jôun, Shôkaku, and their colleagues from cheap imitations which soon began to compete with them, so that ultimately the Sanseisha had to be closed. This page in the modern history of Japan's bronzes needs little alteration to become true of her applied art in general. Foreign demand has shown so little discrimination that experts, finding it impossible to obtain adequate remuneration for first-class work, have been obliged to abandon the field altogether, or to lower their standard to the level of general appreciation, or, by forgery, to cater for the perverted taste which attaches unreasoning value to age. Jôun has produced, and is thoroughly capable of producing, bronzes at least equal to the best of Seimin's masterpieces, yet he has often been induced to put Seimin's name on objects for the sake of attracting buyers who attach more value to cachet than to quality. If to the names of Jôun and his brilliant pupil Riuki we add those of Suzuki Chôkichi, Okazaki Sessei, Hasegawa Kumazo, Kanaya Gorosaburo, and Jômi Eisuke, we have a group of modern bronze-casters who unquestionably surpass the ten experts beginning with Seimin and ending with Sômin. Okazaki Sessei has successfully achieved a task previously beyond the strength of his country's experts, the casting of huge panels carrying designs in high relief; and whether there is question of patina or of workmanship, Jômi Eisuke has never been surpassed.

Occidental influence has been felt, of course, in the field of modern bronze-casting. At a school of art officially established in Tôkyô in 1873 under the direction of Italian teachers—a school which owed its signal failure partly to the incompetence and intemperate behaviour of some of its foreign professors, partly to a strong renaissance of pure Japanese classicism—one of the few accomplishments successfully taught was that of modelling in plaster and chiselling in marble after Occidental methods. Marble statues are out of place in the wooden buildings as well as in the parks of Japan, and even plaster busts or groups, though less incongruous perhaps, have not yet found favour. Hence the skill undoubtedly possessed by several graduates of the defunct art school has to be devoted chiefly to a subordinate purpose, namely, the fashioning of models for metal-casters. To this combination of modellers in European style and metal-workers of such force as Suzuki and Okazaki, Japan owes various memorial bronzes and likeness effigies which are gradually finding a place in her parks, her museums, her shrines, or her private houses. There is here little departure from the well-trodden paths of Europe. Studies in drapery, prancing steeds, ideal poses, heads with fragments of torsos attached (in extreme violation of true art), crouching beasts of prey—all the stereotyped styles are reproduced. The imitation is excellent. That is all that can yet be said, though some of these works suggest that Japanese artists will by and by attain distinction in the new field.

Occidental influence.

Wood and Ivory Carving.—Among the artists of early times it is often perplexing to distinguish between the carver of wood and the caster of bronze. The latter sometimes made his own models in wax, sometimes chiselled them in wood, and sometimes had recourse to a specialist in wood-carving. The group of splendid sculptors in wood that graced the 11th, 12th, and 13th centuries left names never to be forgotten, but undoubtedly many other artists of scarcely less force regarded bronze-casting as their principal business. Thus the story of wood-carving is very difficult to trace. Even in the field of architectural decoration for interiors, tradition tells us scarcely anything about the masters who carved such magnificent works as those seen in the Kyôtô temples, the Tokugawa mausolea, and some of the old castles. There are, however, no modern developments of such work to be noted. The ability of former times exists and is exercised in the old way, though the field for its employment has been greatly narrowed.

When Japanese sculpture in wood or ivory is spoken of, the first idea that presents itself is connected with the *nétsuké*, which, of all the art objects found in Japan, is perhaps the most essentially Japanese. If Japan had given us nothing but the *nétsuké*, we should still have no difficulty in differentiating the bright versatility of her national genius from the comparatively sombre, mechanic, and unimaginative temperament of the Chinese. But the *nétsuké* may now be said to be a thing of the past. The *inro* (medicine-box), which it served to fix in the girdle, has been driven out of fashion by the new civilization imported from the West, and artists who would have carved *nétsuké* in former times now devote their chisels to statuettes and alcove ornaments. It is not to be inferred, however, though it is a favourite assertion of collectors, that no good *nétsuké* have been made in modern times. That theory is based upon the fact that after the opening of the country to foreign intercourse in 1857, hundreds of inferior specimens of *nétsuké*—ceasing on the one hand to be valued by the Japanese themselves, and becoming on the other objects of curiosity and admiration to foreigners—were chiselled by inexpert hands, purchased wholesale by treaty-port merchants, and sent to New York, London, and Paris, where, though they brought profit to the exporter, they also disgusted the connoisseur and soon earned discredit for their whole class. But in fact the glyptic artists of Tôkyô, Osaka, and Kyôtô, though, as has been said above, they now devote their chisels chiefly to works of more importance than the *nétsuké*, are in no sense inferior to their predecessors of feudal days, and many beautiful *nétsuké* bearing their signatures are in existence. As for the modern ivory statuette or alcove ornament, of which great numbers are now carved for the foreign market, it certainly stands on a plane much higher than the *nétsuké*, since anatomical defects, which escape notice in the latter owing to its diminutive size, become painfully obtrusive in the former. It may confidently be said, therefore, of the modern Japanese sculptor in ivory that since, on the whole, he succeeds in avoiding such defects, he is a greater artist than the *nétsuké*-carver of former times.

Nétsuké-*carvers.*

One of the most remarkable developments of figure sculpture in former Japan was due to Matsumoto Kisaburo (1830–69). He carved human figures with as much accuracy as though they were destined for purposes of surgical demonstration. Considering that this man had neither art education nor anatomical instruction, and that he never enjoyed an opportunity of studying from a model in a studio, his achievements were remarkable. He and the craftsmen of the school he established completely refute the theory that the anatomical solecisms commonly seen in the works of Japanese sculptors are due to faulty observation. Without scientific training of any kind Matsumoto and his followers produced works in which the eye of science cannot detect any error. But it is impossible to admit within the circle of high-art productions these wooden figures of everyday men and women, unrelieved by any subjective element, and owing their merit entirely to the fidelity with which their contours are shaped, their muscles modelled, and their anatomical proportions preserved. They have not even the attraction of being cleanly sculptured in wood, but are covered with thinly lacquered muslin, which, though doubtless a good preservative, accentuates their puppet-like character. Nevertheless, Matsumoto's figures marked an epoch in Japanese wood

The realistic departure.

sculpture. Their vivid realism appealed strongly to the taste of the average foreigner. A considerable school of carvers soon began to work in the Matsumoto style, and hundreds of their productions have gone to Europe and America, finding no market in Japan.

The semi-foreign school.

Midway between the Matsumoto school and the pure style approved by native taste in former times stand a number of wood-carvers headed by Takamura Kôun, who occupies in the field of sculpture much the same place as that held by Hashimoto Gaho in the realm of painting. Kôun carves figures in the round which not only display great power of chisel and breadth of style, but also tell a story not necessarily drawn from the motives of the classical school. This departure from established canons must be traced to the influence of the short-lived academy of Italian art established by the Japanese Government early in the *Meiji* era. In the forefront of the new movement are to be found men like Yoneharu Unkai and Shinkai Taketaro, the former of whom chiselled a figure of Jenner for the Medical Association of Japan when they celebrated the centenary of the great physician, and the latter has carved life-size effigies of two Imperial princes who lost their lives in the war with China (1894–95). The artists of the Kôun school, however, do much work which appeals to emotions in general rather than to individual memories. Thus Arakawa Reiun, one of Kôun's most brilliant pupils, exhibited a figure of a swordsman in the act of driving home a furious thrust. The weapon is not shown. Reiun sculptured simply a man poised on the toes of one foot, the other foot raised, the arm extended, and the body straining forward in strong yet elastic muscular effort. This carving emphasizes the advantage of not working from a model. A posed figure could not possibly suggest the alert vitality and high muscular tension of the swordsman. A more imaginative work by the same artist is a figure of a farmer who has just shot an eagle that swooped upon his grandson. The old man holds his bow still raised. Some of the eagle's feathers, blown to his side, suggest the death of the bird; at his feet lies the corpse of the little boy, and the horror, grief, and anger that such a tragedy would inspire are depicted with striking realism in the farmer's face. Such work has very close affinities with Occidental conceptions. The chief distinguishing feature is that the glyptic character is preserved at the expense of surface finish. The undisguised touches of the chisel tell a story of technical force and directness which could not be suggested by perfectly smooth surfaces. To subordinate process to result is the European canon; to show the former without marring the latter is the Japanese ideal. Many of Kôun's sculptures appear unfinished to eyes trained in Occidental galleries, whereas the Japanese connoisseur detects evidence of a technical feat in their seeming roughness.

Textile Fabrics.—In no branch of applied art does the decorative genius of Japan show more attractive results than in that of textile fabrics, and in none has there been more conspicuous progress during recent years. Her woven and embroidered stuffs have always been beautiful; but in former times few pieces of size and splendour were produced, if we except the curtains used for draping festival cars and the hangings of temples. Tapestry, as it is employed in Europe, was not thought of, nor indeed could the small hand-looms of the period be easily adapted to such work. All that has been changed, however. Arras of large dimensions, showing remarkable workmanship and grand combinations of colours, is now manufactured in Kyôtô, the product of years of patient toil on the part of weaver and designer alike. Kawashima of Kyôtô has acquired high reputation for work of this kind. He inaugurated the new departure a few years ago by copying a Gobelin, but it may safely be asserted that no Gobelin will bear comparison with the pieces now produced in Japan. The most approved fashion of weaving is called *tsuzure-ori* (linked-weaving); that is to say, the cross threads are laid in with the fingers and pushed into their places with a comb by hand, very little machinery being used. The threads extend only to the outlines of each figure, and it follows that every part of the pattern has a rim of minute holes like the pierced lines separating postage stamps in a sheet, the effect being that the design seems to hang suspended in the ground—linked into it, as the Japanese term implies.[1] A specimen of this nature recently manufactured by Kawashima's weavers measured 20 feet by 13 feet, and represented the annual festival at the Nikkô mausolea. The chief shrine was shown; the gate and long flight of stone steps leading up to it, several other buildings, the groves of cryptomeria that surround the mausolea, and the festival procession. All the architectural and decorative details, all the carvings and colours, all the accessories—everything was wrought in silk, and each of the 1500 figures forming the procession wore exactly appropriate costume. Even this wealth of detail, remarkable as it was, seemed less surprising than the fact that the weaver had succeeded in producing the effect of atmosphere and aërial perspective. Through the graceful cryptomeria distant mountains and the still more distant sky could be seen, and between the buildings in the foreground and those in the middle distance atmosphere appeared to be perceptible. Two years of incessant labour with relays of artisans working steadily throughout the twenty-four hours were required to finish this piece. Naturally such specimens are not produced in large numbers. Next in decorative importance to *tsuzure-ori* stands *yuzen birôdo*, commonly known among English-speaking people as "cut velvet." Dyeing by the *yuzen* process is an innovation of modern times. The design is painted on the fabric, after which the latter is steamed, and the picture is ultimately fixed by methods which are kept secret. The soft silk known as *habutaye* is a favourite ground for such work, but silk crape also is largely employed. No other method permits the decorator to achieve such fidelity and such boldness of draughtsmanship. The difference between the results of the ordinary and the *yuzen* processes of dyeing is, in fact, the difference between a stencilled sketch and a finished picture. In the case of "cut velvet," the *yuzen* process is supplemented by an operation which can be easily described. The cutter, who works at an ordinary wooden bench, has no tool except a small sharp chisel with a V-shaped point. This chisel is passed into an iron pencil having at the end guards, between which the point of the chisel projects, so that it is impossible for the user to cut beyond a certain depth. When the velvet comes to him, it already carries a coloured picture permanently fixed by the *yuzen* process, but the wires have not been withdrawn. It is, in fact, velvet that has passed through all the usual stages of manufacture except the cutting of the thread along each wire and the withdrawal of the wires. The cutting artist lays the piece of this unfinished velvet before him on his bench, and proceeds to carve into the pattern with his chisel, just as though he were shading the lines of the design with a steel pencil. When the pattern is lightly traced, he uses his knife delicately; when the lines are strong and the shadows heavy, he makes the point pierce deeply. In short, the little chisel becomes in his fingers a painter's brush, and when it is remembered that, the basis upon which he works

[1] This method is some 300 years old. It is by no means a modern invention, as some writers have asserted.

being simply a thread of silk, his hand must be trained to such delicacy of muscular effort as to be capable of arresting the edge of the knife at varying depths within the diameter of the tiny filament, the difficulty of the achievement will be understood. Of course it is to be noted that the edge of the cutting tool is never allowed to trespass upon a line which the exigencies of the design require to be solid. The veining of a cherry petal, for example, the tesselation of a carp's scales, the serration of a leaf's edge —all these lines remain intact, spared by the cutter's tool, while the leaf itself, or the petal, or the scales of the fish, have the threads forming them cut so as to show the velvet nap and to appear in soft, low relief. In one variety of this fabric, a slip of gold foil is laid under each wire, and left in position after the wire is withdrawn, the cutting tool being then used with freedom in some parts of the design, so that the gold gleams through the severed thread, producing a rich and suggestive effect. Velvet, however, is not capable of being made the basis for pictures so elaborate and microscopially accurate as those produced by the *yuzen* process on silk crape or *habutaye*. The rich-toned, soft plumage of birds or the magnificent blending of colours in a bunch of peonies or chrysanthemums cannot be obtained with absolute fidelity on the ribbed surface of velvet.

Embroidery.

The embroiderer's craft has been followed for centuries in Japan with eminent success, but whereas it formerly ranked with dyeing and weaving, it has now come to be regarded as an art. Formerly the embroiderer was content to produce a pattern with his needle, now he paints a picture. The statement is not an exaggeration. So perfectly does the modern Japanese embroiderer elaborate his scheme of values that all the essential elements of pictorial effects—chiaroscuro, aërial perspective, and atmosphere—are present in his work. Thus a graceful and realistic school has replaced the comparatively stiff and conventional style of former times. Further, an improvement of a technical character was recently made, which has the effect of adding greatly to the durability of these embroideries. Owing to the use of paper among the threads of the embroidery and sizing in the preparation of the stuff forming the ground, every operation of folding used to cause perceptible injury to a piece, so that after a few years it acquired a crumpled and dingy appearance. But by the new method embroiderers now succeed in producing fabrics which defy all destructive influences except, of course, dirt and decay.

Keramics.—Speaking broadly, the distinguished products of Japanese keramic art in pre-*Meiji* days may be said to have been the porcelains of Hizen and Kutani and the faiences of Satsuma and Kyôtô. Many other wares have attracted attention, but though not without merits and even beauties, they are comparatively insignificant.

Oriental Pottery.

In the term "Hizen porcelains" are included not merely the richly decorated Imari ware—the "Old Japan" of Western collectors—but also the finely modelled and delicately coloured masterpieces of Hirado, and the jewelled specimens of Nabeshima, which undoubtedly stand at the head of all Japanese porcelains ornamented with vitrifiable enamels over the glaze. Many examples of these varieties deserve the enthusiastic admiration they have received, yet they unquestionably belong to a lower rank of keramic achievements than the choice productions of Chinese kilns. The potters of the Middle Kingdom, from the early eras of the Ming dynasty down to the latest years of the 18th century, stood absolutely without rivals—*haud æqui aut secundi*—as makers of porcelain. Their technical ability was incomparable—though in grace of decorative conception they yielded the palm to the Japanese—and the representative specimens they bequeathed to posterity remained, until quite recently, far beyond the imitative capacity of European or Asiatic experts. As for faience and pottery, however, the Chinese despised them in all forms, with one notable exception, the *Yishing-yao*, known in the Occident as *boccaro*. Even the *Yishing-yao*, too, owed much of its popularity to special utility. It was essentially the ware of the tea-drinker. If in the best specimens exquisite modelling, wonderful accuracy of finish, and *pâtes* of interesting tints are found, such pieces are, none the less, stamped prominently with the character of utensils rather than with that of works of art. In short, the artistic output of Chinese kilns in their palmiest days was, not faience or pottery, but porcelain, whether of soft or hard paste. Japan, on the contrary, owes her keramic distinction in the main to her faience. A great deal has been said by enthusiastic writers about the *Famille Chrysanthemo-Péonienne* of Imari and the *Genre Kakiemon* of Nabeshima, but these porcelains, beautiful as they undoubtedly are, cannot be placed on the same level with the *Kwan-yao* and *Famille Rose* of the Chinese experts. The Imari ware, even though its thick biscuit and generally ungraceful shapes be omitted from the account, shows no enamels that can rival the exquisitely soft, broken tints of the *Famille Rose;* and the *Kakiemon* porcelain, for all its rich though chaste contrasts, lacks the delicate transmitted tints of the shell-like *Kwan-yao*. So, too, the blue-and-white porcelain of Hirado, though assisted by exceptional tenderness of *sous-pâte* colour, by milk-white glaze, by great beauty of decorative design, and often by an admirable use of the modelling or graving tool, represents a keramic achievement palpably below the soft paste *Kai-pien-yao* of Ching-tê-chêng. It is a curious and interesting fact that this last product of Chinese skill remained unknown in Japan down to very recent days. In the eyes of a Chinese connoisseur, no blue-and-white porcelain worthy of consideration exists, or ever has existed, except the *Kai-pien-yao*, with its imponderable *pâte*, its wax-like surface, and its rich, glowing blue, entirely free from superficiality or garishness, and broken into a thousand tints by the microscopic crackle of the glaze. The Japanese, although they obtained from their neighbour almost everything of value she had to give them, did not know this wonderful ware, and their ignorance is in itself sufficient to prove their keramic inferiority. There remains, too, a wide domain in which the Chinese developed high skill, whereas the Japanese can scarcely be said to have entered it at all; namely, the domain of monochromes and polychromes, striking every note of colour from the richest to the most delicate; the domain of *truité* and *flambé* glazes, of "transmutation ware" (*Yô-pien-yao*), and of egg-shell with incised or translucid decoration. In all that region of achievement the Chinese potters stood alone and seemingly unapproachable. The Japanese, on the contrary, made a speciality of faience, and in that particular line they reached a high standard of excellence. No faience produced either in China or any other Oriental country can dispute the palm with really representative specimens of Satsuma ware. Not without full reason have Western connoisseurs lavished panegyrics upon that exquisite production. The faience of the Kyôtô artists never reached quite to the level of the Satsuma in quality of *pâte* and glowing mellowness of decoration: their materials were slightly inferior. But their skill as decorators was as great as its range was wide, and they produced a multitude of masterpieces on which alone Japan's keramic fame might safely be rested.

Such, briefly speaking, had been the story of the art and the distinction between the methods of its practice in China and Japan until the commencement of a new era

in the latter country. When the mediatization of the fiefs, in 1871, terminated the local patronage hitherto extended so munificently to keramic and other artists, the Japanese gradually learned that they must thenceforth depend chiefly upon the markets of Europe and America. They had to appeal, in short, to an entirely new "gallery," and how to secure its approval was to them a perplexing problem. Having little to guide them, they often interpreted Western taste incorrectly, and impaired their own reputation in a corresponding degree. Indeed, it may truly be said that the urgent need of Japan even at present is some intelligent appreciation of foreign wants. Just as her metal-workers devote themselves to the production of cigar-boxes, plaques, and other objects falling within the pecuniary reach of a very small circle of buyers, so her keramists confine their efforts to vases, censers, and more rarely tea and coffee services, this last class of commodities being too often disfigured by some unsightliness of form or clumsiness of design. What has to be considered here, however, is not the business aspect of the question, but rather the gradual steps of technical progress by which the present stage has been reached. In the early years of the *Meiji* era there was a period of complete prostitution. No new skill was developed, and what remained of the old was expended chiefly upon the manufacture of meretricious objects, disfigured by excess of decoration and not relieved by any excellence of technique. In spite of their artistic defects, these specimens were exported in considerable numbers by merchants in the foreign settlements, and their first cost being very low, they found a not unremunerative market. But as European and American collectors became better acquainted with the capacities of the pre-*Meiji* potters, the great inferiority of these new specimens was recognized, and the prices commanded by the old wares gradually appreciated. What then happened was very natural: imitations of the old wares were produced, and having been sufficiently disfigured by staining and other processes calculated to lend an air of rust and age, were sold to ignorant persons, who laboured under the singular yet common hallucination that the points to be looked for in specimens from early kilns were, not technical excellence, decorative tastefulness, and richness of colour, but dinginess, imperfections, and dirt; persons who imagined, in short, that defects which they would condemn at once in new porcelains ought to be regarded as merits in old. Of course a trade of that kind, based on deception, could not have permanent success. One of the imitators of "old Satsuma" was among the first to perceive that a new line must be struck out. Yet the earliest results of his awakened perception helped to demonstrate still further the depraved spirit that had come over Japanese art. For he applied himself to manufacture wares having a close affinity with the shocking monstrosities used for sepulchral purposes in ancient Apulia, where fragments of dissected satyrs, busts of nymphs, or halves of horses were considered graceful excrescences for the adornment of an amphora or a pithos. This Makuzu faience, produced by the now justly celebrated Miyagawa Shôzan of Ota (near Yokohama), survives in the form of vases and pots having birds, reptiles, flowers, crustacea, and so forth plastered over the surface—specimens that disgrace the period of their manufacture, and represent probably the worst aberration of Japanese keramic conception.

Change of style after the Restoration.

Adoption of Chinese models.

A production so degraded as the early Makuzu faience could not possibly have long vogue. Miyagawa soon began to cast about for a better inspiration, and found it in the monochromes and polychromes of the Chinese *Kang-hsi* and *Yung-cheng* kilns. The extraordinary value attaching to the incomparable red glazes of China, not only in the country of their provenance but also in the United States of America, where collectors showed a fine instinct in this matter, seems to have suggested to Miyagawa the idea of imitation. He took for model the rich and delicate "liquid-dawn" monochrome, and succeeded in producing, not indeed a rival of that grand ware, but at any rate some specimens of considerable merit. Thenceforth his example was largely followed, and it may now be said that the tendency of many of the best Japanese keramists is to copy Chinese *chefs-d'œuvre*. To find them thus renewing their keramic reputation by reverting to Chinese models, is not only another tribute to the perennial supremacy of Chinese porcelains, but also a fresh illustration of the eclectic genius of Japanese art. All the products of this new effort are porcelains proper. It is not intended to suggest that beautiful faience has ceased to be a Japanese speciality. The Kyôtô potters still tread successfully in the old grooves. But the question here is of a novel departure which distinguishes the present era. Seven kilns are devoted, wholly or in part, to the new wares: namely, that of Miyagawa Shôzan of Ota, that of Seifû Yôhei of Kyôtô, those of Takemoto Hayata and Kato Tomojiro of Tôkyô, that of Higuchi Haruzane of Hirado, that of Shida Yasukyo of Kaga, and that of Kato Masukichi of Seto.

Seifû of Kyôtô.

Among the seven keramists here enumerated, Seifû of Kyôtô probably enjoys the highest reputation. If we except the ware of Satsuma, a unique product, it may be said that nearly all the fine faience of Japan was manufactured formerly in Kyôtô. Nomura Ninsei, in the middle of the 17th century, inaugurated a long era of beautiful productions with his cream-like, "fish-roe" *craquelé* glazes, carrying rich decoration of clear and brilliant vitrifiable enamels. It was he who gave their first really artistic impulse to the kilns of Awata, Mizoro, and Iwakura, whence so many delightful specimens of faience issued almost without interruption until the middle of the 19th century and continue to issue to-day. The three Kenzan—of whom the third died in 1820; Ebisei; the four Dôhachi, of whom the fourth is still alive; the Kagiya family, manufacturers of the celebrated *Kinkôzan* ware; Hôzan, whose imitations of Delft faience and his *pâte-sur-pâte* pieces with fern-scroll decoration remain incomparable; Taizan Yôhei, whose ninth descendant of the same name now produces fine specimens of Awata ware for foreign markets; Tanzan Yôshitaro and his son Rokuro, to whose credit stands a new departure in the form of faience having *pâte-sur-pâte* decoration of lace patterns, diapers and archaic designs executed in low relief with admirable skill and minuteness; the two Bizan, renowned for their representations of richly-apparelled figures as decorative motives; Rokubei, who studied painting under Maruyama Okyo and followed the naturalistic style of that great artist; Mokubei, the first really expert manufacturer of translucid porcelain in Kyôtô; Shuhei, Kintei, and above all, Zengoro Hôzen, the celebrated potter of *Eiraku* wares—these names and many others give to Kyôtô keramics an eminence as well as an individuality which few other wares of Japan can boast. Nor is it to be supposed that the ancient capital now lacks great potters. Okamura Yasutaro, commonly called Shôzan, produces specimens which only a very acute connoisseur can distinguish from the work of Nomura Ninsei; Tanzan Rokuro's half-tint enamels and soft creamy glazes would have stood high in any epoch; Taizan Yôhei produces Awata faience not inferior to that of former days; Kagiya Sôbei worthily supports the reputation of the *Kinkôzan* ware; Kawamoto Eijiro has made to the order of a well-known Kyôtô firm

many specimens now figuring in foreign collections as old masterpieces; and Ito Tôzan succeeds in decorating faience with seven colours *sous couverte* (black, green, blue, russet-red, tea-brown, purple, and peach), a feat never before accomplished. It is therefore an error to assert, as has been so often asserted, that Kyôtô has no longer a title to be called a great keramic centre if estimated by old-time standards. Seifû Yôhei, however, has the special faculty of manufacturing monochromatic and jewelled porcelain and faience, which differ essentially from the traditional Kyôtô types, their models being taken directly from China. But a sharp distinction has to be drawn between the method of Seifû and that of the other six keramists mentioned above as following Chinese fashions. It is this, that whereas the latter produce their chromatic effects by mixing the colouring matter with the glaze, Seifû paints the biscuit with a pigment over which he runs a translucid colourless glaze. The Kyôtô artist's process is much easier than that of his rivals, and although his monochromes are often of most pleasing delicacy and fine tone, they do not belong by any means to the same category of technical excellence as the wares they imitate. From this judgment must be excepted, however, his ivory-white and *céladon* wares, as well as his porcelains decorated with blue, or blue and red *sous couverte*, and with vitrifiable enamels over the glaze. In these five varieties he is emphatically great. It cannot be said, indeed, that his *céladon* shows the velvety richness of surface and tenderness of colour that distinguished the old *Kuang-yao* and *Lungchuan-yao* of China, or that he has ever essayed the moss-edged crackle of the beautiful *Ko-yao*. But his *céladon* certainly equals the more modern Chinese examples from the *Kang-hsi* and *Yung-cheng* kilns. As for his ivory-white, it distinctly surpasses the Chinese Ming *Chen-yao* in every quality except an indescribable intimacy of glaze and *pâte* which probably can never be obtained by either Japanese or European methods.

Miyagawa Shôzan.

Miyagawa Shôzan, or Makuzu, as he is generally called, has never followed Seifû's example in descending from the difficult manipulation of coloured glazes to the comparatively simple process of painted biscuit. This comment does not refer, it need scarcely be said, to the use of blue and red *sous couverte*. In that class of beautiful ware the application of pigment to the unglazed *pâte* is inevitable, and both Seifû and Miyagawa, working on the same lines as their Chinese predecessors, produce porcelains that almost rank with choice *Kang-hsi* specimens, though they have not yet mastered the processes sufficiently to employ them in the manufacture of large imposing pieces or wares of moderate price. But in the matter of true monochromatic and polychromatic glazes, to Shôzan belongs the credit of having inaugurated Chinese fashions, and if he has never fully succeeded in achieving *Lang-yao* (*sang-de-bœuf*), *Chi-hung* (liquid-dawn red), *Chiang-tou-hung* (bean-blossom red, the "peach-blow" of American collectors), or above all *Pin-kwo-tsing* (apple-green with red bloom), his efforts to imitate them have resulted in some very interesting pieces.

Tôkyô keramists.

Takemoto and Kato of Tôkyô entered the field subsequently to Shôzan, but follow the same models approximately. Takemoto, however, has made a speciality of black glazes, his aim being to rival the *Sung Chien-yao*, with its glaze of mirror-black or raven's-wing-green, and its leveret-fur streaking or russet-moss dappling, the prince of all wares in the estimation of the Japanese tea-clubs. Like Shôzan, he is still very far from his original, but, also like Shôzan, he produces highly meritorious pieces in his efforts to reach an ideal that will probably continue to elude him for ever. Of Kato there is not much to be said. He has not succeeded in winning great distinction, but he manufactures some very delicate monochromes, fully deserving to be classed among prominent evidences of the new departure. Tôkyô was never a centre of keramic production. Even during the 300 years of its conspicuous prosperity as the administrative capital of the Tokugawa Shoguns, it had no noted factories, doubtless owing to the absence of any suitable potter's clay in the immediate vicinity. Its only notable production of a keramic character was the work of Miura Kenya (1830–43), who followed the methods of the celebrated Haritsu (1688–1704) of Kyôtô in decorating plain or lacquered wood with mosaics of *Raku* faience having coloured glazes. Kenya was also a skilled modeller of figures, and his factory in the Imado suburb obtained a considerable reputation for work of that nature. He was succeeded by Tozawa Benshi, now an old man of over seventy, who, using clay from Owari or Hizen, has turned out many porcelain statuettes of great beauty. But although the capital of Japan formerly played only an insignificant part in Japanese keramics, modern Tôkyô has an important school of artist-artisans. Every year large quantities of porcelain and faience are sent from the provinces to the capital to receive surface decoration, and in wealth of design as well as carefulness of execution the results are praiseworthy. But of the pigments employed nothing very laudatory could be said until very recent times. They were generally crude, of impure tone, and without depth or brilliancy. Now, however, they have lost these defects and entered a period of considerable excellence. As for the nature of the designs, it may fairly be said that figure-subjects constitute their chief feature. A majority of the artists are content to copy old pictures of Buddha's Sixteen Disciples, the Seven Gods of Happiness, and other similar assemblages of mythical or historical personages, not only because such work offers large opportunity for the use of striking colours and the production of meretricious effects, dear to the eye of the average Western householder and globe-trotter, but also because a complicated design, as compared with a simple one, has the advantage of hiding the technical imperfections of the ware. Of late there have happily appeared some decorators who prefer to choose their subjects from the natural field in which their great predecessors of former times excelled, and there is reason to hope that this more congenial and more pleasing style will supplant its modern usurper. The best known factory in Tôkyô for decorative purposes is the Hyôchi-en. It was established in the Fukagawa suburb in 1875, with the immediate object of preparing specimens for the first Tôkyô Exhibition held at that time. Its founders obtained a measure of official aid, and were able to secure the services of some good artists, among whom may be mentioned Obanawa and Shimauchi. The porcelains of Owari and Arita naturally received most attention at the hands of the Hyôchi-en decorators, but there was scarcely one of the principal wares of Japan upon which they did not try their skill, and if a piece of monochromatic Minton or Sèvres came in their way, they undertook to improve it by the addition of designs copied from old masters or suggested by modern taste. To all such pieces the cachet of the Fukagawa atelier was indiscriminately applied, and has probably proved a source of considerable confusion to collectors. Many other factories for decoration were established from time to time in Tôkyô. Of these some still exist; others, ceasing to be profitable, have been abandoned. On the whole, the industry may now be said to have assumed a domestic character. In a house, presenting no distinctive features whatsoever, one finds the decorator with a cupboard full of bowls and vases in

glazed biscuit, which he adorns, piece by piece, using the simplest conceivable apparatus and a meagre supply of pigments. Sometimes he fixes the decoration himself, employing for that purpose a small kiln which stands in his back garden; sometimes he entrusts this part of the work to a factory where greater facilities are provided. As in the case of everything Japanese, there is no pretence, no useless expenditure about the process. Yet it is plain that this school of Tôkyô decorators, though often choosing their subjects badly, have contributed much to the progress of the keramic art during the past few years. Little by little there has been developed a degree of skill which compares not unfavourably with the work of the old masters. Table services of Owari porcelain—the ware itself excellently manipulated and of almost egg-shell fineness—are now decorated with floral scrolls, landscapes, insects, birds, figure-subjects, and all sorts of designs, chaste, elaborate, or quaint; and these services, representing so much artistic labour and originality, are sold for prices that bear no due ratio to the skill required in their manufacture. There is only one reservation to be made in speaking of the modern decorative industry of Japan under its better aspects. It is a reservation applying equally to the work done in Tôkyô, Kyôtô, Yokohama, and Kobe, in all of which places decorating ateliers (*etsuke-dokoro*), similar to those of Tôkyô, have been established in modern times: the artists use chiefly pigments, seldom venturing to employ vitrifiable enamels. That the results achieved with these different materials are not comparable is a fact which every connoisseur must admit. The glossy surface of a porcelain glaze is ill fitted for rendering artistic effects with ordinary colours. The proper field for the application of these is the biscuit, in which position the covering glaze serves at once to soften and to preserve the pigment. It can scarcely be doubted that the true instincts of the keramist will ultimately counsel him to confine his decoration over the glaze to vitrifiable enamels, with which the Chinese and Japanese potters of former times obtained such brilliant results. But to employ enamels successfully is an achievement demanding special training and materials not easy to procure or to prepare. The Tôkyô decorators are not likely, therefore, to change their present methods immediately. An impetus was given to keramic decoration by the efforts of a new school, which owed its origin to Dr G. Wagener, an eminent German expert formerly in the service of the Japanese Government. Dr Wagener conceived the idea of developing the art of decoration under the glaze, as applied to faience. Faience thus decorated has always been exceptional in Japan. Rare specimens were produced in Satsuma and Kyôtô, the colour employed being chiefly blue, though brown and black were used in very exceptional instances. The difficulty of obtaining clear, rich tints was nearly prohibitive, and though success, when achieved, seemed to justify the effort, this class of ware never received much attention in Japan. By careful selection and preparation of *pâte*, glaze, and pigments, Dr Wagener proved not only that the manufacture was reasonably feasible, but also that decoration thus applied to pottery possesses unique delicacy and softness. Ware manufactured by his direction at the Tôkyô School of Technique (*Shokkô Gakkô*), under the name of *Asahi-yaki*, ranks among the interesting productions of modern Japan. The decorative colour chiefly employed is chocolate brown, which harmonizes excellently with the glaze. But the ware has never found favour in Japanese eyes, an element of unpleasant garishness being imparted to it by the vitreous appearance of the glaze, which is manufactured according to European methods. The modern faience of Ito Tôzan of Kyôtô, decorated with colour under the glaze, is incomparably more artistic than the Tôkyô *Asahi-yaki*, from which, nevertheless, the Kyôtô master doubtless borrowed some ideas. The decorative industry in Tôkyô owed much also to the Kôshô-Kaisha, an institution started by Messrs Wakai and Matsuo in 1873, with official assistance. Owing to the intelligent patronage of this company, and the impetus given to the keramic trade by its enterprise, the style of the Tôkyô *etsuke* was much improved and the field of their industry extended. It must be acknowledged, however, that the Tôkyô artists often devote their skill to purposes of forgery, and that their imitations, especially of old *Satsuma-yaki*, are sometimes franked by dealers whose standing should forbid such frauds. In this context it may be mentioned that, of late years, decoration of a remarkably microscopic character has been successfully practised in Kyôtô, Osaka, and Kobe, its originator being Meisan of Osaka. Before dismissing the subject of modern Tôkyô keramics, it may be added that Kato Tomataro, mentioned above in connexion with the manufacture of special glazes, has also been very successful in producing porcelains decorated with blue *sous couverte* at his factory in the Koishikawa suburb.

Modern wares of Hirado.

Higuchi of Hirado is to be classed with keramists of the new school on account of one ware only, namely, porcelain having translucid decoration, the so-called "grains-of-rice" of American collectors, designated "fire-fly style" (*hotaru-de*) in Japan. That, however, is an achievement of no small consequence, especially since it had never previously been essayed outside China. The Hirado expert has not yet attained technical skill equal to that of the Chinese. He cannot, like them, cover the greater part of a specimen's surface with a lacework of transparent decoration, exciting wonder that *pâte* deprived so greatly of continuity could have been manipulated without accident. But his artistic instincts are higher than those of the Chinese, and there is reasonable hope that in time he may excel their best works. In other respects the Hirado factories do not produce wares nearly so beautiful as those manufactured there between 1759 and 1840, when the *Hirado-yaki* stood at the head of all Japanese porcelain on account of its pure, close-grained *pâte*, its lustrous milk-white glaze, and the soft clear blue of its carefully executed decoration.

Ware of Owari.

The Owari potters were slow to follow the lead of Miyagawa Shôzan and Seifû Yôhei. At the industrial exhibition in Kyôtô in 1895 the first results of their efforts were shown, attracting attention at once. Owari, though from the abundance of the output of its Seto kilns the Japanese generic term for keramic ware (*setomono*) is derived, never deserved to be reckoned among the centres of art production. In mediæval times it was celebrated for faience glazes of various colours, much affected by the tea-clubs, but its staple manufacture from the beginning of the 19th century was porcelain decorated with blue under the glaze, the best specimens of which did not approach their Chinese prototypes in fineness of *pâte*, purity of glaze, or richness of colour. During the first twenty-five years of the *Meiji* era the Owari potters sought to compensate the technical and artistic defects of their pieces by giving to them magnificent dimensions; but at the Tôkyô industrial exhibition of 1891 they were able to contribute some specimens showing decorative, plastic, and graving skill of no mean order. Previously to that time, one of the Seto experts, Kato Gosuke, had developed remarkable ability in the manufacture of *céladon*, though in that field he was subsequently distanced by Seifû of Kyôtô. Only lately did Owari feel the influence of the new movement towards Chinese types. Its potters took *flambé* glazes

for models, and their pieces of that nature possessed an air of novelty that attracted connoisseurs. But the style was not calculated to win general popularity, and the manufacturing processes were too easy to occupy the attention of great potters. On a far higher level stood egg-shell porcelain, remarkable examples of which were sent from Seto to the Kyôtô industrial exhibition of 1895. Chinese potters of the *Yung-lo* era (1403–14) enriched their country with a quantity of ware to which the name of *totai-ki* (bodiless utensil) was given on account of its wonderfully attenuated *pâte*. The finest specimens of this porcelain had incised decoration, sparingly employed but adding much to the beauty of the piece. In subsequent eras the potters of Ching-te-chen did not fail to continue this remarkable manufacture, but its only Japanese representative was a porcelain distinctly inferior in more than one respect, namely, the egg-shell utensils of Hizen and Hirado, some of which had finely woven basket-cases to protect their extreme fragility. The Seto experts, however, are now making bowls, cups, and vases that rank nearly as high as the celebrated *Yung-lo totai-ki*. In purity of tone and velvet-like gloss of surface there is distinct inferiority on the side of the Japanese ware, but in thinness of *pâte* it supports comparison, and in profusion and beauty of incised decoration it excels its Chinese original.

Latest of all to acknowledge the impulse of the new departure have been the potters of Kaga. For many years their ware enjoyed the credit, or discredit, of being the most lavishly decorated porcelain in Japan. It is known to Western collectors as a product blazing with red and gold, a very degenerate offspring of the Chinese *Ming* type, which Hozen of Kyôtô reproduced so beautifully at the beginning of the 19th century under the name of *Eiraku-yaki*. Undoubtedly the best specimens of this *kinran-de* (brocade) porcelain of Kaga merit praise and admiration; but, on the whole, ware so gaudy could not long hold a high place in public esteem. The Kaga potters ultimately appreciated that defect. They still manufacture quantities of tea and coffee sets, and dinner or dessert services of red-and-gold porcelain for foreign markets; but about 1885 some of them made zealous and patient efforts to revert to the processes that won so much fame for the *Kutani-yaki* of the old times, with its grand combinations of rich, lustrous, soft-toned glazes. The attempt was never entirely successful, but its results restored something of the Kaga kilns' reputation. Since 1895, again, a totally new departure was made by Morishita Hachizaemon, a keramic expert, in conjunction with Shida Yasukyo, president of the Kaga Products Joint Stock Company (*Kaga Bussan Kabushiki Kaisha*) and teacher in the Kaga Industrial School. The line chosen by these keramists is purely Chinese. Their great aim seems to be the production of the exquisite Chinese monochromes known as *u-kwo-tien-tsing* (blue of the sky after rain) and *yueh-peh* (*clair-de-lune*), into the composition of both of which glazes gold enters. But they also devote much attention to porcelains decorated with blue or red *sous couverte*. Their work shows much promise, but like all fine specimens of the Sinico-Japanese school, the prices are too high to attract wide custom.

Ware of Kaga.

The sum of the matter is that the modern Japanese keramist, after many efforts to cater for the taste of the Occident, evidently concludes that his best hope consists in devoting all his technical and artistic resources to reproducing the celebrated wares of China. In explanation of the fact that he did not essay this route in former times, it may be noted, first, that he had only a limited acquaintance with the wares in question; secondly, that Japanese connoisseurs never attached any value to their countrymen's imitation of Chinese porcelains so long as the originals were obtainable; thirdly, that the keramic art of China not having fallen into its present state of decadence, the idea of competing with it did not occur to outsiders; and fourthly, that Europe and America had not developed their present keen appreciation of Chinese masterpieces. Yet it is remarkable that China, at the close of the 19th century, should have again furnished models to Japanese eclecticism. There are reasons which render it doubtful whether the Japanese potter, without a radical change of technical methods, will ever reach the level upon which the Chinese masters stood, but it is very probable that he may produce *en route* many beautiful and excellent varieties of porcelain.

Summary.

Cloisonné Enamel.—Cloisonné enamel is a branch of applied art which may be considered essentially of modern development in Japan. The process was known at an early period, and was employed for purposes of subsidiary decoration from the close of the 16th century, but not until the 19th century did Japanese experts begin to manufacture the objects known in Europe as "enamels"; that is to say, vases, plaques, censers, bowls and so forth, having their surface covered with vitrified pastes applied either in the *champlevé* or the *cloisonné* style. It is necessary to insist upon this fact, because the only European author who has attempted to discuss the subject of Japanese enamels at any length fell into the serious error of supposing that numerous specimens which began to be exported from 1865 were the outcome of industry commencing in the 16th century and reaching its point of culmination at the beginning of the 18th. There is not the slenderest ground for such a theory. The work began in 1838, and Kaji Tsunekichi of Owari was its originator. Without pausing here to describe the circumstances that led to this innovation, it will be sufficient to say that, during twenty years previously to the reopening of the country in 1858, *cloisonné* enamelling was practised in the manner now understood by the term, and that when foreign merchants began to settle in Yokohama several experts were working skilfully in Owari after the methods of Kaji Tsunekichi. Up to that time there had been little demand for enamels of large dimensions, but when the foreign market called for vases, censers, plaques, and such things, no difficulty was found in supplying them. Thus, about the year 1865, there commenced an export of enamels which had no prototypes in Japan, being destined frankly for European and American collectors. From a technical point of view these specimens had much to recommend them. The base, usually of copper, was as thin as cardboard; the cloisons, exceedingly fine and delicate, were laid on with care and accuracy; the colours were even, and the designs showed artistic judgment. Two faults, however, marred the work—first, the shapes were clumsy and unpleasing, being copied from bronzes whose solidity justified forms unsuited to thin enamelled vessels; secondly, the colours, sombre and somewhat impure, lacked the glow and mellowness that give decorative superiority to the technically inferior Chinese enamels of the later *Ming* and early *Tsing* eras. Very soon, however, the artisans of Nagoya (Owari), Yokohama, and Tôkyô—where the art had been taken up—found that faithful and fine workmanship did not pay. The foreign merchant desired many and cheap specimens for export, rather than few and costly. There followed then a period of gradual decline, and the enamels exported to Europe showed so much inferiority that they were supposed to be the products of a widely different era and of different makers. The industry was threatened with extinction, and would certainly have dwindled to

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insignificant dimensions had not a few earnest artists, working in the face of many difficulties and discouragements, succeeded in striking out new lines and establishing new standards of excellence.

Three clearly differentiated schools now (1875) came into existence. One, headed by Namikawa Yasuyuki of Kyôtô, took for its objects the utmost delicacy and perfection of technique, richness of decoration, purity of design, and harmony of colour. The thin clumsily-shaped vases of the Kaji school, with their uniformly distributed decoration of diapers, scrolls, and arabesques in comparatively dull colours, ceased altogether to be produced, their place being taken by graceful specimens, technically flawless, and carrying designs not only free from stiffness, but also executed in colours at once rich and soft. This school may be subdivided, Kyôtô representing one branch, Nagoya, Tôkyô, and Yokohama the other. In the products of the Kyôtô branch the decoration generally covered the whole surface of the piece; in the products of the other branch the artist aimed rather at pictorial effect, placing the design in a monochromatic field of low tone. It is plain that such a method as the latter implies great command of coloured pastes, and, indeed, no feature of the manufacture is more conspicuous than the progress made during the period 1880–1900 in compounding and firing vitrifiable enamels. Many excellent examples of *cloisonné* enamel have been produced by each branch of this school. There is nothing like them to be found in any other country, and they stand at an immeasurable distance above the works of the early Owari school represented by Kaji Tsunekichi and his pupils and colleagues.

New schools.

The second of the modern schools is headed by Namikawa Sosuke of Tôkyô. It is an easily traced outgrowth of the second branch of the first school just described, for one can readily understand that from placing the decorative design in a monochromatic field of low tone, which is essentially a pictorial method, development would proceed in the direction of concealing the mechanics of the art in order to enhance the pictorial effect. Then arose the so-called "cloisonless enamels" (*musenjippô*). They are not always without cloisons. The design is generally framed at the outset with a ribbon of thin metal, precisely after the manner of ordinary *cloisonné* ware. But as the work proceeds the cloisons are hidden—unless their presence is necessary to give emphasis to the design—and the final result is a picture in vitrified enamels.

Cloisonless enamels.

The characteristic productions of the third among the modern schools are monochromatic and translucid enamels. All students of the keramic art know that the monochrome porcelains of China owe their beauty to the fact that the colour is in the glaze, not under it. The keramist finds no difficulty in applying a uniform coat of pigment to porcelain biscuit, and covering the whole with a diaphanous glaze. The colour is fixed and the glaze set by secondary firing at a lower temperature than that necessary for hardening the *pâte*. Such porcelains, however, lack the velvet-like softness and depth of tone so justly prized in the genuine monochrome, where the glaze itself contains the colouring matter, *pâte* and glaze being fired simultaneously at the same high temperature. It is apparent that a vitrified enamel may be made to perform, in part at any rate, the function of a porcelain glaze. Acting upon that theory, the experts of Tôkyô and Nagoya have produced many very beautiful specimens of monochrome enamels—yellow (canary or straw), *rose du Barry*, liquid-dawn red, aubergine purple, green (grass or leaf), dove-gray and lapis-lazuli blue. These pieces do not quite reach the level of Chinese monochrome porcelains, but their inferiority is not marked. The artist's great difficulty is to hide the metal base completely. A monochrome loses much of its attractiveness when the colour merges into a metal rim, or when the interior of a vase is covered with crude unpolished paste. But to spread and fix the enamel so that neither at the rim nor in the interior shall there be any break of continuity, or any indication that the base is copper, not porcelain, is a *tour de force* demanding quite exceptional skill.

Mono-chromatic enamels.

The translucid enamels of the modern school are generally associated with decorative bases. In other words, a suitable design is chiselled in the metal base so as to be visible through the diaphanous enamel. Very beautiful effects of broken and softened lights, combined with depth and delicacy of colour, are thus obtained. But the decorative designs which lend themselves to such a purpose are not numerous. A gold base deeply chiselled in wave diaper and overrun with a paste of aubergine purple is the most pleasing. A still higher achievement is to apply to the chiselled base designs executed in coloured enamels, finally covering the whole with translucid paste. Admirable results are thus produced; as when, through a medium of cerulean blue, bright goldfish and blue-backed carp appear swimming in silvery waves, or brilliantly-plumaged birds seem to soar among fleecy clouds. The artists of this school show also much skill in using enamels for purposes of subordinate decoration —for example, suspending enamelled butterflies, birds, floral sprays, &c., among the reticulations of a silver vase chiselled *à jour*; or filling with translucid enamels parts of a decorative scheme sculptured in iron, silver, gold, or *shakudo*.

Translucid enamel.

It will be seen at once that Japanese workers in *cloisonné* enamels have made immense strides since the days when they sent to Europe specimens such as those depicted in Mr Audsley's book on *The Ornamental Arts of Japan*. The art may indeed be said to have been developed during the last quarter of the 19th century from a condition of comparative crudeness to one of unparalleled excellence. There was no reason to anticipate that the Japanese would take the lead of the world in this branch of applied art. They had no presumptive title to do so. Yet they certainly have done so. (F. BY.)

Lacquer.—The early history of the art of lacquer work in Japan consists of references to it in the ancient chronicles, and to the creation of official posts for its regulation, which go back to a date as early as the 3rd century B.C. These statements may not be of absolute authenticity, but it is indisputable that the industry existed at that time or soon afterwards, and at an extraordinarily early period a very considerable amount of skill had been developed in working it. In the temple at Nara are still preserved specimens of lacquer work attributed to the 3rd century of our era, and a series of objects which certainly belonged to Shotoku Daishi (died A.D. 621), as well as other examples but little later in date. The art became popular, and was always in high favour among the aristocracy, so that from this time numerous records of its progress are found, as well as a continuous series of examples. Up to the end of the 12th century the art had been practised at Kyôtô; but the first Shoguns removed the capital at that time to Kamakura, which thus became its centre for the next 200 years, after which it again followed the seat of the main Government. Among the many skilled artists who have practised this beautiful craft since the first on record, Kiyohara Norisuye (*c.* 1169), may be mentioned Kôyetsu (1558–1637) and his pupils, who are especially noted for their *inro* (medicine-cases worn as part of the costume); Kajikawa Kinjirô (*c.* 1680), the founder of the

great Kajikawa family, which continued up to the 19th century; and Koma Kiuhaku (d. 1715), whose pupils and descendants maintained his traditions for a period of equal length. Of individual artists, perhaps the most notable is Ogata Kôrin, whose skill was equally great in the arts of painting and pottery. He was the eldest son of an artist named Ogato Sôken, and studied the styles of the Kanô and Tosa schools successively. Among the artists who influenced him were Kanô Tsunenobu, Nomura Sotatsu, and Kôyetsu. His lacquer ware is distinguished for a bold and at times almost eccentric impressionism, and his use of inlay is strongly characteristic. He died in 1716 at an age variously stated by Japanese authorities as fifty-five and fifty-nine. Ritsuô (1663–1747), a pupil and contemporary of Kôrin, and like him a potter and painter also, was another lacquerer of great skill. Then followed Hanzan, the two Shiome, Yamamoto Shunshô and his pupils, Yamada Jôka and Kwanshôsai Tôyô (late 18th century). In the beginning of the 19th century worked Shôkwasai, who frequently collaborated with the metal-worker Shibayama, encrusting his lacquer with small decorations in metal by the latter. The greatest lacquerer of the 19th century was, however, Shibata Zeshin (a pupil of Koma Kwansai), who died in 1891, and to whose efforts and influence the survival of the making of good art lacquer ware in Japan at the present time is undoubtedly due. His pupil, Ikeda Taishin, was alive in 1894, and his son, Reisai Shibata, has also produced excellent work on the lines of that of his father. It is of interest to note that the Official Report of the Third National Industrial Exhibition of Japan classified the lacquer workers of Tôkyô into five groups, headed by the following artists respectively:—1. Shibata Zeshin; 2. Ogawa Shômin; 3. Shirayama Shôya; 4. Kawanobe Itcho; 5. Uyematsu Hômin. With the growth of commerce with the West there was a great danger that this beautiful and laborious art would be vulgarized in order to meet the demand in Europe for cheap imitations of the old wares; but although the modern productions are perhaps hardly quite up to the level of those of bygone days, still they do retain very considerable artistic qualities, and the patronage extended to the lacquerers by the Court and aristocracy of Japan is still sufficient to preserve it as a living art. (See also LACQUER.)

AUTHORITIES.—QUIN. *Report by H.M. Acting Consul at Hakodate on the Lacquer Industry of Japan.* Japan, No. 3, 1882.—GILBERTSON. *Japanese Lacquer.* Burlington Fine Arts Club. Catalogue of Exhibition, 1894.—BING. *Artistic Japan.* Asiatic Society of Japan, *Transactions.*—Japan Society. *Transactions.*—AUDSLEY. *The Ornamental Arts of Japan.*—TOMKINSON. *A Japanese Collection.* (E. F. S.)

Engraving.—Although a little engraving on copper has been practised in Japan of late years, it is of no artistic value, and the only branch of the art which calls for recognition is the cutting of wood-blocks for use either with colours or without. This, however, is of supreme importance, and as its technique differs in most respects from the European practice, it demands a somewhat detailed description. The wood used is generally that of the cherry-tree, *sakura*, which has a grain of peculiar evenness and hardness. It is worked plank-wise to a surface parallel with the grain, and not across it. A design is drawn by the artist, to whom the whole credit of the production generally belongs, with a brush on thin paper, which is then pasted face downwards on the block. The engraver, who is very rarely the designer, then cuts the outlines into the block with a knife, afterwards removing the superfluous wood with gouges and chisels. Great skill is shown in this operation, which produces perhaps the finest facsimile reproduction of drawings ever known without the aid of photographic processes. A peculiar but highly artistic device is that of gradually rounding off the surfaces where necessary, in order to obtain in printing a soft and graduated mass of colour which does not terminate too abruptly. In printing with colours a separate block is made in this manner for each tint, the first containing as a rule the mere lines of the composition, and the others providing for the masses of tint to be applied. In all printing the paper is laid on the upper surface of the block, and the impression rubbed off with a circular pad, composed of twisted cord within a covering of paper, cloth, and bamboo-leaf, and called the *baren.* In colour-printing the colours, which are much the same as those in use in Europe, are mixed, with rice-paste as a medium, on the block for each operation, and the power of regulating the result given by this custom to an intelligent craftsman (who, again, is neither the artist nor the engraver) was productive in the best period of very beautiful and artistic effects, such as could never have been obtained by any mechanical device. A register or correct superposition successively of each block of wonderful accuracy is got mainly by the skill of the printer, who is assisted only by a mark defining one corner, and another showing the opposite side limit. The origins of this method of colour-printing are obscure. It has been practised to some extent in China and Korea, but there is no evidence of its antiquity in these countries. It appears to be one of the few indigenous arts of Japan. But before accepting this conclusion as final, one must not lose sight of the fact that the so-called *chiaroscuro* engraving was at the height of its use in Italy at the same time that embassies from the Christians in Japan visited Rome, and that it is thus possible that the suggestion at least may have been derived from Europe. The fact that no traces of it have been discovered in Japan would be easily accounted for, when it is remembered that the examples taken home would almost certainly have been religious pictures, would have been preserved in well-known and accessible places, and would thus, likely enough, have been entirely destroyed in the terrible and minute extermination of Christianity by Hideyoshi at the beginning of the 17th century. The Japanese tradition ascribes the invention of colour-printing to Idzumiya Gonshirô, who about the end of the 17th century first made use of a second block to apply a tint of red (*beni*) to his prints. Sir Ernest Satow states more definitely that "Sakakibara attributes its origin to the year 1695, when portraits of the actor Ichikawa Dajiuro, coloured by this process, were sold in the streets of Yedo for five cash apiece." The credit of the invention is also given to Torii Kiyonobu, who worked at about this time, and, indeed, is said to have made the prints above mentioned. But authentic examples of his work now remaining, printed in three colours, seem to show a technique too complete for an origin quite so recent. However, he is the first artist of importance to have produced the broadsheets—chiefly for many years portraits of notable actors, historical characters, and famous courtesans—which are the leading and characteristic use to which the art was applied. Pupils, the chief of whom were Kiyomasa, Kiyotsume, Kiyomitsu, Kiyonaga, and Kiyomine, carried on his tradition until the end of the 18th century, the earlier using but few colours, while the works of the two last named show a technical mastery of all the capabilities of the process. The next artist of importance is Sazuki Harunobu (worked *c.* 1760–80), to whom the Japanese sometimes ascribe the invention of the process, probably on the grounds of an improvement in his technique, and the fact that he seems to have been one of the first of the colour-print makers to attain great popularity. Katsukawa

Shunshō (d. 1792) must next be mentioned, not only for the beauty of his own work, but because he was the first master of Hokusai; then Yeishi (worked c. 1781–1800), the founder of the Hosoda school; Utamaro (1754–1806), whose prints of beautiful women were collected by Dutchmen while he was still alive, and have had in our own day a vogue greater, perhaps, than those of any other of his fellows; and Toyokuni I. (1768–1825), who especially devoted himself to broadsheet portraits of actors and dramatic scenes. The greatest of all the artists of the popular school was, however, Hokusai (1760–1849). His most famous series of broadsheets is the "Thirty-Six Views of Mount Fuji" (1823–29), which, in spite of the conventional title, includes at least forty-six. His work is catalogued in detail by E. de Goncourt. At the beginning of the 19th century the process was technically at its greatest height, and in the hands of the great landscape artist, Hiroshige I., as well as the pupils of Toyokuni I.—Kunisada and Kuniyoshi—and those of Hokusai, it at first kept up an excellent level. But an undue increase in the number of blocks used, combined with the badness of the imported colours and carelessness or loss of skill in printing, brought about a rapid decline soon after 1840. This continued until the old traditions were well-nigh exhausted, but since 1880 there has been a distinct revival. The prints of the present day are cut with great skill, and the designs are excellent, though both these branches seem to lack the vigour of conception and breadth of execution of the older masters. The colours now used are almost invariably of cheap German origin, and though they have a certain prettiness—ephemeral, it is to be feared—they again cannot compare with the old native productions. Among workers in this style, Yoshitoshi (died c. 1898) was perhaps the best. Living artists in 1902 included Toshihide, Miyagawa Shuntei, Yoshiu Chikanobu—one of the elder generation—Tomisuka Yeishu, Toshikata, and Gekko. Formerly the colour-print artist was of mean extraction and low social position, but, thanks perhaps to European influence, he now has some recognition at the hands of the professors of more esteemed branches of art. (E. F. S.)

Illustrated Books.—The history of the illustrated book in Japan may be said to begin with the *Ise Monogatari*, a romance first published in the 10th century, of which an edition adorned with woodcuts appeared in 1608. In the course of the 17th century many other works of the same nature were issued, including some in which the cuts were roughly coloured by hand; but the execution of these is of no great merit, and certainly not as good as contemporary European work. The date of the first use of colour-printing in Japanese book illustration is uncertain. In 1667 a collection of designs for *kimono* appeared, in which inks of several colours are made use of; but these are only employed in turn for single printings, and in no case are two of them used on the same print. It is certain, however, that the mere use of coloured inks must soon have suggested the combination of two or more of them, and it is probable that examples of this will be discovered much earlier in date than known at present. About the year 1680 lived and worked Hishikawa Moronobu, whose vigour and artistic excellence achieved a great popularity for woodcut illustration, and laid the foundations of the splendid school which followed. The names of the engravers who cut his designs are not known, and in fact the reputation of these craftsmen is curiously subordinated to that of the designers in all Japanese work of the kind. Moronobu died between 1711 and 1715, at the age of about 70. With him must be associated Okumura Masanobu, who was a little later perhaps in date, but whose work is also of considerable value. During the ensuing thirty years numerous illustrated books appear, including the earliest yet known which are illustrated by colour-printing. The next artist of importance is Nishikawa Sukenobu (1671–1751), who illustrated a very large number of books, many of which were only published after his death. With him may be associated Ichiô Shumboku (died c. 1773) and Tsukioka Tange (1717–1786), the latter of whom made the drawings for many of the *meishô* or guide-books which form so interesting and distinctive a branch of Japanese illustration. The work of Tachibana Morikuni (1670–1748) is also of great importance. The books illustrated by the men of this school were mainly collections of useful information, guide-books, romances, and historical and religious compilations; but much of the best of their work is to be found in the collections of pictorial designs, very often taken from Chinese sources, which were produced for the use of workers in lacquer, pottery, and similar crafts. These, both for design and for skill of cutting, hold their own with the best work of European woodcutting of any period. The development of the art of Japanese colour-printing naturally had its effect on book-illustration, and the latter years of the 18th and the earlier of the 19th century saw a vast increase of books illustrated by this process. The subjects also now include a new series of landscapes and views drawn as seen by the designers, and not reproductions of the work of other men; and also sketches of scenes and characters of every-day life, and of the folk-lore in which Japan is so rich. Of the artists of this period, as of all others in Japan, Hokusai (1760–1849) is absolutely pre-eminent. His greatest production in book-illustration was the *Mangwa*, a collection of sketches which cover the whole ground of Japanese life and legend, art and handicraft. It consists of fifteen volumes, which appeared at intervals from 1812 to 1875, twelve being published during his life and the others from material left by him. Among his many other works may be mentioned shortly the *Azuma Asobi*, "Walks round Yedo" (1799), *The Hundred Views of Mount Fuji* (1834), and his many illustrations to novels. Of his pupils, Hokkei (1780–1856) and Kiôsai were the greatest. Most of the artists, whose main work was the designing of broadsheets, produced elaborately illustrated books; and this series includes specimens of printing in colours from wood-blocks, which for technique have never been excelled. Among them, as typical instances, should be mentioned Shunshô (*Seirô Bijin Awase kagami*, 1776); Utamaro (*Seirô Nenjiu gioji*, 1804); Toyokuni I. (*Yakusha Kono Teikishiwa*, 1801); as well as Harunobu Yeishi (*Onna sanjiu rokkasen*, 1798); Kitao Masanobu, and Tachibana Minko, each of whom produced beautiful work of the same nature.

In the period next following the chief artists were Keisai Yeisen (*Keisai so-gwa*, 1832), and Kikuchi Yosai (*Zenken Kojitsu*), the latter of whom ranks perhaps as highly as any of the artists who confined their work to black and white. The books produced in the period 1880–1900 in Japan are still of high technical excellence. The colours are, unfortunately, of cheap European manufacture; and the design, although quite characteristic and often beautiful, is as a rule merely pretty. The engraving is as good as ever. Among the book-illustrators of our own generation must be again mentioned Kiôsai; Kôno Bairei (d. 1895), whose books of birds—the *Bairei Hyakuchô Gwafu* (1881 and 1884) and *Iuaka-no-Tsuki* (1889)—are unequalled of their kind; Imao Keinen, who also issued a beautiful set of illustrations of birds and flowers, *Keinen Kwachô Gwafu*, engraved by Tanaka Jirokichi, and printed by Miki Nisaburô (1891–92);

and Watanabe Seitei, whose studies of similar subjects have appeared in *Seitei Kwachô Gwafu* (1890–91) and the *Bijutsu Sekai* (1894), engraved by Gotô Tokujirô. Mention should also be made of several charming series of fairy tales, of which that published in English by the *Kobunsha* at Tôkyô in 1885, &c., is perhaps the best. In their adaptation of modern processes of illustration the Japanese are entirely abreast of the Western nations, the chromo-lithographs and other reproductions in the *Kokkwa*, a periodical record of Japanese works of art (begun in 1889), and in the publications of Ogawa being of quite a high order of merit.

BIBLIOGRAPHY.—WILLIAM ANDERSON. *Pictorial Arts of Japan*, 1886; *Japanese Wood Engravings*; and *Catalogue of the Chinese and Japanese Paintings in the British Museum.*—STRANGE. *Japanese Illustration.* London.—E. DE GONCOURT. *Ontamaro et Hokusai.* Paris.—SEIDLITZ. *Geschichte des Japanischen Farbenholzschnitts.*—FENOLLOSA. *The Masters of Ukiyo-ye.*—L. GONSE. *L'Art Japonais.*—REIN. *The Industries of Japan.* These are the more modern authorities only, and cover the subject of Japanese engraving as well as of book-illustration.

(E. F. S.)

V. RECENT LITERATURE (1867–1900).

The downfall of the Shogunate was a fatal blow to the Chinese influences which for two and a half centuries had moulded every department of the Japanese national life—the political institutions, laws, science, philosophy, and literature. Signs of change were observable at an earlier period. In the latter part of the 18th century China had already lost some of its prestige, and the Dutch language with the European art of medicine had begun to be studied. But no substantial progress in the substitution of Europe for China as a source of knowledge and inspiration was made until the revolution which in 1867 restored the Mikado to his rightful position as sovereign. Under the new political conditions there were at first more urgent matters to be attended to than the cultivation of literature. The constitution had to be rebuilt, the laws remodelled, an army and navy organized, and a national system of education established. For these purposes, however, the study of European models was indispensable, and was taken up with extraordinary zeal and energy by all the younger and more active minds. A group of writers now came forward who made it their business to meet the demand of their countrymen for information as to the manners and customs, the learning, science, and institutions of Europe. Of these the most eminent was Fukuzawa, whose *Seiyō Jijō* ("*Things European*") was published in 1866, while a more recent work, an autobiography, bears date 1899. The latter is a noteworthy document bearing on the spread of European ideas in Japan. Translations of English books appeared in increasing numbers, and about 1872 a fresh impulse was given to the dissemination of European knowledge by the rise of a magazine and newspaper press.

The influence of Europe on Japanese literature proper dates from 1879, when a translation appeared of Lord Lytton's *Ernest Maltravers.* It attracted great attention, and was followed by other works of fiction, mostly English. More recently, French, German, and even Russian novelists have been laid under contribution. The result has been a thorough revolution in the Japanese art of novel-writing. The artificial word-plays, conventional character-drawing, fantastic morality, and extravagances of every kind of the older romantic school, have now been in great measure abandoned in favour of a more sober, common-sense style of writing. Tsuboüchi Yuzô was the leader of this movement. His *Shôzetsu Shinsui* ("*Spirit of Fiction*") is an unsparing attack on the methods and principles of Bakin and his school. He illustrated his views by novels and dramas, which have not only much intrinsic merit, but are valuable as pointing the way to a return to living realities. Bimyôsai writes in the colloquial dialect, which in Japan differs considerably in grammar and vocabulary from the literary language. His *Natsu Kadachi* is a series of short stories which bear manifest traces of the influence of European models. Kôyô in his realistic novels is also a writer in the colloquial dialect, the use of which for literary purposes has made great progress in recent years. Rohan is perhaps the most popular, as he is the most voluminous, writer of the present day. His historical novels are distinguished by dignity of language and by a tone of moral sentiment which belongs more to the past than to the present. Ichiyô, who died in 1896 at the age of twenty-four, was the author of a series of novelettes of great promise. She took the human and especially the female heart for her province. There is no little pathos in some of her stories, but it is to be regretted that the pleasure of their perusal is often marred, at least for European readers, by a subtlety or haziness of expression which borders on the unintelligible. Murai's *Hinodeshima* (1898–1900) is an entertaining study of New Japan, in which those who are interested in the curious moral and social results of the conflict between old and new, between China and Europe, will find much food for reflexion. Fiction occupies as prominent a position in recent Japanese literature as it does in Great Britain or the United States, and the above-mentioned writers are only a few out of many. Both for quality and quantity it is the most important that Japan has yet seen.

Although European principles of historical criticism are to some extent known and appreciated in Japan, little practical progress has been made in writing historical works. There is no scarcity of books of this kind, but they are generally either epitomes of Chinese, Japanese, or European histories, or else mere collections of materials. Tokutomi Iichirô's *Shôrai no Nihon* ("*Japan of the Future*") is an attempt to forecast the future of Japan by a philosophical examination of its past history. It has received high praise, not only for its matter, but for its style. Other important works are Marquis Ito's *Commentary on the Constitution*, Nose Yei's *Treatise on Education*, and a *History of Japanese Literature* by Mikami and Takatsu.

Until recently the poetry of Japan consisted mainly of short effusions in pure Japanese of seventeen or thirty-one syllables, forms of verse which afford no scope for the exercise of the poet's higher faculties. The publication in 1882 of a little work entitled *Shintaishishô* ("*Poetry of New Form*") by three authors, one of whom was Toyama, a professor of the Imperial University, marks the beginning of a new era in the history of Japanese poetry. It consists of nineteen poems of no great length, only a few of which are original compositions, the remainder being with one exception verse translations from English poets. The writers follow the traditional rule of the alternation of phrases of five and seven syllables, which in Japan constitutes metre, but the influence of their foreign models is traceable in the division of their poems into stanzas of equal length, an improvement which has been largely followed. Their most striking innovation, however, is the free introduction of Chinese words, which, on account of their flagrantly exotic appearance, had hitherto been rigorously excluded from all but the most vulgar forms of verse. A rule which debarred the use of such common words as *budô* (vine), Tôkyô (the name of the capital), *honshin* (conscience), was bound sooner or later to be relaxed, but Toyama probably went too far in this direction. The most successful poets of the new school are far more sparing in their use of Chinese vocables. In

their choice of themes and mode of treatment, Toyama and his collaborators are avowedly influenced by their English models. A lively controversy between old and new was aroused by this publication. The new school is at present unquestionably in the ascendant, and though the old thirty-one syllable poems are still written, they must be regarded rather as literary exercises than as literature. The real poetry of Japan is exemplified by such works as *Hana Momiji* by Shiwoi Ukô and two others, *Natsumushi Suzumushi* by Usuda, and *Wakana-Shiu* by Shiwozaki, collections of vague and dreamy, but pleasing and melodious lyrics, which give promise of better days for the art of poetry in Japan.

AUTHORITIES.—*A History of Japanese Literature*, by W. G. ASTON.—Various articles in the *Japan Weekly Mail*.—B. H. CHAMBERLAIN. *Things Japanese*, third edition; and his *Moji no Shirube*.

(W. G. AS.)

Jarkent, or DJARKENT, a district town of Russian Central Asia, province Semiryechensk, 153 miles east of Vyernyi, near to Ili river. It has a customs house for trade with China. Population (1897), 16,372.

Jaromierz (Czech, *Jaroměř*), a town in the government district of Königinhof in Bohemia. It has two suspension bridges across the Elbe, and is a station on the Austrian North-Western Railway. It has manufactures of chicory, sugar, jute, and textiles, and has a number of steam mills and brickfields. Population (1890), 6543, mostly Czech and Roman Catholic; (1900), 6671.

Jaroslau, the chief town of a government district in Galicia, Austria, on the left bank of the San, a tributary of the Vistula, and a station on the Austrian State railway between Cracow and Lemberg. It is the military headquarters of the district and has a garrison of 4964 men. The manufactures comprise linen, spodium or tutty, bricks and tiles, pottery, spirits, &c., and there is a considerable trade in hides, corn, and timber. Population (1890), 18,065; (1900), 22,614.

Jarrow-on-Tyne, a municipal borough (1875, extended 1884) in the Jarrow parliamentary division of County Durham, England, 6 miles east of Gateshead by rail. St Peter's Church was erected in 1881, and a chapel of ease in 1885, besides a mission church and Roman Catholic, Congregational, Baptist, Presbyterian, Wesleyan, and other places of worship. The area of the borough is 1064 acres. Population (1881), 25,483; (1901), 34,294.

Jassy, in Rumanian *Iaşi*, a town of Rumania, chief town of the district of Jassy and the former capital of Moldavia, is situated 5 miles west of the Pruth, at the junction of railways from Galatz, Czernowitz, and Odessa. The town stands pleasantly amid vineyards and gardens, partly on the slopes of two hills, partly in the hollow between them, and is the see of an archbishop of the Orthodox Greek Church and of a bishop of the Roman Catholic Church; the seat of a university with about 420 students, a military school, music school, art school, and commercial school; and has an active trade in cereals, petroleum, salt, textiles, clothing, and metals. Population (1900), 78,067. Population of the district of Jassy (1900), 191,828; area, 1201 square miles.

Jath, a native state of India, in the Deccan division of Bombay, ranking as one of the Southern Mahratta Zagirs. Area (together with Daphlapur), 979 square miles. The population in 1881 was 49,486; in 1891, 71,443; average density (with Daphlapur), 81 persons per square mile; estimated gross revenue, Rs.4,05,195, of which Rs.10,243 was devoted to public works in 1897–1898; tribute, Rs.6400; number of police, 72; number of schools, 27, with 870 pupils. The chief, whose title is Deshmukh, is a Mahratta of the Daphle family. The town of JATH is 92 miles south-east of Satara. Population (1891), 5264.

Jativa, a town of Spain, in the province of Valencia, on the railway from Madrid to Valencia. The population is decreasing, and in 1897 was only 11,830. It is a centre for trade in the agricultural products of the fertile surrounding districts—wheat, fruit of all kinds, raisins, wine, oil, and rice. Several public buildings have been erected, including an institute, a foundling hospital, a bull-ring, two theatres, fine markets and public lavatories.

Jauer, a town of Prussia, province of Silesia, 13 miles by rail south of Liegnitz, on the Roaring (*Wüthende*) Neisse. It has a new town hall (1898), and is famous for its cooked sausages. The chief industries include sugar, carpets, leather, cloth, and carriages. Population (1885), 11,178; (1895), 11,978; (1900), 13,027.

Jaunpur, a city and district of British India, in the Benares division of the North-West Provinces. The city is on the left bank of the river Gumti, 34 miles north-west from Benares by rail. Population (1881), 44,845; (1891), 42,819; (1901), 42,532; municipal income (1897–1898), Rs.35,178; incidence of taxation, Rs.0:9:3 per head; registered death-rate (1897), 46·29 per thousand. The city has lost its importance, the only industry surviving being the manufacture of perfumes. The district of JAUNPUR has an area of 1550 square miles. The population in 1881 was 1,209,663; in 1891, 1,264,949, showing an increase of nearly 5 per cent.; average density, 810 persons per square mile, being the highest in the province. In 1901 the population was 1,202,710, showing a decrease of 5 per cent. The land revenue and rates were Rs.12,56,047, the incidence of assessment being just under R.1 per acre; cultivated area (1896–97), 600,666 acres, of which 351,540 were irrigated entirely from private wells; number of police, 2612; number of vernacular schools (1896–97), 112, with 4671 pupils; registered death-rate (1897), 36·40 per thousand. There are five printing-presses, all owned by Mahommedans, issuing one vernacular newspaper; 161 indigo factories, employing 5474 persons, with an out-turn valued at Rs.2,11,000. The district is crossed by the line of the Oudh and Rohilkhand railway from Benares to Fyzabad.

Jauréguiberry, Jean Bernard (1815–1887), French admiral, was born at Bayonne, 26th August 1815. He entered the navy in 1831, was made a lieutenant in 1845, commander in 1856, and captain in 1860. After serving in the Crimea and in China, and being governor of Senegal, he was promoted to rear-admiral in 1869. During the Franco-German war he had a command under Chanzy, and was repeatedly mentioned in despatches for his brilliant conduct and remarkable tenacity. He was promoted to be vice-admiral on 9th December 1870; and in the following January he played a brilliant part at the battle of Le Mans. In 1871 he commanded the fleet at Toulon; in 1875 he was a member of the council of admiralty; and in October 1876 he was appointed to command the evolutionary squadron in the Mediterranean. In February 1879 he became minister of the navy in the Waddington cabinet, and on the 27th May following was elected a senator for life. He was again minister of the navy in the Freycinet cabinet in 1880. He was made commander of the Legion of Honour in 1861, grand officer on 17th November 1870, and grand cross on 14th January 1879. A fine example of the fighting French seaman of his time, Jauréguiberry died at Paris on the 21st of October 1887.

Java, an island of the Malay (or Eastern) Archipelago, chief of the Dutch foreign possessions. It has a total area, with Madura, of 50,390 square miles.

Physical Features.—Three points in the geology of Java are important. (1) Like Sumatra and Borneo, Java was for several geological periods united with south-eastern Asia; hence the shallowness of the sea to the north, contrasting with the greater depth on the south in the direction of the Indian Ocean. (2) During the Triassic and Jurassic, though not during the Cretaceous era, Java, like Sumatra, was raised above sea-level, and in the Eocene and Oligocene periods subsided to below it. The strata of the late Tertiary era, broken and folded, constitute with their eruptive rocks the prevalent formation of Java. They compose the steep coasts and mountains up to 2950 feet high, and, at a lower level, the deep bays and gulfs of the straits of Sunda and Bali on the extreme east and west and of parts of the south coast, such as the gulfs of Prigi and Patjitan. (3) Later formations, viz., diluvial tuffs and alluvium of rivers and seas, gradually silting up bays and lakes and extending the coasts, served ultimately to piece together into one island the separate islands (at least eight) of which in that age Java consisted. Volcanoes especially have played a great part in giving to Java its present shape and character of surface. How far the younger formations prevail over the older rocks will be evident from the following arithmetical determinations:—All rocks dating from before the late Tertiary formation occupy only 1·16 per cent. of the surface. Rocks of the late Tertiary formation occupy 37·7 per cent. These stretch in a west-to-east direction over nearly all the residencies, with a thickness of from 10,000 to 19,600 feet and more. Recent volcanic rocks (leucite and phonolith) and volcanoes occupy 27·6 per cent. These lie in the direction of the longitudinal axis or run in cross lines. Only fourteen of the volcanoes have remained active within historic times. The Quaternary and recent formations occupy 33·5 per cent. These are found as alluvial deposits along the north and south coasts near the rivers, and as diluvial tuffs at the base or in the neighbourhood of the volcanoes, filling up lakes or basins in the Tertiary formation and occupying plains.

The relief of the surface of Java is in close keeping with its geological formations. Leaving out of account the oldest rocks, it is to be observed in respect of the Tertiary sediments and their eruptive rocks that, like the Deccan traps in British India, they have formed, as in South Preanger, plateaux of gentle declivity, or, as in Gunong Gaja in Tegal and Gunong Lingga in Kediri, steep and, owing to erosion, fantastically-shaped mountains, with a maximum height of 6200 feet: the former rise in chalk ranges to 2950 feet, in other sedimentary rocks to from 4200 to 4400 feet. The recent volcanoes vary much in height. There are fourteen more than 10,000 feet, Smeru being 12,060 feet; Slamat, 11,391 feet; Arjuno, 10,925 feet; Sumbing, 10,915 feet; Ravun, 10,902 feet; Lavu, 10,712 feet. In respect of the recent formations, it is to be observed that the alluvium of sea and rivers deposits itself in more level layers, or rises in table-lands of not more than 300 to 400 feet. More elevated, however, are the volcanic sediments of lakes formed in Tertiary basins, and drained by rivers eroding the banks. These old lake bottoms now form high plateaux, which are very fertile and often healthy. Such is the plateau of Bandong (2230 feet), the plain of Garut (1640 to 2290 feet), of Sumedang (1500 feet), of Ambarava (1500 feet), &c.

Western, middle, and eastern Java are distinguished from one another by the character of their mountains and plains. Bounded on the east by Tji Losari and Tji Tanduwi, western Java is a mountain mass of volcanic summits and plateaux, relieved by valleys, and is resolvable into five distinct regions: (1) The isolated mountains of north and west Bantam: Gunong Ayung and Batur in Anjer, and the extinct volcanoes Pulosari and Karang. (2) The mountains of south Bantam, covered with forests and thinly populated. (3) The Blue Mountains on the frontier of Batavia and Preanger, with the volcanic systems of Slamat and Gede. (4) The mountains of Preanger, consisting of four plateaux, those of Bandong, Pengalengan, Tegal Badung, and Garut, encircled by volcanoes. (5) The mountains of north-east Preanger and Cheribon, bounded on the east by the plain of Sumedang and the Tjerimaï. The low-lying plains of any great extent in western Java are all in the northern half, though some plains of narrow compass skirt parts of the west and south coast. Middle Java, stretching from Tjerimaï and Losari on the west to Merbabu and Merapi on the east, presents narrower chains, each flanked by low lands, smaller and more isolated volcanoes, and, accordingly, larger rivers flowing to the south coast. The high land of the western part as far east as the Slamat, 1000 to 1300 feet in height, stretches in a N.N.W.–S.S.E. direction. The high land of the central part pursues a course S.S.E.–N.N.W., reaching in the Jembangan a height of 8200 feet. The eastern part is occupied with the plateau of Dieng, the soil of which consists of the lava of a crater, with lakes and ruins round its edge. Its highest point is Prahu. The valley of the Progo, stretching away southwards, between the volcanoes of Sumbing and Sindoro on its west and of Merbabu and Merapi on its east, is included within the limits of middle Java. Eastern Java differs in its orographic character from both western and middle Java. Barren mountain chains of limestone and sandstone skirt the north and the south coast, running in a double range along the former. The plains lie between the coast chains and the intermediate volcanoes. Flowing between the coast chains in a west-to-east or east-to-west direction, or winding in a south-to-north direction between the volcanoes, the rivers drain much larger basins.

The plains differ in surface and fertility, according to their geological formation. Built up of alluvium and diluvium, the plains of the north coast lands in western and middle Java are at their lower levels, near the mouths of rivers and the sea, in many cases marshy and abounding in lakes and coral remains, but for the rest they are fertile and available for culture. The plains, too, along the south coast of middle Java—of Banyumas and Bagelen—contain many morasses as well as sandy stretches and dunes impeding the outlet of the rivers. They are, nevertheless, available for the cultivation more particularly of rice, and are thickly peopled. In eastern Java, again, the narrow coast plains are to be distinguished from the wider plains lying between the parallel chains of limestone and between the volcanoes. The narrow plains of the north coast are constituted of yellow clay and tuffs containing chalk, washed down by the rivers from the mountain chains and volcanoes. Like the western plains, they, too, are in many cases low and marshy, and fringed with sand and dunes. The plains, on the other hand, at some distance from the sea, or lying in the interior of eastern Java, such as Surakarta, Madiun, Kediri, Pasuruan, Probolinggo, and Besuki, owe their formation to the volcanoes at whose bases they lie, occupying levels as high as 1640 feet down to 328 feet above the sea, whence they decline to the lower plains of the coast. Lastly, the plains of Lusi, Solo, and Brantas, lying between the parallel chains in Japara, Rembang, and Surabaya, are in part the product of rivers formerly flowing at a higher level of from 30 to 60 or 70 feet, in part the product of the sea, dating from a time when the northern part of the above-named residencies was still an island, such as Madura

is still, the mountains of which are the continuation of the north parallel chain.

The considerable rivers of western Java all have their outlets on the north coast, the chief among them being the Tji Tarum and the Tji Manuk. They are navigable for native boats and rafts, and are used for the transport of coffee and salt. On the south coast the Tji Tanduwi, on the east of the Preanger, is the only stream available as a waterway, and this only for a few miles above its mouth. In middle Java, also, the rivers discharging at the north coast—the Pamali, Tjomal, &c.—are serviceable for the purposes of irrigation and cultivation, but are navigable only near their mouths. The rivers of the south coast—Progo, Serayu, Bogowonto, and Upak, enriched by rills from the volcanoes—serve abundantly to irrigate the plains of Bagelen, Banyumas, &c. Their stony beds, shallows, and rapids, and the condition of their mouths lessen, however, their value as waterways. More navigable are the larger rivers of eastern Java. The Solo is navigable for large praus or native boats as far up as Surakarta, and above that town for lighter boats, as is also its affluent the Gentung. The canal constructed in 1893 at the lower part of this river, and alterations effected at its mouth, have proved of important service both in irrigating the plain and facilitating the river's outlet into the sea. The Brantas is also navigable in several parts. The smaller rivers of eastern Java are, however, much in the condition of those of western Java. They serve less as waterways than as reservoirs for the irrigation of the fertile plains through which they flow.

The north coast of Java presents everywhere a low strand covered with nipa or mangrove, morasses and fishponds, sandy stretches and low dunes, shifting river-mouths and coast lines, ports and roads, demanding continual attention and regulation. The south coast is of a different make. The dunes of Banyumas, Bagelen, and Jokjokarta, ranged in three ridges, rising to 50 feet high, and varying in breadth from 300 to over 1600 feet, liable, moreover, to transformation from tides and the east monsoon, oppose everywhere, also in Preanger and Besuki, a barrier to the discharge of the rivers and the drainage of the coast lands. They assist the formation of lagoons and morasses. At intervals in the dune coast, running in the direction of the limestone mountains, there tower up steep inaccessible masses of land, showing neither ports nor bays, hollowed out by the sea, rising in perpendicular walls to a height of 160 feet above sea-level. Sometimes two branches project at right angles from the chain on to the coast, forming a low bay between the capes or ends of the projecting branches, from 1000 to 1600 feet high. Such a formation occurs frequently along the coast of Besuki, presenting a very irregular coast line. Of course the north coast is of much greater commercial importance than the south coast.

Climate.—The meteorological observations accumulated at Batavia, the extension of stations for measurement of rainfall all over the archipelago, and the instructive publications of the director of the Batavia Observatory, have contributed materially to the scope and definiteness of our knowledge of the climate. The monthly temperature, reaching the high mean throughout the year of 78·69° F., shows variations among the different months of not more than 1·8° F. The warmest months are May and October, registering 79·50° and 79·46° F. respectively. The coldest months are January and February, registering 77·63° and 77·70° F. respectively. The daily variations are much greater than the monthly, amounting to from 9° to 10·8° F. The causes of such a steady high temperature are to be attributed, not solely to the perpendicular direction of the sun's rays on the island, but also, as Mr Wallace rightly observes, to the warmth of the soil, the dampness of the atmosphere, and the high temperature of the sea (82·4° to 84·2° F.) over which the winds sweep. Anemometrical observations of higher precision and of wider compass show a strongly prevalent N.W. wind blowing from November to March, and a prevalent S.E. wind throughout the other half of the year. In some parts, however, of the archipelago, N.E. and S.W. winds occasionally take the place of the prevailing winds, a phenomenon to be explained by the fact of the transition of the one monsoon into the other ("*Kentering*," as it is called), by the mutual influence of land and sea breezes, or perhaps by the neighbourhood of the large island of Borneo. The amount of rainfall and the number of rainy days under the N.W. and under the S.E. monsoon are represented by very different figures. Out of 72·283 inches of annual rainfall at Batavia, 51·496 inches is the contribution of the N.W., and only 20·787 inches of the S.E. monsoon. The heavier burden of moisture brought by the N.W. monsoon and the lesser borne by the S.E. is to be explained not only by the interception of neighbouring Australia and its limitation of the sea on the S.E., but also by the fact that the ocean over which the S.E. monsoon blows is cooler than the Sea of Java, which is licked by the N.W. monsoon. The climate of western and middle Java differs in many respects from that of eastern Java. In western and middle Java the amount of rainfall and the number of rainy days increase with the increase of height, and the rain is much more regularly distributed over the year. Buitenzorg, *e.g.*, receives from November to April 97·5 inches of rain; in the other months 75·15 inches. Sinagar, south-east of Salak and Gede, again, has a rainfall from November to April of 75·075 inches; in the other months of 49·335 inches. In eastern Java the coast lands receive a smaller share of the annual rainfall—less than 58 inches. But contrasting the interior of the island in western and middle Java on the one hand with the interior of eastern Java on the other, whereas the former gets yearly from 108·6 to 156 inches or more of rain, the latter's share is only 72·6 to 117·6 inches. In eastern Java the four dry months from July to October show a great difference in their respective rainfalls, the monthly rainfall for each showing respectively a declining series of 1·1, 0·51, 0·236, and 0·157 inches, while the number of wet days in these months dwindles down to as low as 2 and 1 at Pasuruan and Besuki. On the south coast Tjilatjap is remarkable for the annual amount of its rainfall, 151·43 inches, the greater portion of which, 87·8 inches, is brought by the S.E. monsoon. The climate differs, of course, with difference of altitude.

Area and Population.—The following table gives the areas of the different residencies, together with the numbers of the various races inhabiting the island, and the total population in 1897:—

Residencies.	Area in Square Miles.	Europeans.	Chinese.	Arabs.	Other Foreign Inhabitants.	Natives.	Total Population 1897.
Bantam	3,030	302	1,959	54	35	706,989	709,339
Batavia	2,631	12,434	82,510	3,279	147	1,215,013	1,313,383
Krawang	1,785	201	4,717	90	..	441,957	446,965
Preanger	7,885	2,475	5,274	110	14	2,166,271	2,174,144
Cheribon	2,608	867	21,108	1,896	120	1,553,530	1,577,521
Tegal	1,466	953	8,650	717	7	1,191,292	1,201,619
Pekalongan	691	607	5,917	944	51	566,626	574,145
Banyumas	2,147	915	5,454	11	101	1,264,096	1,270,577
Bagelen	1,324	1,029	3,937	..	52	1,459,385	1,464,403
Jokjokarta	1,192	2,409	3,836	86	142	851,919	858,392
Surakarta	2,404	2,853	8,524	85	246	1,214,860	1,226,368
Kedu	791	858	7,274	133	6	759,523	767,794
Samarang	2,002	5,648	20,421	831	1,130	1,481,647	1,509,677
Japara	1,205	983	10,983	74	167	953,640	965,847
Rembang	2,910	1,013	16,551	387	63	1,333,972	1,351,986
Madiwûn	2,506	1,363	4,456	15	74	1,132,657	1,138,565
Kediri	2,610	2,171	10,034	..	..	1,287,692	1,299,897
Surabaya	2,091	8,785	22,525	3,463	676	2,181,671	2,217,120
Pasuruan	2,066	2,442	7,071	1,284	88	1,057,118	1,068,003
Probolinggo	1,126	1,477	3,634	446	11	572,298	577,866
Madura	1,770	558	4,252	1,591	108	1,646,071	1,652,580
Besuki	3,890	1,394	2,220	1,579	..	753,726	758,919
Java (with the isles).	50,130	51,737	261,107	17,075	3,238	25,791,953	26,125,110

The total population in 1880 was 19,794,505, and in 1890, 23,912,564. The population of 1898 shows a considerable decline from the figures of 1897, being only 25,697,701, in which the native element numbers 25,370,545. The number of British residents at Batavia at the end of 1899 was 128; at Surabaya, 84; and at Samarang, 17. The population of Batavia (31st December 1896) was 115,567, 9423 of them Europeans; Buitenzorg, 25,000, 1500 of them Europeans; Surabaya, 142,980, 6988 of them Europeans; Samarang, 84,266, 3355 of them Europeans. The population of Batavia in 1897 was 115,567; Samarang, 84,244; Surabaya, 142,980; Surakarta, 86,074, of whom 1370 were Europeans; and Jokjokarta, 60,523, of whom 2240 were Europeans. One million out of the twenty-six millions are concentrated in towns, a fact readily explained by their sources of livelihood.

Occupations.—Of the European inhabitants, one-half are employed in the civil and military service, one-third are engaged in agriculture, and one-sixth follow trades. The Chinese inhabitants are mostly traders and labourers. The Arabs are nearly all traders

or employed on ships. At least three-quarters of the natives live by agriculture, and therefore the differences in density and concentration of population are chiefly to be explained by the different character of the land and the special physical features; in part, however, they are due to the character and habits of the Javanese, to the care exercised by the Government for the improvement of agriculture, ways of communication, and means of irrigation, to say nothing of its efforts for alleviating the pressure of inundation, blight of crops, and the low prices of products.

Religion and Instruction.—The number of Christians in Java increased from about 6000 in 1875 to 19,193 on the 1st January 1896. In 1900 there were 141 Christian missionaries in the Dutch East Indies. Primary schools for the natives increased from 306 with 37,099 pupils in 1883 to 468 with 67,480 pupils in 1899. The number of teachers in Government schools was, in 1888, 1405; in 1899, 1824. For the education of Europeans and persons assimilated with them, there were in the Dutch East Indies, in 1899, 7 public middle-class schools, with 1051 pupils and 118 teachers, costing the Government £49,278, the revenue from school fees being £7268. For Europeans there were, besides, in 1899, 135 mixed public elementary schools, 30 girls' schools, and 21 private schools. The 165 public schools had 546 teachers with 15,132 pupils, 1626 of them natives. The 21 private schools had 166 teachers with 3270 pupils. The cost of public elementary schools was, in 1899, £212,211, and the income £23,674. The Government expenditure on public instruction for the natives of Java in 1899 amounted to £125,108.

Minerals.—The geological explorations of Dr Verbeek have revealed the poverty of Java in minerals. Gold has been found in very small quantity, if, indeed, it actually has been found. Lead, copper, and zinc have been found in only two residencies, also in very small quantity. Coal is found only in Preanger and Bantam, but, handicapped by the want of railways and good ports in the neighbourhood of the coal-fields, not in paying quantity. Veins of iodine and salt, sulphur and marble, and latterly petroleum, particularly in Surabaya, Rembang, and Samarang, have been worked.

Cultivation and Production.—Taking as basis Dr Holle's charts and statistics and the Government Colonial Report for 1892–93, we find that 40 per cent. of the soil is under cultivation. Bantam and Besuki have each 16 per cent. of land under cultivation; Krawang, 21 per cent.; Preanger, 23 per cent.; Rembang, 30 per cent.; Japara, 62 per cent.; Surabaya, 65 per cent.; Kedu, 66 per cent.; Samarang, 67 per cent. Proceeding along the south coast from its west end, we find that in Bantam all the land cultivated on its south shore amounts to at most but 5 per cent. of that regency; in Preanger and Banyumas, as far as Tjilatjap, the land under cultivation amounts at a maximum to 20 per cent. East of Surakarta the percentages of land on the south coast under cultivation decline from 30 to 20 and 10. East of the residency of Probolinggo the percentage of land cultivated on the south coast sinks to as low as 2. On the north coast, in Krawang and Rembang, with their morasses and double chains of chalk, there are districts with only 20 and 10 per cent. of the soil under cultivation. In the residencies, on the other hand, of Batavia, Cheribon, Tegal, Samarang, Japara, Surabaya, and Pasuruan, there are districts having 80 to 90 per cent. of soil, and even more, under cultivation.

The agricultural products of Java must be distinguished into those raised by the natives for their own use and those raised for the Government and private proprietors. The land assigned to the natives for their own culture and use amounts to about 9,625,000 acres. In western Java the prevailing crop is rice, less prominently cultivated in middle Java, while in eastern Java and Madura other articles of food take the first rank. The agricultural produce grown on the lands of the Government and private proprietors, comprising an area of about 3½ million acres, consists of sugar, cinchona, coffee, tobacco, tea, indigo, &c. The number of factories for the manufacture of sugar was, in 1881, 42; in 1890, 57; in 1899, 144; and the production in these three years was, in piculs, each of 135,872 ℔ avoir., respectively 528,420, 1,512,955, and 9,792,957. The average production per backu (1¾ acres) of cultivated land rose from 52·88 piculs in 1881 to 110·91 piculs in 1899. About 4 million piculs are exported to the United States and Canada, 2 millions to China, and 1½ millions to Europe. The total crop of sugar in 1899 amounted to 11,895,010 piculs (or 796,324 tons), against 11,349,523 piculs (or 689,104 tons) in 1898 and 9,025,617 piculs (or 546,760 tons) in 1897. About 6,600,000 ℔ of cinchona are annually raised. The export of cinchona bark from Java amounted in 1899 to 11,221,000 Amsterdam ℔ (1 Amst. ℔ = 1·0893 ℔ avoir.), against 11,150,000 Amst. ℔ in 1898, and 8,511,000 Amst. ℔ in 1897. The production of coffee for the Government, often 1 million piculs in a year between 1874 and 1884, amounted in 1890 to 96,000 piculs; in 1892 to 693,000; in 1893 to 69,000; in 1897 to 474,000; and in 1899 to 198,858; the amounts for 1890 and 1893 being minimum yields. The production of coffee on private property increased from 120,000 piculs in 1890 to 550,000 piculs in 1893. The total crop of coffee in 1899 was 44,900 tons, against 29,827 tons in 1898 and 55,280 tons in 1897. In the production of coffee and cinchona Preanger, Pasuruan, and Tegal take the first place. Java tobacco, amounting to about 35,200,000 ℔ avoir. a year, is cultivated almost exclusively in eastern Java. The tobacco crop of 1899 amounted to 53,417,672 ℔ avoir., against 49,853,656 ℔ in 1898 and 30,223,416 ℔ in 1897. The tea crop was, in 1899, 12,841,702 ℔; in 1898, 12,110,724 ℔; in 1897, 11,218,559 ℔; and in 1896, 9,568,732 ℔. The production of indigo in 1899 amounted to 1,784,553 ℔, against 2,555,133 ℔ in 1898 and 2,107,921 ℔ in 1897, the falling-off being due to the fall in prices and consequent reduction in the area of land laid out. The production of cocoa in 1899 was 2,116,976 ℔, against 2,073,592 ℔ in 1898, 1,920,184 ℔ in 1897, and 1,784,875 ℔ in 1896. The production of nutmegs was 241,000 ℔, and of mace 33,048 ℔ in 1899, against 182,784 ℔ of nutmegs and 87,176 ℔ of mace in 1898, 81,600 ℔ of nutmegs and 12,452 ℔ of mace in 1897. The rice raised for export in 1899 amounted to 43,265 tons, against 36,211 tons in 1898 and 18,236 tons in 1897. The yield of pepper in 1899 amounted to 18,840,272 ℔, against 8,686,864 ℔ in 1898 and 12,409,184 ℔ in 1897. In 1899, 499,703 hides were exported; in 1898, 504,058. Of arrack 430,274 gallons were exported in 1899, against 404,477 gallons in 1898 and 499,016 gallons in 1897. In 1899, 45,331 tons of copra were exported, against 2467 tons in 1898, 5541 tons in 1897, and 19,122 tons in 1896.

Live Stock.—As in agricultural products, so also in cattle-rearing, western Java is distinguished from middle and eastern Java. There were, in 1895, 2,643,223 buffaloes, 2,572,231 head of cattle, 485,567 horses, numbers which underwent no material alteration in succeeding years. The average distribution of buffaloes is 106 per 1000 inhabitants, varying considerably in different districts, being greatest in western Java. The fact that rice is the prevailing culture in the west, while in eastern Java other plants constitute the chief produce, explains the larger number of buffaloes found in western Java, these animals being more in requisition in the culture of rice.

Shipping and Commerce.—The total tonnage of sailing and steam vessels chartered in 1899 amounted to 678,671 tons, against 555,718 tons in 1898. The total number of steam vessels entered in 1899 at the ports of Batavia, Samarang, and Surabaya, was 2146 of 2,840,159 tons. The total number of sailing vessels entered in 1899 at these ports was 264 of 151,056 tons. The steam vessels that cleared at these ports in 1899 was 2173 of 2,749,386 tons, while the sailing vessels that cleared numbered 258 of 146,115 tons. In addition to the agricultural exports, tin was exported, from Banka and Billiton through Java, in 1899 to the amount of 16,807 tons, against 14,128 tons in 1898. The imports into Java (and Madura) in 1899 included cotton goods bleached, from Holland, of the value of £616,124, against £738,770 in 1898; and, from Great Britain, in 1899, £395,729, against £326,593 in 1898; cotton goods, printed and coloured, from Holland, £364,321, against £333,159 in 1898; and from Great Britain in 1899 £414,310, against £395,404 in 1898. Petroleum, 13,258,419 gallons, against 16,144,942 gallons in 1898.

The Java Bank has a capital of £500,000 and a reserve of about £100,000. In March 1900 there were notes in circulation to the value of £5,049,250, and bank operations to the value of £2,718,583. The amounts deposited in the Post Office Savings Bank in 1900 were: Europeans, 2,521,963 florins; natives, 266,003 fl.; Chinese and other Asiatics, 50,021 fl.; or a total of 2,837,987 fl.

Roads and Railways.—Unless for purposes of defence and political communications, the roads and railways under the management of the Government avoid the uninhabited mountain chains of sandstone and chalk. For the most part they follow the fertile plains and table-lands along the coast and between the volcanoes. Besides the Kalisat–Banyuwangi Extension Railway there is the Batavia–Anjer line, which was opened as far as Serang in July 1900. Altogether there were in 1900 in Java 1106 miles of railway and 414 miles of tramway. There are also 344 post and telegraph stations. The Dutch Steam Navigation Company has 31 steamers running through the whole archipelago.

AUTHORITIES.—VETH. *Java, geographisch, ethnologisch, historisch.* 2nd ed., 1895.—VERBEEK and FENNEMA. *Geologische Beschryving van Java en Madoera*, 1896; with atlas and geological bibliography.—VETH'S *Album*, with articles on coasts and orography of Java.—VAN DORP. *Officieele Reisgids*, 1897.—VAN DER STOK. *Regenwaarnemingen in N. Indië* (1899), and *Atlas of Wind and Weather*, &c.—VAN GORKOM. *De Indische Cultures*, 2nd ed.—*Jaarcijfers Uitgegeven door de Centrale Commissie voor de Statistiek.* The Hague, 1899.—*Encyclopaedie v. N. Indië*, art. "Java."—*Guide à travers l'Exposition de Paris*, The Hague, 1900; with articles by specialists on each department of the Dutch colonies, more particularly Java.—*Koloniale Verslagen en Regeerings-almanak van N. Indië*, being official publications of the Dutch and Dutch East-Indian Government. (C. M. K.)

Recent History.—Being the principal Dutch colony in the Malay Archipelago, Java was the first to benefit from the material change which resulted from the introduction of the *Grondwet* or Fundamental Law of 1848 in Holland. The main changes were of an economical character, but the political developments were also important. Since 1850 Dutch authority has steadily advanced, principally at the expense of the semi-independent sultanates in central Java, which had been allowed to remain after the capture and exile of Dipâ Negârâ, the last Javanese prince, who claimed the whole island, a man as capable as he was unscrupulous, as bold as he was influential. To subdue him and his following taxed all the resources of the Dutch Indian army for a period of five years, and cost it the loss of 15,000 officers and soldiers, besides millions of guilders. Nor did his great influence die with him when his adventurous career came to a close in 1855 at Macassar. Many Javanese, who dream of a restoration of their ancient empire, do not believe even yet that Dipâ Negârâ is dead. They are readily persuaded by fanatical *hadjees* that their hero will suddenly appear to drive away the Dutch and claim his rightful heritage. Several times there have been political troubles in the native states of central Java, in which Dipâ Negârâ's name was used, notably in 1883, when many rebellious chieftains had to be exiled. Similar attempts at revolt had been made before, mainly in 1865 and 1870, but none so serious perhaps as that in 1849, in which a son and a brother of Dipâ Negârâ were implicated, whose avowed aim was to deliver and reinstate the latter. All such attempts proved as futile there as others in different parts of Java, especially in Bantam, where the troubles of 1850 and 1888 had a religious origin, and in the end they directly contributed to the consolidation of Dutch sway. The power of the sultans of Jokjokarta and Surakarta has diminished; in 1863 Dutch authority was strengthened in the neighbouring island of Madura, and Bantam has lost every vestige of semi-independence. Everywhere, in fact, since 1850 the position of the Dutch in Java has become much stronger. Their increase in power has largely resulted from a more statesmanlike and more generous treatment of the natives, who have been educated to regard the *Orang blanda*, or white man, as their protector against the native rulers. Thus, in 1866, passports for natives in Java, when travelling, were abolished by the then Governor-General, Dr Sloet van de Beele, who also introduced many reforms, reducing the *corvée* in the Government plantations to a minimum, and doing away with the monopoly of fisheries. Six years later a primary education system for the natives, and a penal code, whose liberal provisions seemed framed for Europeans, were introduced. Material welfare was also promoted by lines of steamships between Java and the other islands, all belonging to a Royal Packet Company, established in 1888 under a special statute, and virtually possessing a monopoly on account of the Government mail contracts; as well as by the construction of a system of railways, which, gradually extending in all directions, now enable the traveller to cover the whole of Java in a few days. The earliest Java lines, between Batavia and Buitenzorg, its pleasant suburb, and between Samarang and the capitals of the sultanates, were built, about 1870, by a private company with a State guarantee. Since 1875, when the late Dr van Goltstein, then a cabinet minister and afterwards Netherlands minister in London, had an Act passed for the construction of State railways in Java, their progress has become much more rapid. In addition, several private companies have built either light railways or tramways. Telegraphs have also been extensively laid between Java and the other islands of the archipelago—Java forming an important link in the cable communication with Australia. The services for passengers, goods, and mails from Europe to Java, and *vice versâ*, have also improved since the establishment of the Netherland and Rotterdam Lloyd Steamship Companies. The construction of large harbour works at Tandjong Priok, near Batavia, which took eight years to build (1877–85), contributed to the increased prosperity of Java during the second half of the 19th century—a progress all the more remarkable because of industrial and agricultural depression. Among the exceptions, the chief one to be noted is the petroleum industry. In 1875 the existence of petroliferous deposits in Java was not so much as suspected, but at the beginning of the present century several large companies were successfully at work in Surabaya, Samarang, and Rembang, the principal petroleum centres of Java to-day.

For the recent history of Java, consult the works mentioned under HOLLAND and MALAY ARCHIPELAGO; also Prof. P. J. VETH's *Java* (in Dutch), an indispensable and masterly compendium largely based upon JUNGHUHN's description. The second edition of VETH's *Java*, much enlarged and brought up to date, is in course of publication. Haarlem, 1895 *et seq.* (H. TI.)

Jawhar, a native state of India, in the Konkan division of Bombay, situated among the lower ranges of the Western Ghats. Area, 534 square miles. The population in 1881 was 48,556; in 1891, 52,831; average density, 99 persons per square mile. In 1901 the population was 47,264, showing a decrease of 11 per cent. The estimated gross revenue is Rs.1,57,520, of which Rs.37,063 was expended on public works in 1897–98; no tribute; number of police, 41; number of schools, 8, with 449 pupils. The chief, who is a Koli by caste, traces back his descent to 1343. The town of JAWHAR is 50 miles north-east of Thana, on a plateau about 1000 feet above the sea. Population (1891), 2991.

Jaworów, the chief town of a district in the Austrian crownland of Galicia, 30 miles west of Lemberg. It has a pottery, a brewery, and a distillery, and some trade in agricultural produce. In 1890 the commune had a population of 9219 Ruthenians and Poles, including 2572 Jews; (1900), 10,090.

Jaworzno, a market-place in the Galician government district of Chrzanów, Austria, 30 miles west of Cracow, and a station on the Ferdinands-Northern Railway. It has important coal-mines, deposits of calamine or hydrous silicate of zinc, smelting furnaces for this ore, and a glass factory. Population, mostly Polish (1890), 6637; (1900), 9206.

Jeannette, a borough of Westmoreland county, Pennsylvania, U.S.A., on the Pennsylvania Railroad. It is situated in the natural-gas territory, and has extensive glass factories. Population (1890), 3296; (1900), 5865, of whom 1340 were foreign-born.

Jebrail, a district town of Russia, Transcaucasia, government and 105 miles south-south-east of Elisabethpol, one of the chief custom-houses for trade with Persia.

Jedburgh, a royal burgh and the county town of Roxburghshire, Scotland, on the Jed water, 56 miles south-east of Edinburgh by rail. Its constituency was merged in that of the county in 1885. The town has five woollen mills. The ruined abbey was acquired from the heritors by the marquis of Lothian in 1875 in exchange for a fine church and manse. There are two public parks, a new public hall (in place of the Corn Exchange burned down), and a free library. A new grammar school, built in 1883, is the only public school. Population (1881), 3400; (1901), 2222.

Jedlersdorf, officially *Gross-Jedlersdorf*, an industrial village in the government district of Floridsdorf, in Lower Austria, situated in the Marchfeld, north of Vienna.

It has extensive railway works and manufactures of machinery, screws, malt, yeast, gutta-percha, &c. Population (1890), 2038; (1900), 2607.

Jefferies, Richard (1848–1887), English naturalist and author, was born on 8th November 1848, at a farmhouse called Coate, which stands about 2½ miles from Swindon, on the road to Marlborough, Wiltshire, England. He was sent to school, first at Sydenham and then at Swindon, till the age of fifteen or so, but his actual education was at home, at the hands of his father, who gave him his love for Nature and taught him how to observe. For the faculty of observation, as Jefferies, Gilbert White, and Thoreau have remarked, several gifts are necessary, including the possession of long sight and quick sight, two things which do not always go together. To them must be joined trained sight and the knowledge of what to expect. The boy's father first showed him what there was to look for in the hedge, in the field, in the trees, and in the sky. This kind of training would in many cases be wasted: to one who can understand it, the book of Nature will by and by offer pages which are blurred and illegible to the city-bred lad, and even to the country lad the power of reading them must be maintained by constant practice. To live amid streets or in the working world destroys it. The observer must live alone and always in the country; he must not worry himself about the ways of the world; he must be always, from day to day, watching the infinite changes and variations of Nature. Perhaps, even when the observer can actually read this book of Nature, his power of articulate speech may prove too imperfect for the expression of what he sees. But Jefferies, as a boy, was more than an observer of the fields; he was bookish, and read all the books that he could borrow or buy. And presently, as is apt to be the fate of a bookish boy who cannot enter a learned profession, he became a journalist and obtained a post on the local paper. He developed literary ambitions, but for a long time to come was as one beating the air. He tried local history and novels; but his early novels, which were published at his own risk and expense, were, deservedly, failures. In 1872, however, there appeared a remarkable letter in *The Times* from him, on "The Wiltshire Labourer," full of original ideas and of facts new to most readers. This was in reality the turning-point in his career. In 1873, after more false starts, Jefferies returned to his true field of work, the life of the country, and began to write for *Fraser's Magazine* on "Farming and Farmers." He had now found himself. The rest of his history is that of continual advance, from close observation becoming daily more and more close, to that intimate communion with Nature with which his later pages are filled. The developments of the later period are throughout touched with the melancholy that belongs to ill-health. For, though in his prose poem called "The Pageant of Summer," the writer seems absolutely revelling in the strength of manhood that belongs to that Pageant, yet, in the "Story of my Heart," written about the same time, we detect the mind that is continually turned to death. He died at Goring, worn out with many ailments, on 14th August 1887. The best-known books of Richard Jefferies are:—*The Gamekeeper at Home* (1878); *The Story of my Heart* (1883); *Life of the Fields* (1884), containing the best paper he ever wrote, "The Pageant of Summer"; *Amaryllis at the Fair* (1884), in which may be found the portraits of his own people; and *The Open Air*. He stands among the scanty company of men who address a small audience, for whom he read aloud these pages of Nature spoken of above, which only he, and the few like unto him, can decipher. (W. BE.)

Jefferson City, capital of Cole county and of the state of Missouri, U.S.A., on the south bank of the Missouri, at an altitude of 555 feet. The Missouri Pacific, the Chicago and Alton and the Missouri, Kansas and Texas Railways pass through it. Its site is partly in the bottom-lands of the river and partly on the steep banks. Population (1890), 6742; (1900), 9664, of whom 786 were foreign-born and 1822 negroes.

Jefferson, Joseph (1829–——), American actor, was born at Philadelphia on the 20th of February 1829. He was the third and most famous actor of this name, and perhaps the most famous of all American comedians. In childhood he appeared as a supernumerary, and followed the company of which his father and mother were members throughout the west and south, becoming himself a stock actor and manager. His first pronounced success was made in 1858 as Asa Trenchard in Tom Taylor's *Our American Cousin*. The naturalness and spontaneity of humour with which he acted the love scenes revealed a spirit in comedy new to his contemporaries, long used to a more artificial convention; and the touch of pathos which the part required revealed no less to the actor an unexpected power in himself. Other early parts were Newman Noggs in *Nicholas Nickleby*, Caleb Plummer in *The Cricket on the Hearth*, Dr Pangloss in *The Heir at Law*, Salem Scudder in *The Octoroon*, and Bob Acres in *The Rivals*, the last part being not so much an interpretation of the character as Sheridan sketched it as a creation of the actor's. In 1859 Jefferson made a dramatic version of the story of *Rip Van Winkle* on the basis of older plays, and acted it with success at Washington. The play was given its permanent form by Dion Boucicault (1865) in London, where it ran 170 nights, with Jefferson in the leading *rôle*. Jefferson continued to act with undiminished popularity in a limited number of parts in nearly every town in the United States, his Rip Van Winkle, Bob Acres, and Caleb Plummer being the most popular. He was one of the first to establish the travelling "combinations" which superseded the old system of local stock companies. With the exception of minor parts, such as the First Gravedigger in *Hamlet*, which he played in an "all star combination" headed by Edwin Booth, Jefferson created no new character after 1865; and the success of Rip Van Winkle was so pronounced that he has often been called a one-part actor. He devoted much of his time to painting. The *Autobiography of Joseph Jefferson* (New York, 1889) is written with admirable spirit and humour, and its judgments with regard to the art of the actor and of the playwright will probably entitle it to a place beside *An Apology for the Life of Colley Cibber*.

Jeffersonville, capital of Clark county, Indiana, U.S.A., on the north bank of the Ohio, opposite Louisville, Kentucky, with which it is connected by several bridges. It is on the Baltimore and Ohio South-Western and the Pittsburg, Cincinnati, Chicago and St Louis Railways, and is at an altitude of 441 feet. It is at the head of the falls, which descend 26 feet in two miles, giving abundant water power, which is utilized in manufactures both here and in Louisville. Population (1890), 10,666; (1900), 10,774, of whom 615 were foreign-born and 1818 negroes.

Jeisk, a district town of Russia, northern Caucasia, in Jeisk Bay, in the north-east of the Sea of Azov, province of Kubañ, 140 miles north-west of Ekaterinodar. Owing to its situation amidst a fertile region, its exports of corn, wool, and linseed are of some importance. Population (1897), 20,706.

Jena, a town of Germany, grand-duchy of Saxe

Weimar, on the Saale, 28 miles by rail east of Erfurt (14 east of Weimar), the seat of the joint university of the Saxon duchies; in 1900 nearly £40,000 was voted for providing new university buildings. Amongst the famous Jena professors have been Schiller, Oken, Fichte, Schelling, and Hegel. In 1900 the university was attended by 758 students, and had 97 professors. Its library now numbers 200,000 volumes. Jena is the seat of a veterinary school, an agricultural institute, a new astronomical observatory, all connected with the university; and in 1900 it was proposed as the seat of a technical high school for the Saxon duchies. There are monuments to Bismarck (1892), Fritz Reuter (1888), and the students' societies of the first half of the 19th century, the *Burschenschaften* (1883), by Donndorf. The Lichtenhainer beer, brewed in the villages adjacent (Lichtenhain, Zeigenhain, Wöllnitz, &c.), is widely celebrated. Population (1885), 11,680; (1900), 20,677.

Jenkin, Henry Charles Fleeming (1833–1885), British engineer, was born near Dungeness on 25th March 1833, his father (died 1885) being a naval commander, and his mother (died 1885) a novelist of some literary repute (her best books perhaps being *Cousin Stella*, 1859, and *Who Breaks, Pays*, 1861). Fleeming Jenkin was educated at first in Scotland, but in 1846 the family went to live abroad, owing to financial straits, and he studied at Genoa University, where he took a first-class degree in physical science. In 1851 he began his engineering career as apprentice in an establishment at Manchester, and subsequently he entered Newall's submarine cable works at Birkenhead. In 1859 he began, in concert with Sir William Thomson (afterwards Lord Kelvin), to work on problems respecting the making and use of cables, and the importance of his researches on the resistance of gutta-percha was at once recognized. From this time he was in constant request in connexion with submarine telegraphy, and he became known also as an inventor. In 1865 he was elected F.R.S., and was appointed professor of engineering at University College, London. In 1868 he obtained the same professorship at Edinburgh University, and in 1873 he published a text-book of *Magnetism and Electricity*, full of original work. He was the author of the article BRIDGES in the ninth edition of this Encyclopædia. His influence among the Edinburgh students was pronounced, and R. L. Stevenson's well-known *Memoir* is a sympathetic tribute to his ability and character. His interests were by no means confined to engineering, but extended to the arts and literature; his miscellaneous papers, showing his critical and unconventional views, were issued posthumously in two volumes (1887). In 1882 Jenkin invented an automatic method of electric transport for goods—"telpherage," but before he could complete its details he died (12th June 1885). A telpher line on his system was subsequently erected at Glynde in Sussex. Fleeming Jenkin was also well known as a sanitary reformer, and during the last ten years of his life he did much useful work in inculcating more enlightened ideas on the subject both in Edinburgh and outside.

Jenner, Sir William, 1st BARONET (1815–1898), English physician and surgeon, was born at Chatham on 30th January 1815, and educated at University College, London. He became M.R.C.S. in 1837, and F.R.C.P. in 1852, and in 1844 took the London M.D. degree. In 1847 he began at the London Fever Hospital investigations into cases of "continued" fever which enabled him finally to make the distinction between typhus and typhoid with which his reputation as a pathologist is principally connected. In 1849 he was appointed professor of pathological anatomy at University College, and also assistant physician to the hospital; afterwards he held other professorships there, and was physician (1854–76) and consulting physician (1879), besides holding similar appointments at other hospitals. He was President of the College of Physicians (1881–88), President of the Epidemiological Society (1866–68), of the Pathological Society (1873–75), and of the Clinical Society (1875); he was elected F.R.S. in 1864, and received honorary degrees from Oxford, Cambridge, and Edinburgh. He was in constant attendance on the Royal Family. In 1861 he was appointed physician extraordinary to Queen Victoria, in 1862 physician in ordinary, and in 1863 physician in ordinary to the prince of Wales, and he attended both the Prince Consort and the prince of Wales in their attacks of typhoid fever. In 1868 he was created a baronet. As a consultant Sir William Jenner had a great reputation, and he left a large fortune when he died on 11th December 1898, having then retired from practice for eight years owing to ill-health.

Jerez de la Frontera, a town of Spain, in the province of Cadiz, on the railway from Cadiz to Seville. Its population is decreasing, and was only 55,951 in 1897. With the growth of its wine trade and its commerce in agricultural products, however, Jerez has become one of the most important cities of southern Spain. The modern buildings are of handsome appearance, and include the institute, 14 primary schools, a state remount and stud, an academy of law, a school of medicine, a fine arts and Philharmonic academy, model farms, a commercial experts' school, a chamber of commerce, several casinos, orphanages for both sexes, hospitals, and a reformatory. There are also public gardens, and tramways have been laid down. The vineyards around Jerez furnish in reality only part of the wine actually exported and labelled Vino de Jerez. In 1898 this amounted to 4,949,100 gallons. The export of wine is no longer confined practically to Great Britain. In 1898 the export to France was valued at £170,908, and that to England at only £167,827, the total exports being valued at £497,904. The district has earned a reputation for being disaffected, and has frequently been the scene of anarchical outbursts.

Jericho, now ERÍHÁ, 820 feet below the level of the sea, a village in the Jordan valley, east-north-east of Jerusalem. It forms part of one of the large estates owned by the Sultan in Palestine, and is a centre of administration under a Mudír. An aqueduct has been built and much waste land has been brought under cultivation. Clearances in the jungle east of ʿAin es-Sultán, "Elisha's fountain," have brought to light several remains of Roman and Byzantine Jericho. There are Greek and Russian churches and monasteries.

Jersey. See CHANNEL ISLANDS.

Jersey City, capital of Hudson county, New Jersey, U.S.A., the second city in size in the state and its principal seaport, on the Hudson river, opposite New York, of which it is a part commercially and industrially. It is well paved, most of its streets being of either granite blocks or asphalt; it has a good water-supply and is well sewered, and is progressive in all matters of municipal government and improvement. It is the terminus of several steamship lines from Europe and the south of the United States, and of most of the railway lines from the south and west to New York. These lines are connected with New York by ferries. Of the foreign commerce it is impossible to supply figures, as the city is included in the port of New York, for which alone statistics are given. Although Jersey City is mainly a commercial city, its

manufactures are of much importance. In 1890 it contained 726 establishments, with a total capital of $18,165,094. They employed 12,869 hands, and their yield had a value of $37,376,322. The principal were meat, the product of slaughtering and meat-packing establishments, $10,624,859; soap and candles, $1,554,270; chemicals, $1,804,339; foundry and machine shop products, $1,822,104; cars, $1,484,423; and silk goods, $1,066,000. The assessed valuation of real and personal property in 1900 was $93,325,000, the net debt was $16,701,353, and the rate of taxation was $28.20 per $1000. The total receipts for the fiscal year were $7,433,501, and the expenditures were $6,811,104. Population (1880), 120,722; (1890), 163,003; (1900), 206,433, of whom 58,424 were foreign-born and 3704 negroes. There were 63,495 persons of school age (5 to 20 years). Of 60,319 males 21 years of age and over, 3094 were illiterate (unable to write), of whom only 192 were native-born.

Jerusalem.—Letters found at Tell el-'Amarna, which were written by an early ruler of Jerusalem, show that the name existed under the form *Urusalim*—that is, "city of Salim," or "city of peace"—many years before the Israelites entered Canaan. Jerusalem was then one of the most important cities in southern Palestine, subject to Egypt, and ruled by princes, or possibly priest-kings, who were appointed by the Pharaoh.

Natural Topography and Results of Excavations.

Since the termination of Sir C. Warren's noteworthy researches in 1870, excavations have been made for the Palestine Exploration Fund by M. Clermont-Ganneau, 1873–74, and Dr Bliss, 1894–97; for the German Palestine Society by Professor Guthe, in 1881; by the Russian Palestine Society; and by the German Government. Information, chiefly derived from excavations made for building purposes, has also been collected by Dr Schick, Père Vincent, and others.[1] Much light has been thrown on the course of the old walls, but excavations are still necessary at several points to disclose the original form of the ground upon which the city was built.

Jerusalem is a mountain city—the highest point within the walls is 2570 feet above the sea—situated in the heart of the hill country of southern Palestine, amidst limestone hills which are seamed by countless ravines. It has been connected with Jaffa by a railway, but a few years ago it could only be approached by rough mountain roads. Thus, though close to, it was in a sense remote from the maritime plain along which the great highway of the nations formerly ran. The city occupies the lower extremity of a limestone plateau, barely 1000 acres in extent, which projects southwards from the central watershed of the country, and is bounded on the east by Wádi Sitti Maryam, valley of the Kidron, and on the west by Wádi Rabábi, valley of Hinnom. These valleys unite beneath the south-east corner of the plateau after a fall of 670 feet, and for some distance above their junction are deep rocky ravines. The city is thus easily accessible from the north, whilst on all other sides it is protected by nature. The little plateau is itself divided into two spurs of unequal size by a ravine, called by Josephus "Tyropœon," which joins the Kidron at Siloam. The western spur, upon which stood the palace of Herod and the "Upper City" of Josephus, is the broader and higher. The eastern, Mount Moriah, on which the Temple was built, is, so far as it lies within the walls, a narrow ridge of rock, of which the exact form is still imperfectly known. Towards the north this spur is cut into by a short deep ravine, possibly the "ravine called Kedron" of Josephus, which runs through the north-east corner of the city and joins the Kidron near the "Golden Gate." The sides of the ravines are covered with the ruins of ancient Jerusalem, and their beds are concealed by *débris*, which in one place is 125 feet deep. The geological structure of the plateau—thin beds of hard silicious chalk, locally called *misse*, overlying a thick bed of soft white limestone, *meleke*—facilitated in many ways the growth of the city. Excellent building material was obtained from both beds, whilst in the *meleke* were hewn underground chambers, tanks, cisterns, tombs, aqueducts, and drains. The plateau is arid. The only known spring is the "Fountain of the Virgin," in the Kidron valley, and the only deep well is Bír Eyúb, below the junction of the Kidron and Hinnom valleys. The city was consequently dependent upon rain-water, collected and stored in tanks and cisterns, and upon water brought from a distance by aqueducts. Many interesting remains of these works are visible. Since 1865 several projects have been brought forward for the improvement of the water-supply.

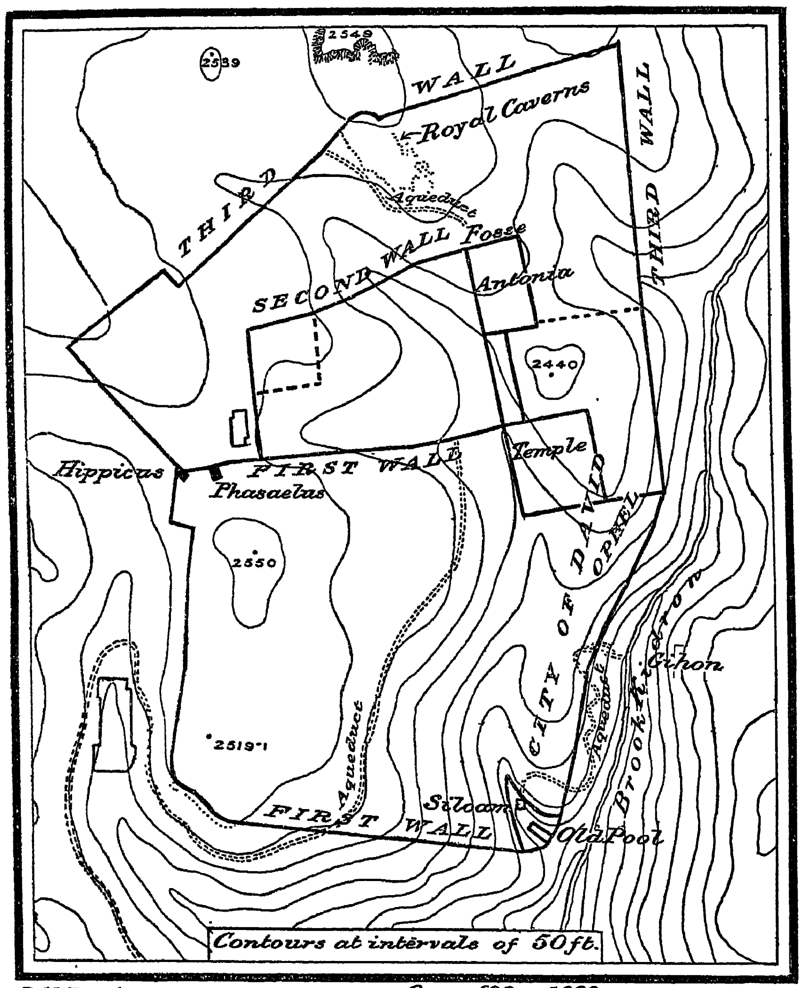
The extensive building operations north of the city have brought to light no trace of any rock-hewn ditch, nor of any masonry that could have formed part of a wall erected for purposes of defence. This strongly supports the view that the present north wall follows closely the line of that which is called by Josephus the "third wall." South of the city Dr Bliss ascertained the course of the wall from the south-west angle of the existing fortifications to Siloam. Several building periods were recognized, and it was found that whilst at one time the wall excluded the two pools of Siloam, at another it was carried across the dam of the lower pool so as to include them. The form and size of the two pools, and the remains of the church at Siloam, mentioned by pilgrims before the Arab conquest, were discovered at the same time; and light was thrown on the ancient system of drainage, and on the course of the mediæval walls on the western spur. Amongst other discoveries are the ruins of the Church of St Stephen, built by the Empress Eudocia in 460; of the Church of St Mary-the-Less; of portions of the buildings erected by Constantine near the reputed sepulchre of Christ; and of the mediæval Church and Pool of Bethesda.

Ancient Jerusalem.

Jerusalem, when the Israelites entered Palestine, probably consisted of a walled town and acropolis on the eastern spur, and of a small suburb on the lower slopes of the western spur. The town was captured and burned by Judah, but the acropolis, or stronghold of Zion, held out until it was stormed by Joab. David strengthened the acropolis and made it his residence, whence it was called the "City of David," a name that was soon extended to all that part of the city which lay on the eastern spur. Under Solomon, Jerusalem became the religious and political centre of the Hebrews; there was a great development of trade, and a period of prosperity, during which the city was enlarged and fortified, and the Temple and the royal palace were built. The large increase of the population was met by enclosing that portion of the western spur which lay south of the Jaffa Gate, and joining it to the City of David. Special attention was paid to the fortifications by Uzziah, Jotham, Hezekiah, and Manasseh; and it was probably Hezekiah who built the "second wall" to protect a suburb which had grown up to the north of Solomon's wall on the western spur. Hezekiah also greatly improved the water-

[1] See *Quarterly Statements of Pal. Exp. Fund*, the *Zeitschrift d. Deutschen Pal. Vereins*, and the *Revue Biblique*.

supply of the city. After the Captivity, Nehemiah rebuilt the walls on the old lines, and it is impossible to reconcile his account of their restoration and dedication with the theory that the city was then confined to the eastern spur.[1] During the five centuries that intervened between Nehemiah and Herod, no occasion arose for a large extension of the city's limits, and no record has survived of the execution during that period of a work of such magnitude as the fortification of the western spur with a great wall standing above a rock-hewn scarp. According to the writer's view, Jerusalem, in the reign of Hezekiah, was practically coextensive with the walled city of Herod.



B. V. Darbishire & O. J. R. Howarth, 0 500 1000 feet. Oxford, 1901.

PLAN OF THE THREE WALLS OF JERUSALEM.

Nehemiah mentions the gates and towers of the walls under their old names, and various attempts have been made to reconstruct pre-exilic Jerusalem from his description.[2]

Nehemiah, when restoring the walls, must have rebuilt the acropolis, of which the towers of Meah and Hananeel possibly formed part. It is apparently mentioned as the "castle (Birah) that appertaineth to the house" (Neh. ii. 8); and may have been the fortress which, according to Aristeas, stood on a commanding eminence to the north of the Temple. That position was certainly occupied by the Acra, or acropolis, built by Antiochus Epiphanes, 187–168 B.C., which is described as being in close proximity to and overlooking the Temple (1 Macc. iv. 41; Josephus, *Ant.* xii. 5, § 4). As in the earlier case of the City of David, the name of the citadel, "Acra," was popularly applied to the spur. After the demolition of the Macedonian fortress a portion of its site was reoccupied by the Baris of Hyrcanus, and this in turn was replaced by Herod's castle called Antonia. The city as it existed at the time of the siege by Titus, and the important buildings erected by Herod, are described by Josephus. On the eastern spur stood the Temple, connected by colonnades with the castle of Antonia; the palaces of Helena, Monobazus, and Grapte; and the hippodrome. On the western were Herod's fortress-palace with its three lofty towers, and the palace of Agrippa. The northern side of the city was then defended by three walls, and with regard to the position of the "first," or oldest, there are few differences of opinion. But it is still a question whether the "second" wall included or excluded the Church of the Holy Sepulchre; and whilst some authorities identify the line of the "third" wall with that of the present north wall of the city, others draw it so as to enclose a large additional area on the north-west. The two questions upon which, perhaps, there has been most controversy are the site of the Temple of the Jews and that of the tomb of Christ. It is agreed that the Temple stood within the limits of the enclosure known as the Harám esh-Sherif, but there is a divergence of opinion as to the exact position within that area occupied by the building and its courts. It has been maintained on the one hand that the Temple occupied the south-west corner of the Harám, and on the other that it stood near the centre of the same enclosure.[3] Both views present difficulties which can only be solved by excavation. The Church of the Holy Sepulchre stands on the ground which was once occupied by the churches erected by Constantine over and adjoining the rock-hewn tomb which he believed to be that of Christ. It has been maintained, however, that the information at the disposal of the Emperor and his advisers was not sufficient to enable them to determine the exact position of Golgotha, and that the place selected must have been within the "second" wall of Josephus, and so not genuine. Several opinions have been expressed with regard to the position of Golgotha by those who reject the site honoured by Constantine. Amongst these the view of Otto Thenius, published in 1849, that Christ was crucified on the hillock above "Jeremiah's Grotto," outside the Damascus Gate, has attracted most attention from its adoption by General Gordon. This identification rests on no evidence and no tradition, and is simply a guess. In the absence of any precise indication of direction in the Bible there can be no certainty; but if excavations ever show that the Church of the Holy

[1] The area of this spur is 255,939 square yards, which, allowing 30 square yards per person—a high allowance, considering that the Temple, acropolis, and palaces are included—would give a population of 8531.

[2] The reconstruction suggested by the writer, which differs from that proposed by the late Professor Robertson Smith in the 9th edition of this Encyclopædia, is given in Smith's *Dictionary of the Bible*, 2nd ed., art. JERUSALEM.

[3] A discussion of the whole question by the writer will be found in Smith's *Dictionary of the Bible*, 2nd ed., art. JERUSALEM, pp. 1634–42. For the first theory see Fergusson, *The Temples of the Jews*; for the second, Warren, *Underground Jerusalem*, and *The Temple or Tomb*; Conder, *Tent Work in Palestine*.

Sepulchre is outside the "second" wall, it will be difficult to dispute the authenticity of the sites it covers.

Modern Jerusalem.

Jerusalem is the chief town of a sanjak, governed by a *mutesarrif*, who reports directly to the Porte. It has the usual executive and town councils, upon which the recognized religious communities, or *millets*, have representatives; and it is garrisoned by infantry of the fifth army corps. The city is connected with its port, Jaffa, by a carriage road, forty-one miles, and by a metre-gauge railway, fifty-four miles, which was completed in 1892, and is worked by a French company. There are also carriage roads to Bethlehem, Hebron, and Jericho. Prior to 1858, when the modern building period commenced, Jerusalem lay wholly within its 16th-century walls, and even as late as 1875 there were few private residences beyond their limits. At present Jerusalem without the walls covers a larger area than that within them. The growth has been chiefly towards the north and north-west; but there are large suburbs on the west, and on the south-west near the railway station on the "Plain of Rephaim." The village of Siloam has also increased in size, and the western slopes of Olivet are being rapidly covered with churches, monasteries, and houses. Amongst the most marked features of the change that has taken place since 1875 are the growth of religious and philanthropic establishments; the settlement of Jewish colonies from Bokhara, Yemen, and Europe; the migration of Europeans, old Moslem families, and Jews from the city to the suburbs; the increased vegetation, due to the numerous gardens and improved methods of cultivation; the substitution of timber and red tiles for the vaulted stone roofs which were so characteristic of the old city; the striking want of beauty, grandeur, and harmony with their environment exhibited by most of the new buildings; and the introduction of wheeled transport, which, cutting into the soft limestone, has produced mud and dust to an extent previously unknown. To facilitate communication between the city and its suburbs, the Báb ez-Záhire, or "Herod's Gate," and a new gate, near the north-west angle of the walls, have been opened; and a portion of the wall, adjoining the Jaffa Gate, has been thrown down, to allow free access for carriages. Within the city the principal streets have been roughly paved, and iron bars placed across the narrow alleys to prevent the passage of camels. Without the walls carriage roads have been made to the Mount of Olives, the railway station, and various parts of the suburbs, but they are kept in bad repair. Little effort has been made to meet the increased sanitary requirements of the larger population and wider inhabited area. There is no municipal water-supply, and the main drain of the city discharges into the lower pool of Siloam, which has become an open cess-pit. In several places the *débris* within the walls is saturated with sewerage, and the water of the Fountain of the Virgin, and of many of the old cisterns, is contaminated and unfit for drinking. Amongst the more important buildings for ecclesiastical and philanthropic purposes erected to the north of the city since 1860 are the Russian cathedral, hospice, and hospital; the French hospital of St Louis, and hospice and church of St Augustine; the German schools, orphanages, and hospitals; the new hospital and industrial school of the London Mission to the Jews; the Abyssinian church; the church and schools of the Church Missionary Society; the Anglican church, college, and bishop's house; the Dominican monastery, seminary, and church of St Stephen; the Rothschild hospital and girls' school; and the industrial school and workshops of the Alliance Israélite. On the Mount of Olives are the Russian church, tower, and hospice, near the Chapel of the Ascension; the French Paternoster church; the Carmelite nunnery; and the Russian church of St Mary Magdalene, near Gethsemane. South of the city are the Armenian monastery of Mount Zion and Bishop Gobat's school. On the west side are the Institution of the Sisters of St Vincent; the Ratisbon school; the Montefiore hospice; the British ophthalmic hospital of the Knights of St John; the convent and church of the Clarisses; and the Moravian leper hospital. Within the city walls are the Latin Patriarchal church and residence; the school of the Frères de la Doctrine Chrétienne; the schools and printing house of the Franciscans; the Coptic monastery; the German church of the Redeemer, and hospice; the United Armenian church of the Spasm; the convent and school of the Sœurs de Zion; the Austrian hospice; the Turkish school and museum; the monastery and seminary of the Frères de la Mission Algérienne, with the restored church of St Anne; the church, schools, and hospital of the London Mission to the Jews; the Armenian seminary and Patriarchal buildings; the Rothschild hospital; and Jewish hospices and synagogues.

The climate is naturally good, but continued neglect of sanitary precautions has made the city unhealthy. During the summer months the heat is tempered by a fresh sea-breeze, and there is usually a sharp fall of temperature at night; but in spring and autumn the east and south-east winds, which blow across the heated depression of the Ghór, are enervating and oppressive. A dry season, which lasts from May to October, is followed by a rainy season, divided into the early, winter, and latter rains. Snow falls two years out of three, but soon melts. The mean annual temperature is 62°·8 F., the maximum 112°, and the minimum 25°. The mean monthly temperature is lowest (47°·2) in February, and highest (76°·3) in August. The mean annual rainfall (1861 to 1899) is 26·06 inches. The most unhealthy period is from 1st May to 31st October, when there are, from time to time, outbreaks of typhoid, small-pox, diphtheria, and other epidemics. The unhealthiness of the city is chiefly due to want of proper drainage, impure drinking-water, miasma from the disturbed rubbish heaps, and contaminated dust from the uncleansed roads and streets. The only industry is the manufacture of olive-wood and mother-of-pearl goods for sale to pilgrims and for export. The imports (see JOPPA) are chiefly food, clothing, and building material. The population in 1899 was about 48,600 (Moslems 7700, Christians 10,900, Jews 30,000).[1] During the pilgrimage season it is increased by about 15,000 travellers and pilgrims.

AUTHORITIES.—Pal. Exp. Fund Publications.—WARREN, *Jerusalem, Memoir*, 1884.—CLERMONT-GANNEAU, *Archæol. Researches*, vol. i., 1899.—BLISS, *Excavns. at Jerusm.*, 1898.—CONDER, *Latin Kingdom of Jerusm.*, 1897.—LE STRANGE, *Pal. under the Moslems*, 1890.—FERGUSSON, *Temples of the Jews*, 1878.—HAYTER LEWIS, *Holy Places of Jerusm.*, 1888; *Churches of Constantine at Jerusm.*, 1891.—GUTHE, "Ausgrabungen in Jer.," in *Zeitschrift d. D. Pal. Vereins*, vol. v.—TOBLER, *Topographie von Jerusalem*, Berlin, 1854; *Dritte Wanderung*, 1859.—SEPP, *Jerusalem und das heilige Land*, 1873.—RÖHRICHT, *Regesta Regni Hierosolymitani*; *Bibliotheca Geographica Palæstinæ*, 1890.—DE VOGÜÉ, *Le Temple de Jérusalem*, 1864.—*Ency. Brit.*, 9th ed.—SMITH's *Dict. of the Bible*, 2nd ed. art. "Jerusalem."—Publications of the Pal. Pilgrims' Text Society and of the Société de l'Orient latin.—Papers in *Quarterly Statements* of the P. E. Fund, the *Zeitschrift d. D. Pal. Vereins*, Clermont-Ganneau's *Recueil d'Archéologie orientale* and *Études d'Arch. orientale*, and the *Revue Biblique*.—Baedeker-Socin *Handbook*.—MOMMERT, *Die hl. Grabeskirche zu Jerusalem*, 1898; *Golgotha und das hl. Grab zu Jerusalem*, 1900.—COURET, *La Prise de Jérusm. par les Perses, 614*. Orléans, 1896.—Plans, Ordnance Survey, revised ed.; Ordnance Survey revised by Dr Schick in *Z.D.P.V.* xviii., 1895. (C. W. W.)

[1] The number of Jews has been placed as high as 55,000, but an inquiry by the writer led him to believe that it does not exceed 30,000. The *Jewish Annual* (Luncz) published in Jerusalem gives 28,600; Baedeker 41,000.

Jesi, a town and episcopal see of the province of Ancona, the Marches, Italy, 17 miles south-west of Ancona by rail. It is a place of very considerable industry, especially silk-spinning, raising of cocoons, and manufacture of matches, also manufacture of hosiery, hats, paper, tanning, and brick-making. Jesi has a technical school. Pergolese (1710–1736), composer of a *Stabat Mater*, was born here. Population (1881), 12,118; (1899), 6200.

Jessel, Sir George (1824–1883), British judge, was born in London on the 13th of February 1824. He was the son of Zadok Aaron Jessel, a Jewish coral merchant, trading in the City of London and living in Savile Row, Piccadilly. George Jessel was educated at Mr Neumegen's school for Jews at Kew, and being prevented by then existing religious disabilities, since abolished, from proceeding to Oxford or Cambridge, went to University College, London. He entered as a student at Lincoln's Inn in 1842, and a year later took his B.A. degree at the University of London, graduating with honours in Mathematics and Natural Philosophy, gaining honours also and a prize in Vegetable Physiology and Structural Botany, and becoming M.A. and gold medallist in Mathematics and Natural Philosophy in 1844. In 1846 he became a fellow of University College, and on the 4th of May 1847 he was called to the bar at Lincoln's Inn. His earnings during his first three years at the bar were 52, 346, and 795 guineas, from which it will be seen that his rise to a tolerably large practice was rapid. His work, however, was mainly conveyancing, and for long his income remained almost stationary, so that, like many other young barristers, he declared his belief that he had mistaken his vocation. By degrees, however, he got more work, and having applied for silk and been refused it by Lord Westbury in 1861, eventually, on the recommendation of the same Lord Chancellor, was called within the bar in 1865, becoming a bencher of his Inn in the same year and practising in the Rolls Court. He entered Parliament as Liberal member for Dover in 1868, and although neither his intellect nor his oratory was of a class that would be likely to commend itself to his fellow-members of the House of Commons, he attracted the attention of Mr Gladstone by two learned and lawyer-like speeches on the Bankruptcy Bill which was before the House in 1869, with the result that when in 1871 Sir Robert Collier was made a judicial member of the Privy Council (in evasion of the Act which constituted that office), and Sir John Duke Coleridge succeeded him as Attorney-General, Jessel received the post of Solicitor-General and was knighted. His reputation at this time stood high in the Chancery Courts; on the Common Law side he was unknown, and on the first occasion upon which he came into the Court of Queen's Bench to move on behalf of the Crown, there was very nearly a collision between him and the bench, composed of Lord Chief Justice Cockburn, Mr Justice Blackburn, and Mr Justice Lush. Mr Justice Blackburn having interrupted with a question and a suggestion, Sir George answered promptly, if without heat, "Will your lordship hear the words of the statute before you rush to hasty analogies?" "Mr Solicitor," said Cockburn, as presiding judge, "we are not accustomed to be addressed in this way." Jessel made no direct reply, but continued his argument perfectly unmoved, saying only, "My Lords, when I was interrupted I was reading the words of the statute. I propose to read them to the end." He obtained the rule he asked for, and his forceful and direct method of bringing his arguments home to the bench was not modified in his subsequent practice before it. His great powers were fully recognized; his business in addition to that on behalf of the Crown became very large, and his income for three years before he was raised to the bench amounted to nearly £25,000 per annum. He had married a rich wife, so that the pecuniary loss was comparatively immaterial to him when in 1873 he succeeded Lord Romilly as Master of the Rolls, the Attorney-General having declined to exercise his own right to do so. From 1873 to 1881 Sir George Jessel sat as a judge of first instance in the Rolls Court, being also a member of the Court of Appeal. In November 1874 the first Judicature Act came into effect, and in 1881 the Judicature Act of that year made the Master of the Rolls the ordinary president of the first Court of Appeal, relieving him of his duties as a judge of first instance. In the Court of Appeal Sir George Jessel presided almost to the day of his death. For some time before 1883 he suffered from diabetes with chronic disorder of the heart and liver, but struggled against it; on the 16th of March 1883 he sat in court for the last time, and on the 21st of March he died at his house, 10 Hyde Park Gardens, London, the immediate cause of death being cardiac syncope.

As a judge of first instance Sir George Jessel was a revelation to those accustomed to the proverbial slowness of the Chancery Courts and of the Master of the Rolls who preceded him. He disposed of the business before him with rapidity combined with correctness of judgment, and he not only had no arrears himself, but was frequently able to help other judges to clear their lists. His knowledge of law and equity was wide and accurate, and his memory for cases and command of the principles laid down in them extraordinary. In the Rolls Court he never reserved a judgment, not even in the Epping Forest case (*Commissioners of Sewers* v. *Glasse*, L.R. 19 Eq. *Times*, 11th November 1874), in which the evidence and arguments lasted twenty-two days (150 witnesses being examined in court, while the documents went back to the days of King John), and in the Court of Appeal he did so only twice, and then in deference to the wishes of his colleagues. The second of these two occasions was the case of *Robarts* v. *The Corporation of London* (49 *Law Times* 455; *Times*, 10th March 1883), and those who may read Jessel's judgment should remember that, reviewing as it does the law and custom on the subject, and the records of the City with regard to the appointment of a Remembrancer from the 16th century, together with the facts of the case before the court, it occupied nearly an hour to deliver, but was nevertheless delivered without notes—this, too, on the 9th of March 1883, when the judge who uttered it was within a fortnight of his death. Never during the 19th century was the business of any court performed so rapidly, punctually, and satisfactorily as it was when Jessel presided. He was Master of the Rolls at a momentous period of legal history. The Judicature Acts, completing the fusion of law and equity, were passed while he was a judge of first instance, and were still new to the courts when he died. His knowledge and power of assimilating knowledge of all subjects, his mastery of every branch of law with which he had to concern himself, as well as of equity, together with his willingness to give effect to the new system, caused it to be said when he died that the success of the Judicature Acts would have been impossible without him. His faults as a judge lay in his disposition to be over-rapid, and to be intolerant of those who, not able to follow the rapidity of his judgment, endeavoured to persist in argument after he had made up his mind; but though he was peremptory with the most eminent counsel, young men had no cause to complain of his treatment of them. His masterfulness in his own court was carried into matters of detail. He

was known to tell a counsel to take his hands out of his pockets while addressing the court, and to say to a law officer of the Crown, who was employing more rhetorical methods than are usual in Chancery courts, "Stop, please, Sir 'Enry; we don't allow eloquence in this division." His inability to aspirate his *h*'s led Serjeant Parry, when a junior remarked on it, to turn fiercely round and say to the critic, "I would rather drop my *h*'s with Jessel than aspirate them with you."

Among other public duties performed by him, Sir George Jessel sat on the Royal Commission for the Amendment of the Medical Acts, taking a keen interest in the subject and an active part in the preparation of the report published by the Commission. He interested himself also actively in the management of London University, of which he was a fellow from 1861, and of which he was elected vice-chancellor in 1880. He was one of the commissioners of patents, and trustee of the British Museum. He was also chairman of the committee of judges which drafted the new rules rendered necessary by the Judicature Acts. He was treasurer of Lincoln's Inn in 1883, and vice-president of the Council of Legal Education. He was also a fellow of the Royal Society. He marks an epoch on the bench, owing to the active part taken by him in rendering the Judicature Acts effective, and also as being the last judge capable of sitting in the House of Commons, a privilege of which he did not avail himself. He was the first Jew who, as Solicitor-General, took a share in the executive government of his country, the first Jew who was sworn a regular member of the Privy Council, and the first Jew who took a seat on the judicial bench of Great Britain; he was also, for many years after being called to the bar, so situated that any one might have driven him from it, because, being a Jew, he was not qualified to be a member of the bar. In person Sir George Jessel was a stoutish, square-built man of middle height, with dark hair, somewhat heavy features, a fresh ruddy complexion, and a large mouth. A bust by W. H. Ingram near the entrance to the Chancery Court of Appeal at the Royal Courts of Justice keeps alive some memory of his personality. Sir George Jessel married in 1856 Amelia, daughter of Joseph Moses, who survived him together with three daughters and two sons, the elder of whom was made a baronet shortly after the death of his distinguished father and in recognition of his services. (E. A. AR.)

Jessore, a town and district of British India, in the presidency division of Bengal. The town is on the Bhairab river, and has a railway station 75 miles north-east of Calcutta. Population (1881), 8495; (1891), 8302. It has a Government high school, with 191 pupils in 1896–97, and four printing-presses, issuing two vernacular periodicals. The district of JESSORE has an area of 2925 square miles. The population in 1881 was 1,939,375; in 1891, 1,888,827; showing a decrease of 3 per cent.; average density, 646 per square mile, or nearly one to every acre in a purely rural tract. Classified according to religion, Hindus numbered 737,601; Mahommedans, 1,150,135; Christians, 840, of whom 64 were Europeans; "others," 251. In 1901 the population was 1,812,770, showing a further decrease of 4 per cent. Land revenue and rates (1897–98), Rs.9,70,834; number of police, 503; number of boys at school (1896–97), 40,063, being 28·4 per cent. of the male population of school-going age; registered death-rate (1897), 33·36 per thousand. Jessore is the centre of sugar manufacture from date palms. There are 120 refineries, employing 1200 hands, with an out-turn valued at Rs.14,82,000. Indigo is a declining industry. There are sixteen concerns and factories, employing 4500 hands, with an out-turn valued at Rs.2,35,000. The district is crossed by the Bengal Central Railway, but the chief means of communication are waterways.

Jever, a town of Germany, grand-duchy of Oldenburg, 13 miles by rail north-west of Wilhelmshaven, and connected with the North Sea by a navigable canal. It boasts of a castle (15th and 16th centuries), a town hall (1609), and an old parish church, with the marble tomb of the Frisian prince, Edo Wiemkens (died 1511), and monuments to the historian Schlosser (1776–1861) and the chemist Mitscherlich (1794–1863), both natives of the place. The fathers (*getreuen*) of the town used to send an annual birthday present of 101 plovers eggs to Prince Bismarck. Population (1895), 5306; (1900), 5486.

Jevons, William Stanley (1835–1882), English economist and logician, was born at Liverpool on 1st September 1835. His father, Thomas Jevons, a man of strong scientific tastes and a writer on legal and economic subjects, was a member of a firm of iron merchants. His mother, Mary Ann Jevons, was the daughter of William Roscoe, the author of the *Life of Lorenzo de' Medici*. At the age of fifteen he was sent to London to attend University College School. He appears at this time, though with habitual reserve he kept his aspirations to himself, to have already formed the belief that important achievements as a thinker were possible to him, and at more than one critical period in his career this belief was the decisive factor in determining his conduct. Towards the end of 1853, after having spent two years at University College, where his favourite subjects were chemistry and botany, he unexpectedly received the offer of the assayership to the new mint in Australia. The idea of leaving England was distasteful, but pecuniary considerations had, in consequence of the failure of his father's firm in 1847, become of vital importance, and he accepted the post. He left England for Sydney in June 1854, and remained there for five years. At the end of that period, though he was earning a satisfactory and increasing income, he came to the conclusion that he "could not any longer sacrifice everything that he really desired and that he thought would prove a really useful way of spending life." He therefore resigned his appointment, and in the autumn of 1859 entered again as a student at University College, London, proceeding in due course to the B.A. and M.A. degrees of the University of London. He now gave his principal attention to the moral sciences, considering that his powers lay mainly in that direction. But his interest in natural science was by no means exhausted: throughout his life he continued to write occasional papers on scientific subjects, and his intimate knowledge of the physical sciences greatly contributed to the success of his principal logical work, *The Principles of Science*. Not long after taking his M.A. degree Jevons obtained a post as tutor at Owens College, Manchester; but the work was arduous and badly paid, and, when added to his literary occupations, it involved a great strain upon his health. In 1866 he was elected professor of logic and mental and moral philosophy and Cobden professor of political economy in Owens College. Next year he married Harriet Ann Taylor, whose father had been the founder and proprietor of the *Manchester Guardian*. Jevons suffered a good deal from ill-health and sleeplessness, and found the delivery of lectures covering so wide a range of subjects very burdensome. He felt it to be an absurdity that one man should have to deal with "the whole sphere of the logical, metaphysical, mental, moral, and economical sciences," and in 1876 he was glad to exchange the Owens professorship for the professorship of political

economy in University College, London, a chair yielding a smaller income, but limited to one subject. Travelling and music, to which he was greatly devoted, were the principal recreations of his life; but his health continued bad, and he suffered from depression. He found his professorial duties increasingly irksome, and feeling that the pressure of literary work left him no spare energy, he decided in 1880 to resign the post. On the 13th of August 1882 he was drowned whilst bathing near Hastings. Throughout his life he had pursued with devotion and industry the ideals with which he had set out, and his journal and letters display a noble simplicity of disposition and an unswerving honesty of purpose. In early manhood he had a great dislike of speaking in public, and lecturing was never his strong point. On giving up his professorship at University College, he wrote: "Sometimes I have enjoyed lecturing, especially on logic, but for years past I have never entered the lecture-room without a feeling probably like that of going to the pillory. I shall never lecture, speechify, or do anything of that sort again if I can possibly help it." He was a prolific writer, and at the time of his death he occupied the foremost position in England both as a logician and as an economist. Professor Marshall has said of his work in economics that it "will probably be found to have more constructive force than any, save that of Ricardo, that has been done during the last hundred years." His literary productiveness continued unabated to the end, and at the time of his death he was engaged upon an economic work that promised to be at least as important as any that he had previously undertaken. It would be difficult to exaggerate the loss which logic and political economy sustained through the accident by which his life was prematurely cut short.

Jevons arrived quite early in his career as a student at the doctrines that constituted his most characteristic and original contributions to economics and logic. The theory of utility, which became the keynote of his general theory of political economy, was practically formulated in a letter written in 1860; and the germ of his logical principle of the Substitution of Similars may be found in the view which he propounded in another letter written in 1861, that "philosophy would be found to consist solely in pointing out the likeness of things." The theory of utility above referred to, namely, that the degree of utility of a commodity is some continuous mathematical function of the quantity of the commodity available, together with the implicated doctrine that economics is essentially a mathematical science, took more definite form in a paper on "A General Mathematical Theory of Political Economy," written for the British Association in 1862. This paper does not appear to have attracted much attention either in 1862 or on its publication four years later in the *Journal of the Statistical Society*; and it was not till 1871, when the treatise on the *Theory of Political Economy* appeared, that Jevons set forth his doctrines in a fully-developed form. It is an interesting fact that it was not till after the publication of this work that Jevons became acquainted with the applications of mathematics to political economy made by earlier writers, notably Cournot and Gossen. It is also noteworthy that the theory of utility was, about 1870, being independently developed on somewhat similar lines by Menger in Austria and Walras in Switzerland. As regards the discovery of the connexion between value in exchange and final (or marginal) utility, the priority belongs to Gossen, but this in no way detracts from the great importance of the service which Jevons rendered to English economics by his fresh discovery of the principle, and by the way in which he ultimately forced it into notice. In his reaction from the prevailing view he sometimes expressed himself without due qualification: the declaration, for instance, made at the commencement of the *Theory of Political Economy*, that "value depends entirely upon utility," lent itself to misinterpretation. But a certain exaggeration of emphasis may be pardoned in a writer seeking to attract the attention of an indifferent public. It was not, however, as a theorist dealing with the fundamental data of economic science, but as a brilliant writer on practical economic questions, that Jevons first received general recognition. His tract on *A Serious Fall in the Value of Gold*, published in 1863, in which he discussed the economic consequences of the gold discoveries of the preceding decade, and his work on *The Coal Question*, published in 1865, in which he demonstrated the dangerous rate of consumption of British coal supplies, placed him in the front rank as a writer on applied economics and statistics; and he would be remembered as one of the leading economists of the 19th century even had his *Theory of Political Economy* never been written. Amongst his economic works, in addition to those already referred to, may be mentioned a short treatise on *Money and the Mechanism of Exchange* (1875), written in a popular style, and descriptive rather than theoretical, but wonderfully fresh and original in treatment and full of suggestiveness, a *Primer on Political Economy* (1878), *The State in Relation to Labour* (1882), and two works published after his death, namely, *Methods of Social Reform* and *Investigations in Currency and Finance*, containing papers that had been written at various times and that had appeared separately in various forms during his lifetime. The last-named volume contains Jevons's interesting speculations on the connexion between commercial crises and sun-spots. As already mentioned, he was engaged at the time of his death upon a large treatise on economics, in which he intended to go over the whole field of the subject.

Jevons's work in logic went on *pari passu* with his work in political economy. In 1863 he speaks of having got his logical system free from further doubt, and in 1864 he published a small volume, entitled *Pure Logic; or the Logic of Quality apart from Quantity*, which was based on Boole's system of logic, but freed from what he considered the false mathematical dress of that system. In the years immediately following he devoted considerable attention to the construction of a logical machine, exhibited before the Royal Society in 1870, by means of which the conclusion derivable from any given set of premisses could be mechanically obtained. In 1866 what he regarded as the great and universal principle of all reasoning dawned upon him; and in 1869 he published a sketch of this fundamental doctrine under the title of *The Substitution of Similars*. He expressed the principle in its simplest form as follows: "Whatever is true of a thing is true of its like," and he worked out in detail its various applications. In the following year appeared the *Elementary Lessons on Logic*, which soon became, and has probably since continued to be, the most widely read elementary text-book on logic in the English language. In the meantime, from 1868 onwards, he was engaged upon a much more important logical treatise, which appeared in 1874 under the title of *The Principles of Science*. In this work Jevons embodied the substance of his earlier works on Pure Logic and the Substitution of Similars; he also enunciated and developed the view that induction is simply an inverse employment of deduction; he treated in a luminous manner the general theory of probability, and the relation between probability and induction; and his knowledge of the various natural sciences enabled him throughout to relieve the abstract character of logical doctrine by concrete scientific illustrations, often worked out

in great detail. Jevons's general theory of induction was a revival of the theory laid down by Whewell and criticized by Mill; but it was put in a new form, and was free from some of the non-essential adjuncts which rendered Whewell's exposition open to attack. The work as a whole must be regarded as one of the most notable contributions to logical doctrine that appeared in Great Britain in the 19th century. Another logical work, entitled *Studies in Deductive Logic*, and consisting mainly of exercises and problems for the use of students, was published in 1880. In 1877 and the following years Jevons contributed to the *Contemporary Review* some articles on J. S. Mill, which he had intended to supplement by further articles, and eventually publish in a volume as a criticism of Mill's philosophy. These articles and one other were republished after Jevons's death, together with his earlier logical treatises, in a volume, entitled *Pure Logic and other Minor Works*. The criticisms on Mill contain much that is ingenious and much that is forcible, but on the whole they cannot be regarded as taking rank with Jevons's other work. His strength lay in his power as an original thinker rather than as a critic; and it will be by his constructive work as a logician, an economist, and a statistician that he will be remembered.

See *Letters and Journal of W. Stanley Jevons*, edited by his wife, 1886. This work contains a bibliography of Jevons's writings.

(J. N. K.)

Jewellery.—The Paris International Exhibition of 1900 was the occasion of a display of goldsmith's work which marked it as an epoch in the history of the craft. If we look back to 1875, we see at once that during the two subsequent decades this industry, though prosperous from the commercial point of view, and always remarkable from that of technical finish, remained stationary as an art. During these twenty years French jewellery rested on its reputation. The traditions were maintained of either the 17th and 18th centuries or the style affected at the close of the Second Empire—light pierced work and design borrowed from natural flowers. The last type, introduced by Massin, had exercised, indeed, a revolutionary influence on the treatment of jewellery. This clever artist, not less skilful as a craftsman, produced a new *genre* by copying the grace and lightness of living blossoms, thus introducing a perfectly fresh element into the limited variety of traditional style, and by the use of filagree gold work altering its character and giving it greater elegance. Massin still held the first rank in the Exhibition of 1878; he had a marked influence on his contemporaries, and his name will be remembered in the history of the goldsmith's art to designate a style and a period. In 1889 the report of this section in the Great Exhibition still records that "flowers and foliage held the first place in jewellery for the hair or bodice." Throughout these years the craft was exclusively devoted to perfection of workmanship. The utmost finish was aimed at in the mounting and setting of gems; jewellery was, in fact, not so much an art as a high-class industry; individual effort and purpose were absent. Still goldsmith's work was an important factor in fashionable jewellery. In 1867, however, the diamond mines discovered in South Africa had begun to supply the markets of Europe with a profusion of these stones. Diamonds were no longer the choice jewels of the privileged few; they were within reach of moderate fortunes. Gold ornaments were cast aside in their favour, and it is, in fact, to this economic development that the modern change of taste in jewellery is mainly due. The constantly growing output of gems led to competition in the production of jewellery, and it became an object to increase the quality and reduce the cost. In the report of the Exhibition of 1889 we are told that mechanical processes have been introduced into the manufacture, hand labour having proved insufficient. Up to that time precious stones had been of such intrinsic value that the jeweller's chief skill lay in displaying these costly stones to the best advantage; the mounting was a secondary consideration. The settings were seldom long preserved in their original condition, but in the case of family jewels were renewed with each generation and each change of fashion, a state of things which could not be favourable to any truly artistic development of taste, since the work was doomed, sooner or later, to destruction. However, the evil led to its own remedy. As soon as diamonds fell in value they lost at the same time the prestige which made them an attribute of wealth. Aristocratic taste now gave a preference to trinkets which derived their value and character from artistic design. This revolutionized the jeweller's craft, and revived the simple ornament of gold or silver, which came forward but timidly at first, till, in the Exhibition of the Salon in 1895, it burst upon the world in the exhibits of René Lalique. This artist at the present day holds a unique position. The Exhibition of 1900 confirmed him in it, not only by the beautiful work he produced, but by the evident influence he exerted during the previous five years over all his rival brethren of the craft. What especially stamps the works of Lalique is their striking originality; his individuality is as plainly expressed in his smallest piece as that of Ingres or of Delacroix in their slightest sketches. He has raised jewellery from ranking as an industry to the dignity of an art. His work may be considered from the point of view of design and from that of execution. As an artist he has completely reconstructed from the foundation the scheme of design which had fed the poverty-stricken imagination of the last generation of goldsmiths. He had recourse to the art of the past, but to the spirit rather than the letter, and to nature for many new elements of design—free double curves, suave or soft; opalescent harmonies of colouring; reminiscences, with quite a new feeling, of Egypt, Chaldæa, Greece, and the East, or of the art of the Renaissance; an infinite variety of floral forms even of the humblest: the dandelion, the thistle, the nasturtium, mistletoe, and honesty, now classical in their artistic application. He introduces also the female nude in the form of sirens and sphinxes, full of tragic force and character. In fact, we find in Lalique a poet who has created an art at once logical and imaginative, full of feeling and of method. As a craftsman he has effected a radical change, breaking through old routine, throwing off old fetters, combining all the processes of the goldsmith, the chaser, the enameller, and the gem-setter, and freeing himself from the narrow lines in which the art had been confined. He ignores the hierarchy of gems, caring no more on occasion for a diamond than for a flint, since, in his view, no stone, whatever its original estimation, has any value beyond the characteristic expression he lends it as a means to his end. Thus, while he sometimes uses diamonds, rubies, sapphires, or emeralds as a background, he will, on the other hand, give a conspicuous position to common stones—carnelian, agate, malachite, jasper, coral, and even materials of no intrinsic value such as horn. One of his favourite stones is the opal, which lends itself to his arrangements of colour, and which has in consequence become a fashionable stone in French jewellery. It is to be feared that after Lalique the rather doubtful tendencies of his art may lead to its decadence by an unintelligent adoption of his theories and bad imitations of his style, for the tendency is to produce important pieces, beautiful by themselves, but too heavy for the person. M. Henri Vever, with whom Lalique formerly worked, has, however, done much to save it by reviving old traditions. What distinguishes M. Vever's

work from that of Lalique (though he has often borrowed from him) is that he has maintained the distinction between gem-setting and goldsmith's jewellery. In the former class of work he, like the earlier jewellers, attaches great importance to the selection of stones; but while returning with judgment to the old ways, he shows much freedom of invention and superior methods of composition and execution. His taste, which is solid and serious, has real distinction, and his exhibit in 1900 contributed to mark the date as memorable in the history of French jewellery. Besides these two artists, there are old-established jewellers (famous for the work of Desbazeille and others) who have maintained their high reputation by adopting the new tendencies, among others Messrs Boucheron, Falize, and Sandoz, noted for admirable workmanship and the good style of their pieces, Messrs Coulon, Chaumet, Marret, Mellerio, Desprès, and others.

The movement which took its rise in France spread in due course to other countries. In England the impulse has come from three different directions. The classic work in gold by the elder Giuliano gave way to a treatment of enamel by the same artist which has scarcely been surpassed for perfection of execution and sobriety of taste in design and colour, while the endless variations, original in themselves, on conventional forms show extraordinary resource and invention. The reputation of the father has, since his death, been sustained by the sons, and in a measure also by imitators. Parallel with the Arts and Crafts movement, designers like C. R. Ashbee, Fred Robinson, and Nelson and Edith Dawson have aimed at purging the jeweller's craft of its character of mere gem-mounting in conventional forms (of which the more unimaginative, representing stars, bows, flowers, and the like, are varied by such absurdities as insects, birds, animals, figures of men, and objects made up simply of stones clustered together). Their work is often excellently and fancifully designed, but it lacks that exquisite perfection of execution achieved by the incomparable craftsmen of France. English sculptor-decorators—such as Alfred Gilbert, R.A., and George J. Frampton, A.R.A.—have produced objects of a still higher class, but it is usually the work of the goldsmith rather than of the jeweller. Examples may be seen in the badge executed by Mr Gilbert for the president of the Institute of Painters in Water Colours, and in the mayoral chain for Preston. Symbolism here enters into the design, which has not only an ornamental but a didactic purpose.

In the United States the neglect of gems for their own sake, which is the chief note of the "New Jewellery" in France, has not yet been so clearly demonstrated. Tiffany, usually regarded in Europe as the leader of American artificers, was seen in the Paris Exhibition of 1900 to have maintained the admirable character of workmanship while developing more and more the richness and magnificence that dazzle rather than charm. Philippe Wolfers occupies in Belgium the position which in France is held by René Lalique. If his design is a little heavier, it is not less beautiful in imagination or less masterly in execution. Graceful, ingenious, fanciful, elegant, fantastic by turns, his objects of jewellery and goldsmithery have a solid claim to be considered *créations d'art*. In Germany the movement is headed by Werner and by Hugo Schäfer of Berlin, and on a lower plane by Stöffler and Zerenner of Pforzheim; but the handling of these distinguished craftsmen is heavier still. J. M. Olbrich and Robert Koch, though not without originality, may be considered as followers of Lalique. In Austria Franz Hauptmann has taken the lead in artistic jewellery. As a representative of Russia, Fabergé of St Petersburg deserves to be mentioned long with Lalique and Wolfers. In Switzerland the development, so far as it is original, seems to have proceeded mainly in the direction of enamelling—not only in "superficial" or painted enamel, but also in *plique à jour* (see ENAMELS), in which Desbazeille of Paris attracted much attention about the year 1890. It must be admitted that many of the best artists who have devoted themselves to jewellery have been more successful in design than in securing lightness such as is required by the wearer, which was a characteristic in the works of the Italian craftsmen of the Renaissance. For this reason many of their masterpieces are more beautiful in the case than upon the person.

AUTHORITIES.—L. FALIZE. "Les industries d'art au Champ de Mars (Orfèvrerie et Bijouterie)," *Gazette des Beaux Arts*, 1878 (Sept. 1), and 1889 (Oct. 1).—HENRI VEVER. "Les Bijoux aux Salon de 1898," *Art et Décoration*, 1898.—ROGER MARX. "René Lalique," *Art et Décoration*, 1899.—LÉONCE BÉNÉDITE. "La Bijouterie et la Joaillerie à l'Exposition Universelle: René Lalique," *Revue des Arts Décoratifs*, 1900 (July and August); "Le Bijou à l'Exposition Universelle," *Art et Décoration*, 1900.—E. FONTENAY. *Les Bijoux anciens et modernes.* Paris (Quantin), 1887.

(L. BE.; M. H. S.)

Jeypore, or JAIPUR, a native state of India, in the Rajputana Agency. Total area, 15,349 square miles. The population in 1881 was 2,534,357; in 1891, 2,832,276, showing an apparent increase of 12 per cent.; average density, 184 persons per square mile. In 1901 the population was 2,658,075, showing a decrease of 6 per cent., due to the results of famine. The revenue (1896–97) was Rs.67,00,000, of which Rs.8,82,526 was expended on public works; tribute, Rs.4,00,000; number of schools, 772, attended by 25,589 pupils, of whom 261 were girls, the proportion of boys at school being 11 per cent. of those of school-going age. The reigning maharaja, Madho Singh, G.C.S.I., was born in 1861, and succeeded in 1880. He is distinguished for his enlightened administration and his patronage of art. The mint coins gold, silver, and copper, the emblem being a *jhar*, or branch of six sprigs. In 1896–97 the coinage amounted to Rs.13,13,000. Public works are under the charge of a British officer. Since 1868 no less than Rs.47,00,000 has been expended on irrigation. The number of works is 149, irrigating 84,000 *bighas*, and yielding a revenue of Rs.3,00,000. The foundation-stone of a new irrigation project at Ramgarh, estimated to cost Rs.6,13,000 and to irrigate 30,000 *bighas*, was laid in 1897. The state is traversed by the Rajputana Railway, with its two branches to Agra and Delhi. A railway of 73 miles, begun at the expense of the state, is estimated to cost Rs.28,47,000. The state suffered from the famine of 1899–1900. The city of JEYPORE is 84 miles north-east of Ajmir by rail. Population (1881), 142,578; (1891), 158,905, being the seventeenth largest town in India; (1901), 159,550. It is surrounded by a lofty crenelated wall, with seven gates. Unfortunately the architecture is largely pink stucco, in imitation of sandstone. The palace is in the centre, surrounded by pleasure gardens. An excellent water-supply is provided at an annual cost of Rs.60,000. There are a college, with 56 students in 1897–98; a high school, with 584 pupils; a flourishing art school, which owes much of its success to the active interest of Dr Hendley, who has also been for many years in charge of the Mayo Hospital; and an industrial and economic museum.

Jeysulmere, or JAISALMER, a native state of India, in the Rajputana Agency. Area, 16,039 square miles. The population in 1881 was 108,143; in 1891, 115,701; average density, 7 persons per square mile, compared with 94 persons for Rajputana generally. In 1901 the population was 73,436, showing a decrease of 37 per cent., due to the results of famine. The gross revenue (1897–98) was Rs.1,60,000; no tribute. The chief, whose title is maharawal, is the head of the Bhati clan of Rajputs,

who claim a very ancient descent, and have been settled here for more than a thousand years. Their territory once extended to the Indus. The state came under British protection in 1818. The present maharawal, Salivahan, is a minor, born in 1886. The state suffered from famine in 1897, and to a less extent in 1900. There are no railways. Gold, silver, and copper are coined at the mint, to the value of Rs.49,000 in 1897–98. The town of JEYSULMERE is on a ridge of yellowish sandstone, crowned by a fort, which contains the palace. Many of the houses and temples are sculptured with fine carving. Population (1881), 10,965.

Jhabua, a native state of India, in the Bhopawar Agency. It borders on the Panch Mahals district of Bombay. Area, with the dependency of Rutanmal, 1219 square miles. The population in 1881 was 92,938; in 1891, 119,787, showing an apparent increase of 29 per cent.; average density, 99 persons per square mile. About half the inhabitants belong to the aboriginal tribe of Bhils. The revenue (1897–98) was Rs.1,65,215; subsidy to the Malwa Bhil corps, Rs.1470. The chief, whose title is raja, is a Rajput of the Rahtor clan, descended from a branch of the Jodhpur family. The raja, Udai Singh, was in 1901 invested with the powers of administration. The town of JHABUA is on the bank of a lake, and is surrounded by a mud wall. There is an Anglo-vernacular school. A road is under construction to Meghonagar station on the Rajputana Railway. A dispensary and a rest-house were constructed in commemoration of Queen Victoria's Diamond Jubilee in 1897.

Jhalawar, a native state of India, in the Rajputana Agency. Area, 3043 square miles. The population in 1881 was 340,488; in 1891, 343,601, showing an insignificant increase; average density, 113 persons per square mile; gross revenue (1896–97), Rs.16,53,413; tribute, Rs.80,000; expenditure on public works, Rs.1,10,814; military force, 1811 men; boys at school, 964. The late rana, whose relations with the British Government had long been strained, was finally deposed in 1895, "on account of persistent misgovernment and proved unfitness for the powers of a ruling chief." He now lives at Benares, on a pension of Rs.30,000; and the administration was placed in the hands of the British resident. After much consideration, the Government resolved in 1897 to break up the state, restoring the greater part to Kotah, but forming the two districts of Shahabad and the Chaumahla into a new state, of which Kuar Bhawani Singh, a descendant of Zalim Singh, was appointed chief. In 1901 the population of the reduced state was 90,174, on an area of about 1140 square miles. The chief town is Patan, or Jhalra Patan, founded on an old site by Zalim Singh in 1796, by the side of an artificial lake. It is the centre of trade; but the palace is at the cantonment of Chhaoni, 4 miles north. Population of Patan (1881), 11,469; (1891), 10,783. Population of Chhaoni (1881), 20,303; (1891), 23,381.

Jhang, a town and district of British India, in the Lahore division of the Punjab. The town, which forms one municipality with the newer quarter of Maghiana, is about 3 miles from the present right bank of the river Chenab. Population (1881), 21,629; (1891), 23,290; municipal income (1897–98), Rs.44,188. It has manufactures of cotton goods. The district of Jhang extends along both sides of the Chenab, including its confluences with the Jhelum and the Ravi. Area, 5871 square miles. The population in 1881 was 395,296; in 1891, 436,841, showing an increase of 10 per cent.; average density, 74 persons per square mile. In 1901 the population was 378,800, showing an apparent decrease of 13 per cent., due to the creation of the new district of Lyallpur. The land revenue and rates are Rs.10,01,784, the incidence of assessment being five annas per acre; cultivated area (1896–97), 669,342, of which 563,507 were irrigated, including 302,969 from Government canals; number of police, 529; number of schools (1896–97), 204, with 4371 pupils, the proportion of boys at school to male population of school-going age being 10·8 per cent.; registered death-rate (1897), 40·37 per thousand. It has five factories for cleaning and pressing cotton, and one printing-press and one flour-mill, both within the Chenab canal colony, of which the centre is Lyallpur, called after a late lieutenant-governor. This colony, in the north-east of the district, is due to an extension of the Chenab canal system from the adjoining district of Gujranwala. Within Jhang 700,000 acres of Government waste have already been allotted to colonists, who are reported to be flourishing. A branch of the North-Western Railway enters the district in this quarter, and will extend throughout its entire length. There are only 9 miles of metalled road, but 180 miles of navigable river.

Jhansi, a city and district of British India, in the Allahabad division of the North-West Provinces. The city is the centre of the Indian Midland Railway system, whence four lines diverge to Agra, Cawnpore, Allahabad, and Bhopal. Formerly the capital of a Mahratta principality, after the troubles of the Mutiny it was made over to Gwalior, but has been exchanged for other territory. Even when the city was in Gwalior, the civil headquarters and the cantonment were at Jhansi Noabad, under its walls. Population (1891), 53,779; (1901), 55,288; municipal income (1897–98), Rs.47,901; incidence of taxation, Rs.0 : 11 : 6 per head; registered death-rate (1897), 49·68 per thousand. The district of Jhansi forms part of British Bundelkhand. It has been enlarged by the incorporation of the adjoining district of Lalitpur, which extends still farther into the hill country, almost entirely surrounded by native states. The combined area is 3587 square miles. The population in 1881 was 624,953; in 1891, 683,619, showing an increase of nearly 10 per cent.; average density, 191 persons per square mile, ranging from 249 in Jhansi proper to 141 in Lalitpur. In 1901 the population was 611,644, showing a decrease of 11 per cent., due to the results of famine. The land revenue and rates were Rs.6,95,040, the incidence of assessment being six annas per acre; cultivated area (1896–97), 590,635 acres, of which 65,811 were irrigated, including 3934 from Government canals; number of police, 2700; number of vernacular schools (1896–97), 106, with 3192 pupils; death-rate (1897), 47·38 per thousand. There are seven printing-presses, including one owned by the railway company; one factory for pressing cotton. The railway line from Bhopal to Cawnpore runs through the length of the combined district.

Jhelum, or JEHLAM, a town and district of British India, in the Rawalpindi division of the Punjab. The town is on the right bank of the river Jhelam, here crossed by a bridge of the North-Western Railway which for some years had its terminus on the opposite bank, 103 miles north of Lahore. Population (1881), 21,107; (1891), 12,878; municipal income (1897–98), Rs.28,568. It is a modern town, with river and railway trade, boat-building, and cantonments for a cavalry and an infantry regiment. The district of Jhelum stretches from the river Jhelum almost to the Indus, its chief physical feature being the Salt Range. Area, 3995 square miles. The population in 1881 was 589,373; in 1891, 609,056, the rate of increase being 3 per cent; average density, 152 persons per square mile. In 1901 the population was 594,018, showing a decrease of 2 per cent. The land revenue and rates were Rs.7,59,177, the incidence of assessment being Rs.0:4:7 per acre; cultivated area (1896–97), 592,979 acres,

of which 39,879 were irrigated, mostly from private wells, number of police, 496; number of schools (1896–97), 515, with 10,943 pupils, the proportion of boys at school to male population of school-going age being 15 per cent.; registered death-rate (1897), 31·59 per thousand. At the Mayo mine in the Salt Range, salt is annually quarried to the amount of nearly two million maunds, yielding a net revenue of about Rs.50,00,000. There are two coal-mines, the only ones worked in the province, employing nearly 2000 miners, from which the North-Western Railway obtains about 86,000 tons of coal annually. It has one printing-press, issuing two vernacular periodicals. The most populous place and chief centre of the salt trade is Pind Dadan Khan; population (1891), 15,055. The district is crossed by the main line of the North-Western Railway, and also traversed along the south by a branch line, 74 miles. There are no metalled roads, nor any Government canals. The river Jhelam is navigable throughout for 127 miles.

Jhering, Rudolf von (1818–1892), German jurist, was born on the 22nd of August 1818 at Aurich in East Friesland, where his father practised as a lawyer and his family had been resident for several generations. Having received his early education at the gymnasium of his native town, young Jhering entered the University of Heidelberg in 1836 as a student of jurisprudence, and, after the fashion of German students, visited successively Göttingen and Berlin. Of his university career little is known, except that Puchta, the famous civilian and author of *Geschichte des Rechts bei dem römischen Volke*, alone of all his teachers appears to have gained his admiration and influenced the bent of his mind. After graduating *doctor juris*, Jhering established himself in 1844 at Berlin as *privat-docent* for Roman law, and delivered public lectures on the *Geist des römischen Rechts*, the theme which was nearest his heart, and the elaboration of which may be said to have constituted his life's work. In 1845 he accepted a call as ordinary professor to Basel, in 1846 to Rostock, in 1849 to Kiel, and in 1851 to Giessen. Upon all these seats of learning he left his mark; beyond any other of his contemporaries he animated the dry bones of Roman law. The German juristic world was still under the dominating influence of the Savigny cult, and the older school looked askance at the daring of the young professor, who, acting in the spirit of his idea—*Durch das römische Recht über das römische Recht hinaus*—essayed to adapt the old to new exigencies and to build up a system of natural jurisprudence. This is the keynote of his famous work, *Geist des römischen Rechts auf den verschiedenen Stufen seiner Entwickelung* (Leipzig, 1852–65), which for originality of conception and lucidity of scientific reasoning placed its author in the forefront of modern Roman jurists.

The time of Jhering's professional activity at Giessen coincided with the most famous period of that university's history. Liebig had already made its name of world-wide reputation in the field of chemical research, and it now attracted law students from all climes, eager to sit at the feet of the brilliant young professor. It is no exaggeration to say that in the second half of the 19th century the reputation of Jhering occupied as high a position as that of Savigny in the first. Their methods were entirely distinct, nay, almost diametrically opposed. Savigny and his school represented the conservative, historical tendency. In Jhering the philosophical conception of jurisprudence, as a science to be utilized for the further advancement of the moral and social interests of mankind, was predominant. In 1868 Jhering accepted a call to Vienna to the chair of Roman Law, and the fascination he had ever exercised as a teacher did not fail him in his new sphere of activity. His lecture-room was crowded, not only with regular students but with men of all professions and even of the highest ranks in the official world, and he became in the Kaiserstadt one of the lions of society, the Austrian Emperor conferring upon him in 1872 a title of hereditary nobility. But to a mind constituted as his, the social functions of the Austrian metropolis became wearisome, and he gladly exchanged its brilliant circles for the repose of Göttingen, his own Alma Mater, where he became professor in 1872. In this year he had read at Vienna before an admiring audience a lecture, published under the title of *Der Kampf um's Recht* (Vienna, 1872; English ed., *Battle for Right*, London, 1884). Its success was extraordinary. Within two years it attained twelve editions, and it has been translated into twenty-six languages. This was followed a few years later by *Der Zweck im Recht* (2 vols., Leipzig, 1877–83). In these two works is clearly seen Jhering's individuality. The *Kampf um's Recht* shows the firmness of his character, the strength of his sense of justice, and his juristic method and logic: "to assert his rights is the duty that every responsible person owes to himself." In the *Zweck im Recht* is perceived the bent of the author's intellect. But perhaps the happiest combination of all his distinctive characteristics is to be found in his *Jurisprudenz im täglichen Leben* (Jena, 1870). A great feature of his lectures was his so-called *Praktika*, problems in Roman law, and a collection of these with hints for solution was published as early as 1847 under the title *Civilrechtsfälle ohne Entscheidungen*. In Göttingen he continued to live and work until his death, which occurred on the 17th of September 1892. A short time previously he had been the centre of a devoted crowd of friends and former pupils, assembled *en fête* at Wilhelmshöhe near Cassel to celebrate the jubilee of his doctorate. Almost all countries were worthily represented, and this pilgrimage to do honour to the man affords an excellent illustration of the extraordinary fascination and enduring influence that Jhering commanded. His was indeed a delightful personality: he retained until the last the freshness and vigour of youth; he was the light-hearted, joyous German student once more, eloquent, humorous, kindly, with nothing about him of the pedant. What he undertook he grasped with all the powers of his intellect and the fervour of his soul, and what he imparted to his hearers bore testimony to the lucidity of his grasp of the subject. In appearance he was of middle stature, his face clean-shaven and of classical mould, lit up with vivacity and beaming with good nature He was perhaps seen at his best when dispensing hospitality in his own house; and none of his guests would ever forget the sparkle of the wit and geniality of his entertainer. With him died the best beloved and the most talented of Roman-law professors of modern times. It was said of him by Professor Adolf Merkel in an *In Memoriam* address, *R. v. Jhering* (Jena, 1893), that he belonged to the happy class of persons to whom Goethe's lines are applicable: "Was ich in der Jugend gewünscht, das habe ich im Alter die Fülle," and this may justly be said of him, despite the fact that he did not live to finish his life's programme, which would have been to complete his *Geist des römischen Rechts* and his *Rechtsgeschichte*. For this work the span of a single life would have been insufficient, but what he has left to the world is a monument of vigorous intellectual power and stamps Jhering as an original thinker and unrivalled exponent in his peculiar interpretation of the spirit of Roman law.

Among others of his works, all of them characteristic of the author and sparkling with *jeux d'esprit*, may be mentioned the following: *Beiträge zur Lehre von Besitz*, first published in the

Jahrbücher für die Dogmatik des heutigen römischen und deutschen Privat-rechts, and then separately; *Der Besitzwille*, and an article entitled "Besitz" in the *Handwörterbuch der Staatswissenschaften* (1891), which aroused at the time much controversy, particularly on account of the opposition manifested to Savigny's conception of the subject. See also *Scherz und Ernst in der Jurisprudenz* (Leipzig, 1885); *Das Schuldmoment im romischen Privat-recht* (Giessen, 1867); *Das Trinkgeld* (Brunswick, 1882); and among the papers he left behind him his *Vorgeschichte der Indoeuropäer*, a fragment, has been published by v. Ehrenberg (Leipzig, 1894). See for an account of his life also M. de Jonge, *Rudolf v. Jhering* (Berlin, 1888), and *Meyer's Konversations-Lexikon*, 1897; for his relation to Savigny cf. that article in the ninth edition of the *Encyclopædia Britannica*. (P. A. A.)

Jicin. See GITSCHIN.

Jilolo. See HALMAHERA.

Jimena de la Frontera, a town of Spain, in the province of Cadiz. Built on a spur of the mountains, its streets are very irregular and steep. There are two parish churches, and the ruins of a castle on the site of an older Roman structure. The local industries include the manufacture of leather, flour-milling, and the making of esparto-grass rugs. The trade is chiefly in wheat, cork, oranges, wine, and fruit. Population, 7720.

Jind, a native state of India, within the Punjab. It ranks as one of the cis-Sutlej states, which came under British influence in 1809. The territory consists of three or four isolated tracts, amid British districts. Total area, 1268 square miles. The population in 1881 was 249,862; in 1891, 284,560. In 1901 the population was 282,051, showing a decrease of 1 per cent., compared with an increase of 14 per cent. in the previous decade. The average density is 224 persons per square mile. Estimated gross revenue, Rs.6,28,000; military force (including police), 2043 men; no tribute. The chief, whose title is raja, is a Sikh of the Sidhu Jat clan and of the Phulkian family. The dynasty has always been famous for its loyalty to the British, especially during the Mutiny, which has been rewarded with accessions of territory. The present (1902) raja is a minor, under charge of a British tutor, while the state is managed by a council of regency. During the Tirah expedition of 1897–98, the Jind Imperial Service infantry specially distinguished themselves. In 1896–97 the number of schools was 34, attended by 1031 pupils, of whom 9 were girls; the proportion of boys at school was 11 to every 151 of the total male population. There were three Anglo-vernacular schools. The town of JIND is situated in 29° 19′ N. and 76° 23′ E., and is a station on the Southern Punjab Railway, 80 miles north-west of Delhi. Population (1881), 7136.

Jizakh, a district town and fort of Russian Central Asia, province and 64 miles north-east of Samarkand, on the Transcaspian Railway. Population, 16,041.

Joachim, Joseph (1831——), German violinist and composer, was born at Kitsee, near Pressburg, 28th June 1831, the son of Jewish parents. He lived at Pesth from the age of two, and studied there under Serwaczynski, who introduced him at a concert when he was only eight years old. Afterwards he learnt from Hellmesberger and Joseph Böhm in Vienna, the latter instructing him in the management of the bow. In 1843 he went to Leipzig, where the Conservatorium was newly founded; at Mendelssohn's recommendation he received a thorough education in music generally from Ferdinand David and Moritz Hauptmann. In 1844 he came to England, and made his first appearance at Drury Lane Theatre, where his playing of Ernst's fantasia on *Otello* made a great sensation; he also played Beethoven's concerto at a Philharmonic Concert conducted by Mendelssohn. In 1847–49 and 1852 he revisited England, and after the foundation of the Popular Concerts in 1859, up to 1899, he played there regularly in the latter part of the season. On Liszt's invitation, he accepted the post of "Konzertmeister" (*i.e.*, orchestral leader) at Weimar, and was there from 1850 to 1853. From that year he was royal "Konzert-direktor" at Hanover until 1868, when Berlin became his place of residence. He married in 1863 the mezzo-soprano singer, Amalie Weiss (Schneeweiss); she died in 1899. In 1869 Joachim was appointed head of the newly founded "Hochschule für Musik" in Berlin. The famous "Joachim Quartet" was started in the Sing-Akademie in the following year. Besides the consummate manual skill which helped to make him famous in his youth, Joachim was gifted with the power of interpreting the greatest music in absolute perfection: while Bach, Mozart, Beethoven, and Brahms were masters whose works he played with a degree of insight that has never been approached, he was no less supreme in the music of Mendelssohn and Schumann; in short, the whole of the classical repertory has become identified with his playing. His compositions, which have won a high place in the estimation of musicians, are marked by a strong sense of orchestral colouring. His works include two concertos and three other works for violin and orchestra, the best known of which is the famous "Hungarian Concerto," which he has often played in England; six pieces for violin and piano; two works (one a set of "Hebrew Melodies") for viola and piano; several overtures and marches for orchestra, and a "Scena der Marfa" for mezzo-soprano from Schiller's *Demetrius*. No survey of Joachim's career would be complete which omitted mention of his absolute freedom from tricks or mannerism, his dignified bearing, and his unselfish character. His devotion to the highest ideals, combined with a personal massiveness and repose, has brought against Joachim's style an accusation of coldness from admirers of a more effusive temperament. But the answer to this is given by the depth and variety of expression which his mastery of the resources of his instrument put at his command. His biographer, Herr Andreas Moser, summed up all that the world needs to know of one of the most beautiful natures the world has seen in the words, "He plays the violin, not for its own sake, but in the service of an ideal."

Joachimsthal (Czech, *Jáchymov*), chief town of a government district in Bohemia, 10 miles north of Karlsbad. It is a mining centre. In 1890 the population of the commune was 7046, German and Catholic; (1900), 7378. The mines are now nearly exhausted, and but small quantities of silver and uranium are recovered. The State tobacco factory and the manufacture of gloves, uranium, colour-stuffs, lace, and paper are the most important industries.

Jodhpur, or MARWAR, a native state of India, in the Rajputana Agency. Total area (including the dependency of Mallani), 37,445 square miles. The population in 1881 was 1,750,403; in 1891, 2,521,727, showing an apparent increase of 44 per cent.; average density, 67 persons per square mile. In 1901 the population was 1,935,909, showing a decrease of 23 per cent., due to the results of famine. The gross revenue (1897–98) was Rs.58,24,000, of which Rs.20,00,000 was expended on public works; tribute, Rs.2,13,000. The late maharaja, Jaswant Singh, who died in 1896, was a very enlightened ruler. His brother, Pertap Singh, G.C.S.I., a lieutenant-colonel in the British army and LL.D. of Cambridge, visited England on the occasion of Queen Victoria's Diamond Jubilee, and served on the staff of Sir W. Lockhart during the Tirah campaign, being slightly wounded, and also in the campaign in China against the Boxers. He conducted the

administration until his nephew came of age in 1898. The Imperial Service cavalry formed part of the reserve brigade during the Tirah campaign. The state maintains a railway leading to Bikaner. Total length, 320 miles; gross receipts (1897–98), Rs.10,56,000, yielding a profit of 10·50 per cent. on a capital outlay of Rs.64,63,140. A branch railway of 135 miles towards Haidarabad in Sind is now under construction, at an estimated cost of Rs.42,77,000. Gold, silver, and copper money is coined. The state emblems are a *jhar* or sprig of seven branches and a *khanda* or sword. A few years ago the amount coined averaged nearly Rs.4,00,000, but in 1897–98 it was only Rs.7455. Marwar practically escaped the plague, but it suffered more severely than any other part of Rajputana from the famine of 1899–1900. In February 1900 more than 110,000 persons were in receipt of famine relief. The city of JODHPUR is 64 miles by rail north-west of Marwar junction, on the Rajputana Railway. Population (1881), 57,211; (1891), 61,849; (1901), 60,437. The new palace is lighted by electricity. It has many fine buildings, temples, gardens, and tanks. A steam tramway for conservancy purposes, $4\frac{1}{2}$ miles long, has been constructed at a cost of Rs.1,18,000. Mills for grinding flour and crushing grain have been constructed for the Imperial Service troops. The Jaswant College has been affiliated to the B.A. standard of the Allahabad University. To the Hewson Hospital a wing for eye diseases was added in 1898, and the Jaswant Hospital for women is under an English lady M.D.

Johannesburg, a town of British South Africa, the largest place in the Transvaal, and in the whole of Africa south of Cairo. It had an estimated population of from 120,000 to 130,000 before the exodus which took place previous to the outbreak of hostilities in 1899. Yet it is quite a recent foundation, which owes its existence to the discovery of the rich Witwatersrand goldfields about 1885. It stands 5500 feet above the sea, on the southern slope of the Rand, near the sources of the Natal Spruit, flowing southwards to the Vaal, and of the Jokeskei, going northwards to the Limpopo. It lies 26 miles south by west of Pretoria, with which it is connected by a circuitous railway connecting at Elandsfontein station with the main Transvaal system. The town has been described as a strange intermingling of squalor and luxury, of dirt outside and cleanliness within, of native hovels, wretched stores and shanties jostling shops and warehouses that would not be out of place in London or New York. It is traversed by one or two spacious thoroughfares, such as Commissioner and Pritchard Streets, which are flanked by some stately public buildings, palatial business offices, and private residences, and commanded by a formidable-looking fort erected by the Boer Government to overawe the Uitlanders, but now dismantled. According to the 1896 census, the motley population included 43,000 natives, nearly 1000 Malays, 4800 Chinese, and 51,000 whites, of whom 34,000 were British, 8000 Boers, 5500 Russians and Germans, 800 Hollanders, 600 Americans, and 1600 French, Italians, and other Europeans. But many of these foreigners disappeared after the occupation by the British forces under Lord Roberts on 29th May 1900. In the neighbouring village of KRUGERSDORP stands the national monument erected on the open veldt to commemorate the Boer victory over the Zulu king, Dingaan, in 1838, and the declaration of independence in 1880.

(A. H. K.)

Johns Hopkins University.—The Johns Hopkins University was incorporated in 1867, at Baltimore, Maryland, and formally inaugurated in 1876, after the founder's death. The founder, Johns Hopkins, divided the major part of his fortune between the university and a hospital, giving each about $3,500,000. The first president, Daniel Coit Gilman, served from 1875 to 1901, when he was succeeded by Ira Remsen. The university includes: (1) a graduate school, which confers the degree of Ph.D. after at least three years' residence; (2) a medical school, closely affiliated with the Johns Hopkins Hospital and planned for the instruction of those who have already received a degree in the liberal arts; and (3) a college, in which any one of seven parallel four-year courses leads to the degree of B.A. In 1901 the teaching staff numbered 143, and the students 650. Of the university graduates of the institution, over one-third influence the trend of higher education in America, about 350 holding professorships and instructorships in colleges and universities throughout the land, and 70 teaching in higher-grade schools. The chief characteristics of the university are a gradual growth from a firm basis, no needless duplication of the work of other institutions, freedom in methods of teaching, the liberal encouragement of research, the training of collegiate graduates through the stimulus of original investigation, and medical education on advanced scientific lines. It supports in whole or in part the following serial publications, some of them past their twentieth volume: *The American Journal of Mathematics, The American Chemical Journal, The American Journal of Philology, Studies in Historical and Political Science, Memoirs from the Biological Laboratory, The University Circulars, Contributions to Assyriology, Modern Language Notes, The Journal of Experimental Medicine,* and *Terrestrial Magnetism.* Over three hundred doctors' dissertations have likewise been printed, besides many works by members of the academic staff. The library contains 103,000 volumes. Since its founding the university has received gifts amounting to considerably more than $1,000,000. (See also BALTIMORE, EDUCATION, MEDICAL EDUCATION, and UNIVERSITIES.)

Johnston, Joseph Eggleston (1807–1891), American general in the Confederate army, was born at Cherry Grove, Rockingham county, Virginia, on 3rd February 1807. His father was Judge Peter Johnston, a Virginian of Scottish descent, who in boyhood served in the War of the Revolution, and afterwards became a distinguished jurist; his mother was Mary Wood, a niece of Patrick Henry. He graduated at the U.S. Military Academy at West Point, in the same class with Robert E. Lee, and was promoted to brevet second lieutenant, 4th Artillery, in 1829. He served with distinction until 1837, when he was engaged as a civil engineer, but a year afterwards he was reappointed in the army as first lieutenant of the corps of Topographical Engineers. During the Mexican war he served in that capacity, and later as lieutenant-colonel of a regiment of voltigeurs. He was twice severely wounded in a reconnaissance at Cerro Gordo, 1847. He was engaged in the siege of Vera Cruz, the battles of Contreras, Cherubosco, Molino del Rey, the storming of Chapultepec, and the assault on the city of Mexico, and received three brevets for gallant and meritorious service. In 1860 he was commissioned quartermaster-general. On 22nd April 1861 he resigned from the U.S. army and entered the Confederate service. He was commissioned major-general of volunteers in the army of Virginia, and assisted General Lee in organizing the volunteers. He was later appointed a general officer of the Confederacy, and assigned to the command of the army of the Shenandoah, being opposed by the Federal army under General Patterson. When General M'Dowell advanced upon the Confederate forces under Beauregard at Manassas, Johnston moved with great rapidity to the latter's assistance, and

being senior officer, took command on the field, and won the decisive victory of Manassas or Bull Run for the Confederate arms. On 31st August 1861 he was made one of the five full generals of the Confederacy, and remained in command of the forces in Virginia designated as the army of the Potomac. He commanded in the battle of Seven Pines (31st May 1862), and was so severely wounded as to be incapacitated for duty for several months. On 24th March 1863 he was assigned to the command of the south-west, including the forces of Generals Bragg, Kirby, Smith, and Pemberton, and in May was ordered to take immediate command of all the Confederate forces in Mississippi, then threatened by Grant, who was approaching to attack Vicksburg. When Pemberton's army was besieged in the city of Vicksburg by Grant, Johnston used every effort possible to relieve it, but his force was inadequate. On 18th December 1863 he was transferred to the command of the army of Tennessee, with headquarters at Dalton, Georgia. In February he successfully resisted the advance of the Federal army under General Thomas. On 3rd May 1864 Sherman commenced his advance upon Johnston's army at Dalton. In the remarkable campaign that followed, both armies were reinforced; a conservative estimate places Sherman's average of effective forces throughout at about 100,000 men, and Johnston's at less than half that number. From 9th May to 17th July Johnston fought Sherman almost daily, his line of battle constantly confronting and engaging Sherman's largely preponderating forces, the principal engagements being Tunnel Hill, Rocky Face Ridge, Buzzard Roost, Dug Gap, Mill Creek Gap, Snake Creek, and Varnells, from May 3rd to 12th; Dalton and Resaca, May 13th and 14th; Adairsville, May 17th; Cassville and Kingston, May 18th to 24th; Dallas and New Hope, May 25th, 26th; Pickett's Mill, May 27th; Kenesaw Mountain, including Pine Knob, Kulp's, M'Afee's, Golgotha, Latimer, and Powder Springs, June 9th to 30th; engagements on the Chattahoochie and in front of Atlanta, June 30th to July 17th. Sherman's plans seem to have been to press his large and well-equipped army upon the small force under Johnston and compel him to retreat, but the retrograde movement on the part of Johnston was conducted with such skill that Sherman's advance hardly exceeded an average of a mile a day. Johnston's losses were 10,672. Sherman's losses are given by him approximately at 3700 killed, 19,548 wounded, and 3800 missing. On 17th July Johnston was succeeded in command by General Hood, and on 23rd February 1865 he was ordered by Lee to assume control of the army of Tennessee and all the troops in South Carolina, Georgia, and Florida. Concentrating all available troops, which numbered about 16,000, Johnston threw himself in front of Sherman's army of 60,000, and attacking the head of his column at Bentonville, North Carolina, captured four pieces of artillery and 900 prisoners. He then retired to Raleigh, and later to Greensboro. After Lee surrendered the army of Northern Virginia to Grant, Johnston advised Mr Davis that it was in his opinion wrong and useless to continue the conflict, and he was authorized to make terms with Sherman. The terms entered into between these generals, 18th April, having been rejected by the United States Government, another agreement was signed 26th April, similar in terms to the surrender of Lee. After the close of the war Johnston engaged in civil pursuits, and occupied business positions of importance. In 1874 he published a *Narrative of Military Operations during the Civil War*. In 1877 he was elected to represent the Richmond district of Virginia in Congress. In 1887 he was appointed by President Cleveland U.S. Commissioner of Railroads. Johnston was married in early life to Louisa, daughter of Louis M'Lane; she died in 1886. He died at Washington, D.C., on 21st March 1891, leaving no children. (J. WH.)

Johnstone, a police burgh and manufacturing town of Renfrewshire, Scotland, on the Black Cart river, about 10 miles west by south of Glasgow by rail. The industrial establishments include a large shoe-lace factory. Recent erections are an Established church, municipal buildings, a cottage hospital, and a drill hall; there are also a town hall, and a combination hospital for infectious diseases. The gasworks have been acquired by the town. Population (1881), 9268; (1901), 10,502.

Johnstown, capital of Fulton county, New York, U.S.A., on the Fonda, Johnstown, and Gloversville Railroad, at an altitude of 659 feet. It has a regular plan, and a good water-supply and sewerage system. It is largely engaged in the manufacture of gloves. Population (1880), 5013; (1900), 10,130, of whom 1653 were foreign-born and 108 negroes.

Johnstown, capital of Cambria county, Pennsylvania, U.S.A., on the Conemaugh river and on the Pennsylvania and the Baltimore and Ohio railways, at an altitude of 1170 feet. Its site is the narrow gorge of the river, along which its buildings are arranged irregularly for a considerable distance. It has iron manufactures, and contains furnaces, rolling-mills, and foundries, being the headquarters of the Cambria Steel Works. Its manufactures had in 1900 a capital of $16,940,450, employed 6116 hands, and the product was valued at $22,559,890, nearly all of which consisted of iron and steel. In 1889 a dam on the Little Conemaugh, nine miles above Johnstown, burst, and the flood swept away nearly the entire town and caused the loss of thousands of lives and the destruction of millions of dollars' worth of property. The town was, however, quickly rebuilt, and has since grown with great rapidity. In 1900 the assessed valuation of real and personal property, on a basis of about two-thirds of the full value, was $13,851,987; the net debt was only $373,785, and its rate of taxation was $15·70 per $1000. Population (1880), 8380; (1890), 21,805; (1900), 35,936, of whom 7318 were foreign-born and 314 negroes.

Johor (not JOHORE), an independent Malayan state at the southern end of the peninsula, stretching from 2·40° S. to Cape Romania (Ramûnya), the most southerly point on the mainland of Asia, and including all the small islands adjacent to the coast which lie to the south of parallel 2·40° S. It is bounded on the N. by the protected native state of Pahang; on the N.W. by the Nĕgri Sĕmbîlan and the territory of Malacca; on the S. by the strait which divides Singapore island from the mainland; on the E. by the China Sea; and on the W. by the straits of Malacca. The province of Mûar was placed under the administration of Johor by the British Government as a temporary measure in 1877, and has continued to be a portion of the sultan's dominions since that date. The coast-line, which is the boundary of the state on three sides, measures about 250 miles in length. Greatest length from north-west to south-east, 165 miles; greatest breadth from east to west, 100 miles. The area is estimated at about 9000 square miles. The principal rivers are the Mûar, which is the most important waterway in the south of the peninsula; the Johor, up which river the old capital of the state was situated; the Endau, which marks the boundary with Pahang; and the Bâtu Pâhat and Sĕdĕli, which, however, are of comparative unimportance. Johor is less mountainous than any other state in the peninsula. The highest peak is Gûnong Lêdang, called Mount Ophir by Europeans, which measures some 4000 feet in height.

Like the rest of the peninsula, Johor is covered from end to end by one vast spread of forest, only broken here and there by clearings and settlements of insignificant area. The capital is Johor Bharu, situated at the nearest point on the mainland to the island of Singapore. The late sultan built a fine palace at this place, which is the principal feature of the town. The inhabitants number about 20,000. It is chiefly attractive as a kind of Oriental Monte Carlo, and is much resorted to from Singapore, to which place it is joined by a road 14 miles in length. There is a good service of coaches. The capital of the province of Mûar is Bandar Maharani, named after the wife of the late sultan before he had assumed his final title. It is not a very important place. The climate of Johor is healthy and equable for a country situated so near to the equator; it is cooler than that of Singapore. No exact figures can be obtained as to the population of Johor, but the best estimates place it at about 200,000, of whom 150,000 are Chinese, 35,000 Malays, 15,000 Javanese. We are thus presented with the curious spectacle of a country under Malay rule in which the Chinese outnumber the people of the land by more than four to one. It is not possible to obtain any exact data on the subject of the revenue and expenditure of the state. The revenue, however, is probably about three-quarters of a million of dollars, and the expenditure upon public service is comparatively small. The revenue is chiefly derived from the revenue farms for opium, spirits, gambling, &c., and from duty on pepper and gambier exported by the Chinese. The cultivation of these products forms the principal industry. There is little known mineral wealth.

History.—It is claimed, in common with many of the other states of the peninsula, that the Mahommedan empire of Johor was founded by the sultan of Malacca after his expulsion from his kingdom by the Portuguese in 1511. It is certain that Johor took an active part, only second to that of Achin, in the war which was so long protracted between the Portuguese and the Dutch for the possession of Malacca. Later we find Johor ruled by an officer of the sultan of Rîau, bearing the title of Tumĕnggong, and owing feudal allegiance to his master in common with the Bĕndăhâra of Pahang. In 1812, however, this officer seems to have thrown off the control of Rîau, and to have assumed the title of sultan, for one of his descendants, sultan Husain, ceded the island of Singapore to the East India Company in 1819. In 1855 the then sultan, Ali, was deposed, and his principal chief, the Tumĕnggong, was given the supreme rule by the British. His son Tumĕnggong Abubakar proved to be a man of exceptional intelligence. He made numerous visits to Europe, took considerable interest in the government and development of his country, and was given by Queen Victoria the title of maharaja in 1879. In 1885 he entered into a new agreement with the British Government, and was allowed to assume the title of sultan of the state and territory of Johor. He was succeeded in 1895 by his son sultan Ibrahîm. The government of Johor has been so comparatively free from abuses under its native rulers that it has never been found necessary to place it under the residential system in force in the other native states of the peninsula which are under British control, and on several occasions the late sultan used his influence with good effect on the side of law and order. Mûar was placed under the rule of Johor in 1877.

The close proximity of Johor to Singapore has caused the rulers of the former state to be constantly subjected to the influence of European public opinion, and this has served to bring about the abolition of most of the abuses which are wont to disfigure native rule in a Malayan state. None the less, the Malay is by nature but ill fitted for the drudgery which is necessary if proper attention is to be paid to the dull details whereby government is rendered good and efficient. In sultan Abubakar Johor possessed a man of quite exceptional force of character and intellect, and his principal adviser, the Dâto' Mĕntri, was a worthy servant of his master. Now, however, the reins of government are mostly in the hands of a set of young men who lack either experience or the serious devotion to dull duties which is the distinguishing mark of the English civil servants whose system is mimicked in Johor. The result is that the country is not well ruled, and that the finances are sadly mismanaged. Mûar, in imitation of the British system, is ruled by a raja of the house of Johor, who bears the title of Resident. He has travelled a good deal in other countries. A legal interest attached to one incident connected with his residence abroad. He was made the defendant in a suit for breach of promise of marriage in the English law courts, but the plaintiff was non-suited, since it was decided that no action lay against a foreign sovereign. (H. CL.)

Joinville, François Ferdinand Philippe Louis Marie, Prince de (1818–1900), the third son of Louis Philippe, duc d'Orleans, afterwards king of the French, was born at Neuilly, 14th August 1818. He was educated for the navy, and after passing regularly through every grade of instruction, became lieutenant in 1836. His first conspicuous service was at the bombardment of San Juan de Ulloa, in November 1838, when he headed a landing party and took the Mexican general Arista prisoner with his own hand. He was promoted to be captain, and was in 1840 entrusted with the charge of bringing the remains of Napoleon from St Helena to France. The question of Mehemet Ali caused at the time apprehensions of a war with Great Britain, and the prince made some political capital with his countrymen and excited some ridicule abroad by needless declarations of his intentions in case of his vessel being attacked. In 1845 he conducted naval operations on the coast of Morocco, bombarding Tangier and occupying Mogador, and was recompensed by the grade of vice-admiral. In the following year he published an article on the deficiencies of the French navy which attracted considerable attention, and studied in every way to acquire popularity, especially by an affectation of ill-will towards Great Britain. The Revolution of 1848 nevertheless swept him away with the other Orleans princes. He hastened to quit Algeria, where he was then serving, and took refuge at Claremont, in Surrey, with the rest of his family. In 1861, upon the breaking out of the American Civil War, he proceeded to Washington, and placed the services of his son and two of his nephews at the disposal of the United States Government. Otherwise, he was little heard of until the overthrow of the Empire in 1870, when he re-entered France, only to be promptly expelled by the Government of National Defence. Returning incognito, he joined the army of General d'Aurelle de Paladines, under the assumed name of Colonel Lutherod, fought bravely before Orleans, and afterwards, divulging his identity, formally sought permission to serve. Gambetta, however, arrested him and sent him back to England. In the National Assembly, elected in February, the prince was returned by two departments and elected to sit for the Haute Marne, but, by an arrangement with Thiers, did not take his seat until the latter had been chosen President of the provincial republic. His deafness prevented him from making any figure in the Assembly, and he resigned his seat in 1876. In 1886 the provisions of the law against pretenders to the throne deprived him of his rank as vice-admiral, but he continued to live in France,

and died at Paris, 16th June 1900. He had married in 1843 the Princess Francisca, sister of Pedro II., emperor of Brazil, and had a son, the duc de Penthièvre, also brought up to the navy. The prince de Joinville was the author of several essays and pamphlets, on naval affairs and other matters of public interest, including a criticism on the Potomac campaign of 1862, which were collected and republished after the overthrow of the Second Empire. (R. G.)

Jókai, Maurus (1825——), the greatest Hungarian novelist of the 19th century, was born at Rév-Komárom on 19th February 1825. His father, Joseph, was a member of the Asva branch of the ancient Jókay family; his mother was a scion of the noble Pulays. The lad was timid and delicate, and therefore educated at home till his tenth year, when he was sent to Pressburg, subsequently completing his education at the Calvinist college at Pápá, where he first met Petöfi, Alexander Kozma, and several other brilliant young men who subsequently became famous. His family had meant him to follow the law, his father's profession, and accordingly the youth, always singularly assiduous, plodded conscientiously through the usual curriculum at Kecskemet and Pest, and as a full-blown advocate actually succeeded in winning his first case. But the drudgery of a lawyer's office was uncongenial to the ardently poetical youth, and, encouraged by the encomiums pronounced by the Hungarian Academy upon his first play, *Zsidó fiu* ("The Jew Boy"), he flitted, when barely twenty, to Pest in 1845 with a MS. romance in his pocket; he was introduced by Petöfi to the literary notabilities of the Hungarian capital, and the same year his first notable romance, *Hétköznapok* ("Working Days"), appeared, first in the columns of the *Pesti Dievatlap*, and subsequently, in 1846, in book form. *Hétköznapok*, despite its manifest crudities and extravagances, was instantly recognized by all the leading critics as a work of original genius, and in the following year Jókai was appointed the editor of *Életképek*, the leading Hungarian literary journal, and gathered round him all the rising talent of the country. On the outbreak of the revolution of 1848 the young editor enthusiastically adopted the national cause, and served it with both pen and sword. Now, as ever, he was a moderate Liberal, setting his face steadily against all excesses; but, carried away by the Hungarian triumphs of April and May 1849, he supported Kossuth's fatal blunder of deposing the Hapsburg dynasty, and though, after the war was over, his life was saved by an ingenious strategem of his wife, the great tragic actress, Roza Benke Laborfalvi, whom he had married on 29th August 1848, he lived for the next fourteen years the life of a political suspect. Yet this was perhaps the most glorious period of his existence, for during it he devoted himself to the rehabilitation of the proscribed and humiliated Magyar language, composing no fewer than thirty great romances, besides innumerable volumes of tales, essays, criticisms, and facetiæ. This was the period of such masterpieces as *Erdély Arany Kord* ("The Golden Age of Transylvania"), with its sequel *Törökvilág Magyarországon* ("The Turks in Hungary"), *Egy Magyar Nábob* ("A Hungarian Nabob"), *Karpáthy Zoltán*, *Janicsárok végnapjai* ("The Last Days of the Janissaries"), *Szomorú napok* ("Sad Days"). On the re-establishment of the Hungarian constitution by the Composition of 1867, Jókai took an active part in politics. As a constant supporter of the Tisza Administration, not only in parliament, where he sat continuously for more than twenty years, but also as the editor of the Government organ, *Hon*, founded by him in 1863, he became a power in the state, and, though he never took office himself, frequently extricated the Government from difficult places. As a suave, practical, and witty debater he was particularly successful. Yet it was to literature that he continued to devote most of his time, and his productiveness after 1870 was stupendous, amounting to many hundreds of volumes. Stranger still, none of this work is slipshod, and the best of it deserves to endure. Amongst the finest of his later works may be mentioned the unique and incomparable *Az arany ember* ("A Man of Gold")—translated into English under the title of "Timar's Two Worlds"—and *A tengerzemü hölgy* ("The Lady with Eyes like the Sea"), which won the Academy's prize in 1890. Jókai is an arch-romantic, with a perfervid Oriental imagination, and humour of the purest, rarest description. If one can imagine a combination, in almost equal parts, of Walter Scott, William Beckford, Dumas *père*, and Charles Dickens, plus a semi-savage Magyar *je ne sais quoi*, one may perhaps form a fair idea of the great Hungarian romancer's indisputable genius.

See Névy László, *Jókai Mór*.—Hegedúsis Sándor, *Jókai Mórról*.

Jokjokarta (Dutch, *Djokdjakarta*), a residency of middle Java, on the south coast, forming with Surakarta, another residency, the *Vorstenlanden* (territories of the princes). Its area is about 1200 square miles. The country is very mountainous, only the southern part between the rivers Progo and Opak being low and flat. In the north-west are the southern slopes of the Merapi (9400 feet), and in the east the hills and plateau of Kidul and Sevu, known as the Thousand Hills. The rivers fertilize the soil, but are not navigable. In their immediate vicinity are thirty-nine indigo and sixteen sugar factories, but east and west of the streams only two or three factories are found. Coal and marble occur in Kidul and Sevu. Notwithstanding the natural resources, the natives are poor, owing chiefly to the maladministration of the princes and their functionaries, the use of opium, and the usury practised by foreigners (Chinese, Arabs, &c.). The population in 1897 numbered 858,392 (for details see Java). The principality is divided into the territory of the sultan (vassal of the Dutch Government), that of the so-called independent prince Paku Alam, and two enclaves of Surakarta, Ngawen and Imogiri. There are good roads, and railways connect the chief town with Batavia, Samarang, Surakarta, &c. Jokjokarta, the chief town, is situated at an altitude of about 300 feet at the foot (S.S.E.) of Merapi. It is connected with Batavia by a tramway 420 kilometres in length. It is the seat of the prince, the resident, and Paku Alam, and comprises separate kampongs for Europeans, Chinese, and other foreigners. It is governed by Dutch functionaries, not by the sultan. The most remarkable section of the town is the Kraton (or citadel), containing palaces and kampongs with about 15,000 inhabitants. The total population of the town is 60,523 (Europeans 2240, natives 54,219, Chinese 3836).

Veth, *Java*, iii. p. 618; Rogge, "De kraton van Djokja," *Volksalmanak van 't nut v. het Algem*, 1873, p. 49.

Joliet, capital of Will county, Illinois, U.S.A., on the Des Plaines river and at the intersection of five railways, at an altitude of 538 feet. It has a level site in the bottom-land, and a regular plan, divided into seven wards. It has a good system of water-supply, owned by the city, is sewered, and its business streets are paved. It contains one of the state prisons. It is an important railway centre, with a large trade, and it has, moreover, extensive and varied manufactures. In 1890 there was a manufacturing capital of $9,418,932, employing 3183 hands and producing goods valued at $12,732,933. The

assessed valuation of real and personal property in 1898 was $2,861,152, and the net debt was $239,937. Population (1890), 23,264; (1900), 29,353, of whom 8536 were foreign-born and 650 negroes.

Joncières, Victorin (1839——), French composer, was born in Paris, 12th April 1839. He first devoted his attention to painting, but afterwards took up the serious study of music. He entered the Paris Conservatoire, but did not remain there long, because he had espoused too warmly the cause of Wagner against his professor. He has composed the following operas: *Sardanapale* (Théâtre Lyrique, 1867), *Le Dernier Jour de Pompéi* (Théâtre Lyrique, 1869), *Dimitri* (Théâtre Lyrique, 1876), *La Reine Berthe* (Opéra, 1878), *Le Chevalier Jean* (Opéra Comique, 1885), *Lancelot* (Opéra, 1900). He has also written incidental music to *Hamlet*, a symphony, and other works. M. Joncières' admiration for Wagner asserts itself rather in a musical than a dramatic sense. The influence of the German master's earlier style can be traced in operas. M. Joncières has, however, adhered to the recognized forms of the French opera and has not modelled his works according to the later developments of the Wagnerian "music drama." He may indeed be said to have been at least as much influenced by Gounod as by Wagner. M. Joncières, like so many other French composers, is also a writer of musical criticism, and from 1871 acted in this capacity for *La Liberté*.

Jones, Henry (1831–1899), English author, well known as a writer on whist under his *nom-de-guerre* "Cavendish," was born in London on the 2nd of November 1831, being the eldest son of Henry D. Jones, a medical practitioner. He adopted his father's profession, and after being admitted M.R.C.S. and a member of the Society of Apothecaries in 1852, established himself and continued for sixteen years in practice in London. The father was a keen devotee of whist, and under his eye the son became early in life a good player. He was a member of several whist clubs, among them the "Cavendish," and in 1862 appeared his *Principles of Whist, stated and explained by Cavendish*, which was destined to become the leading authority when disputes had to be settled as to the practice of the game. This work was followed by treatises on the laws of piquet and écarté. "Cavendish" also wrote on billiards, lawn tennis, and croquet, and was a contributor of articles on whist and other games to the ninth edition of the *Encyclopædia Britannica*. *The Times*, in a leading article, 17th February 1899, said of him: "'Cavendish' was not a law-maker, but he codified and commented upon the laws which had been made, no one knows by whom, during many generations of card-playing," and stated that one of the most noteworthy points in "Cavendish's" character was the manner in which he kept himself abreast of improvements in his favourite game. He died on the 10th of February 1899.

Jönköping, one of the principal industrial towns of Sweden, standing at the south extremity of Lake Wetter, 114 miles by rail east of Gothenburg. Its chief industries are the manufacture of matches (since about 1860), and paper and paper roofing; and at Husqvarna, (5 miles to the east) are the principal Swedish factories for firearms, as well as sewing machines, and foundries. Jönköping is the original home of the well-known *säkerhetständstickor* (safety matches). Eight miles to the south is Mount Taberg, a solid mass (394 feet high, 2950 feet long, 1475 feet broad) of magnetic iron ore, which, however, owing to the low percentage (32 per cent.) of iron and the difficulty of smelting it, is but little worked. Population (1880), 16,147; (1900), 23,143.

Joplin, a city of Jasper county, Missouri, U.S.A., at an altitude of 979 feet. It has a level site and a regular plan. It is entered by four railways, the Kansas City, Fort Scott and Memphis, the Missouri Pacific, the Port Arthur route, and the St Louis and San Francisco. It is the centre of the lead and zinc region of south-western Missouri and south-eastern Kansas, and it contains smelting and other works for reducing ores and making by-products. Population (1880), 7038; (1900), 26,023, of whom 893 were foreign-born and 773 negroes.

Joppa, Yáfá, or Jaffa, chief town of a kaza of the Jerusalem sanjak, situated on the sea-coast, and built, for the most part, on a rounded hill about 110 feet high. It is the port of Jerusalem, with which it is connected by a metre-gauge railway and a carriage road; but steamers have to lie in an open roadstead, about half a mile from the shore, and in stormy weather landing is impossible. In the old town the houses rise in terraces from the water's edge, and the streets are narrow and dirty; but beyond its limits, where the fortifications have been rased, new quarters, with well-built houses and broad streets, have sprung up. The celebrated orange gardens now cover an area of four square miles, and more ground is constantly being brought under cultivation. The principal exports (£264,950 in 1900) are soap from Náblus, oranges, sesame, water-melons, and wine; and the imports (£382,405 in 1900) are cotton goods, timber, tiles, and petroleum. The average annual value of the trade during the previous five years was exports £317,736, imports £310,260. The increase of the import trade is due to the opening of the railway to Jerusalem. The population is about 35,000 (Moslems 23,000, Christians 5000, Jews 7000). The German "Temple" colony, founded in 1868, numbers about 320 souls. The number of pilgrims passing through Jaffa to Jerusalem in 1900 was 14,500, and the number of tourists 3000. The town contains British, French, and German hospitals and schools for boys and girls; and Russian and Latin monasteries and hospices. On its outskirts there is an excellent agricultural school for Jews, with a large model farm, established by the Alliance Israélite. (C. W. W.)

Jordan (Arabic, *esh-Sherí'a*, "the watering-place"), the principal river of Palestine and one of the most remarkable rivers in the world. It flows from north to south in a deep trough-like valley, the Ghór, which follows the line of a fault, or fracture of the earth's crust, and for more than two-thirds of its course it lies below the level of the sea. It has never been navigable, no important town has ever been built on its banks, and it runs into a sea which has no port and which is destitute of animal life. From its sources to the Dead Sea it rushes down a continuous inclined plane, broken here and there by rapids and small falls; and between the Sea of Galilee and the Dead Sea its sinuosity is so great that in a direct distance of sixty-five miles it traverses at least 200 miles. The river actually flows in a depression, the Zór, from a quarter to two miles wide, which it has hollowed out for itself in the bed of the Ghór. During the rainy season (January and February), when Jordan overflows its banks, the Zór is flooded, but when the water falls it produces rich crops. The floor of the Ghór falls gently to the Zór, and is intersected by deep channels, which have been cut by the small streams and winter torrents that traverse it on their way to the Jordan. As far south as Kurn Surtabeh most of the valley is fertile, and even between that point and the Dead Sea there are several well-watered oases. In summer the heat in the Ghór is intense, 110° F. in the shade, but in winter the temperature falls to 40°, and sometimes to 32°, at night. During the seasons of rain and melting

snow the river is very full, and liable to freshets. After twelve hours' rain it has been known to rise from four to five feet, and to fall as rapidly. In 1257 the Jordan was dammed up for several hours by a landslip, probably due to heavy rain, near the spot at which the stoppage took place when the Israelites crossed opposite Jericho. On leaving the Sea of Galilee the water is quite clear, but it soon assumes a tawny colour from the soft marl which it washes away from its banks and deposits in the Dead Sea. The Jordan is crossed by two stone bridges—one north of Lake Huleh, the other between that lake and the Sea of Galilee—and by a wooden bridge on the road from Jerusalem to Gilead and Moab. During the Roman period, and almost to the end of the Arab supremacy, there were bridges on all the great lines of communication between eastern and western Palestine, and ferries at other places. The depth of water varies greatly with the season. When not in flood the river is easily fordable, and between the Sea of Galilee and the Dead Sea there are then more than fifty fords—some of them of historic interest. The natural products of the Jordan valley—a tropical oasis sunk in the temperate zone, and overhung by Alpine Hermon—are unique. Papyrus grows in Lake Huleh, and rice and cereals thrive on its shores, whilst below the Sea of Galilee the vegetation is almost tropical. The flora and fauna present a large infusion of Ethiopian types; and the fish, with which the river is abundantly stocked, have a great affinity with those of the rivers and lakes of East Africa.

See LYNCH, *Narrative of the U.S. Expedition to the Jordan and Dead Sea*, 1850.—DUC DE LUYNES, *Voyage d'exploration à la Mer Morte*, vol. iii. *Géologie*.—Pal. Exp. Fund, Hull, *Geology of Palestine*.—TRISTRAM, *Flora and Fauna of Palestine*.—POST, *Flora of Syria and Palestine*.—LORTET, *La Syrie d'aujourd'hui*.—G. A. SMITH, *Historical Geography of the Holy Land*.—WILSON, *s.v.* in Smith's *Dict. of the Bible*, 2nd ed.—WARREN, *s.v.* in Hastings' *Dict. of the Bible*. (C. W. W.)

Josefstadt (formerly known as PLESS), a town in the government district of Königinhof, north-east Bohemia, Austria, at the confluence of the Aupa and Mettau with the Elbe. It was fortified up to 1888, and is the headquarters of a military district and an artillery depot, with a garrison of 3630 men. Although situated in a small German-speaking enclave, more than half the inhabitants (6116 in 1900) are Czech.

Jóshekán, a small province of Persia covering about 1000 square miles. It has a yearly revenue of about £1200, and is held in fief by the family of Prince Bahrám Mirza, Muizz ed Dowleh (died 1882), grand-uncle of the Shah. Its chief town and the residence of the governor used to be Jóshekán-Káli, a large village with fine gardens, formerly famous for its carpets (*káli*), but now the chief place is Maimeh, a little city with a population of 2500, situated at an elevation of 6670 feet, about 63 miles from Isfahán in a north-westerly direction and 13 miles south-west of Jóshekán-Káli.

Joubert, Petrus Jacobus (1834–1900), commandant-general of the South African Republic from 1880 to 1900, was born at Cango, in the district of Oudtshoorn, Cape Colony, on 20th January 1834, an ancestor of his having been among the French Huguenots who fled to South Africa soon after the revocation of the Edict of Nantes by Louis XIV. Left an orphan at an early age, "Piet" Joubert, after enjoying a rudimentary education in his native home as a British subject, soon migrated to the Transvaal, where he settled in the Wakkerstroom district near Lang's Nek and the north-east angle of Natal. There he not only carried on the business of farmer with great success, but turned his attention to the study of the law. The esteem in which his shrewdness in both farming and legal affairs was held led to his election as the Volksraad member for Wakkerstroom early in the 'sixties, Pretorius being then in his second term of office as President. In 1870 Joubert was again elected, and the vigorous use to which he put his slender stock of legal knowledge secured him the appointment of attorney-general of the republic, while in 1874 he acted as President during the absence of Burgers in Europe. During the first British annexation of the Transvaal, Joubert earned for himself the reputation of a consistent irreconcilable by refusing to hold office under the Government, as Paul Kruger and other prominent Boers were doing. Instead of accepting the lucrative post offered him, he took a leading part in creating and directing the agitation which led to the war of 1880, eventually becoming, as commandant-general of the Boer forces, a member of the triumvirate that administered the provisional Boer government set up in 1880 at Heidelberg. He was in command at the battles of Lang's Nek, Ingogo, and Majuba Hill, subsequently conducting the earlier peace negotiations that led to the conclusion of the Pretoria Convention. In 1893 he opposed Kruger in the contest for the Presidency, the voting on that occasion (though there is reason for believing that the voting lists had been manipulated by Kruger's agents) being 7881 for Kruger and 7009 for Joubert, whilst at the next election in 1898 the voting was 12,858 for Kruger and 2001 for Joubert. Joubert's position had then become much weakened by accusations of treachery and of sympathy with the Uitlander agitation, and in order to clear his character of these imputations it became necessary for him to join those who advocated strong measures against the Jameson Raiders of 1896. He took little part in the negotiations that culminated in the ultimatum sent to Great Britain by Kruger in 1899, and though he immediately assumed nominal command of the operations on the outbreak of hostilities, he gave up to others the chief share in the direction of the war, through his inability or neglect to impose upon them his own will. His cautious nature, which had in early life gained him the sobriquet of "Slim Piet," linked with a lack of determination and assertiveness that characterized his whole career, led him to act mainly on the defensive; and the strategically offensive movements of the Boer forces, such as Elandslaagte and Willow Grange, appear to have been neither planned nor executed by him. As the war went on, physical weakness led to Joubert's virtual retirement, and, though two days earlier he was still reported as being in supreme command, he died at Pretoria from peritonitis on 28th March 1900. Sir George White, the defender of Ladysmith, summed up Joubert's character when he called him "a soldier and a gentleman, and a brave and honourable opponent." (J. A. J. DE V.)

Joule, James Prescott (1818–1889), English physicist, was born on 24th December 1818, at Salford, near Manchester. Although he received some instruction from John Dalton in chemistry, most of his scientific knowledge was self-acquired, and this was especially the case with regard to electricity and electro-magnetism, the subjects in which his earliest researches were carried out. From the first he appreciated to the full the importance of accurate measurement, and all through his life the attainment of exact quantitative data was one of his chief considerations. At the age of nineteen he invented an electro-magnetic engine, and in the course of examining its performance dissatisfaction with the vague and arbitrary methods then in vogue of specifying electrical quantities caused him to adopt a convenient and scientific unit, which he took to be the amount of electricity required to decompose nine grains of water in

one hour. In 1840 he was thus enabled to give a quantitative statement of the law according to which heat is produced in a conductor by the passage of an electric current, and in succeeding years he published a series of valuable researches on the agency of electricity in transformations of energy. One of these contained the first intimation of the achievement with which his name is most widely associated, for it was in a paper read before the British Association at its Cork meeting in 1843, and entitled the "Calorific Effects of Magneto-electricity and the Mechanical Value of Heat," that he expressed the conviction that whenever mechanical force is expended an exact equivalent of heat is always obtained. By rotating a small electro-magnet in water, between the poles of another magnet, and then measuring the heat developed in the water and other parts of the machine, the current induced in the coils, and the energy required to maintain rotation, he calculated that the quantity of heat capable of warming one pound of water one degree Fahr. was equivalent to the mechanical force which could raise 838 lb through the distance of one foot. At the same time he brought forward another determination based on the heating effects observable when water is forced through capillary tubes; the number obtained in this way was 770. A third method, depending on the observation of the heat evolved by the mechanical compression of air, was employed a year or two later, and yielded the number 798; and a fourth—the well-known frictional one of stirring water with a sort of paddle-wheel—yielded the result 890 (see *Brit. Assoc. Report*, 1845), though 781·5 was obtained by subsequent repetitions of the experiment. In 1849 he presented to the Royal Society a memoir which, together with a history of the subject, contained details of a long series of determinations, the result of which was 772. A good many years later he was entrusted by the Committee of the British Association on Standards of Electric Resistance with the task of deducing the mechanical equivalent of heat from the thermal effects of electric currents. This inquiry yielded (in 1867) the result 783, and this Joule himself was inclined to regard as more accurate than his old determination by the frictional method; the latter, however, was repeated with every precaution, and again indicated 772·55 foot-pounds as the quantity of work that must be expended at sea-level in the latitude of Greenwich in order to raise the temperature of one pound of water, weighed *in vacuo*, from 60° to 61° Fahr. Ultimately the discrepancy was traced to an error which, not by Joule's fault, vitiated the determination by the electrical method, for it was found that the standard ohm, as actually defined by the British Association Committee and as used by him, was slightly smaller than was intended; when the necessary corrections were made the results of the two methods were almost precisely congruent, and thus the figure 772·55 was vindicated. In addition, numerous other researches stand to Joule's credit—the work done in compressing gases and the thermal changes they undergo when forced under pressure through small apertures (with Lord Kelvin), the change of volume on solution (with Playfair), the change of temperature produced by the longitudinal extension and compression of solids, &c. It was during the experiments involved by the first of these inquiries that incidentally he was led to appreciate the value of surface condensation in increasing the efficiency of the steam engine. A new form of condenser was tested on the small engine employed, and the results it yielded formed the starting-point of a series of investigations which were aided by a special grant from the Royal Society, and were described in an elaborate memoir presented to it on 13th December 1860. His results, according to Lord Kelvin, led directly and speedily to the present practical method of surface-condensation, which is one of the most important improvements of the steam engine, especially for marine use, since the days of Watt. Joule died at Sale on 11th October 1889. His scientific papers were collected and published by the Physical Society of London: the first volume, which appeared in 1884, contained the researches for which he was alone responsible, and the second, dated 1887, those which he carried out in association with other workers.

Jovellar y Soler, Joaquin (1819–1892), captain-general of Spain, was born at Palma de Mallorca, 28th December 1819. At the close of his studies at the military academy he was appointed sub-lieutenant in 1836, went to Cuba as captain in 1842, returned to the War Office in 1851, was promoted major in 1853, and went to Morocco as private secretary to Marshal O'Donnell, who made him colonel in 1860 after Jovellar had been wounded at the battle of Wad el Ras. In 1863 Jovellar became a brigadier-general, in 1864 under-secretary for war, was severely wounded in fighting the insurgents in the streets of Madrid in 1866, and rose to the rank of general of division in 1866. Jovellar adhered to the revolution, and King Amadeus made him a lieutenant-general in 1872. He absented himself from Spain when the federal republic was proclaimed, and returned in the autumn of 1873, when Castelar sent him to Cuba as governor-general. In 1874 Jovellar came back to the peninsula, and was in command of the army of the Centre against the Carlists when Marshal Campos went to Sagunto to proclaim Alphonso XII. General Jovellar became war minister in the first cabinet of the restoration under Canovas, who sent him to Cuba again as governor-general, where he remained until 18th June 1878, when the Ten Years' Insurrection closed with the peace of Zaujon. Alphonso XII. made him a captain-general, president of the council, life-senator, and governor-general of the Philippines. Jovellar died in Madrid, 17th April 1892. (A. E. H.)

Jowett, Benjamin (1817–1893), Regius Professor of Greek and Master of Balliol College, Oxford, was born in Camberwell on 15th April 1817. His father was one of a Yorkshire family who, for three generations, had been supporters of the Evangelical movement in the Church of England. His mother was a Langhorne, in some way related to the poet and translator of Plutarch. At twelve the boy was placed on the foundation of St Paul's School, then in St Paul's Churchyard, and in his nineteenth year he obtained an open scholarship at Balliol, which became his home for the remaining fifty-eight years of his life. In 1838, while an undergraduate, he gained a fellowship, and graduated with first-class honours in 1839. Brought up amongst pious Evangelicals, he came to Oxford at the height of the Tractarian movement, and through the friendship of W. G. Ward was drawn for a time in the direction of High Anglicanism; but a stronger and more lasting influence was that of the Arnold school, represented by A. P. Stanley. Jowett was thus led to concentrate his attention on theology, and in the summers of 1845 and 1846, spent in Germany with Stanley, he became an eager student of German criticism and speculation. Amongst the writings of that period he was most impressed by those of F. C. Baur. But he never ceased to exercise an independent judgment, and his work on St Paul, which appeared in 1855, was the result of much original reflexion and inquiry. He was appointed to the Greek professorship in the autumn of that year. He had been a tutor of Balliol and a clergyman since 1842, and had devoted himself to the work of tuition with unexampled zeal. His pupils became his friends for life. He discerned their capabilities,

studied their characters, and sought to remedy their defects by frank and searching criticism. Like another Socrates, he taught them to know themselves, repressing vanity, encouraging the despondent, and attaching all alike by his unobtrusive sympathy. This work made gradually a strong impression, and those who cared for Oxford began to speak of him as "the great tutor." As early as 1839 Stanley had joined with Tait, the future archbishop, in advocating certain university reforms. From 1846 onwards Jowett threw himself into this movement, which in 1848 became general amongst the younger and more thoughtful Fellows, until it took effect in the Commission of 1850 and the Act of 1854. Another educational reform, the opening of the Indian civil service to competition, took place at the same time, and Jowett was one of the Commission. He had two brothers who served and died in India, and he never ceased to take a deep and practical interest in Indian affairs. A great disappointment, his repulse for the Mastership of Balliol, also in 1854, appears to have roused him into the completion of his book on *The Epistles of St Paul*. This work, described by one of his friends as "a miracle of boldness," is full of originality and suggestiveness, but its publication awakened against him a storm of theological prejudice, which followed him more or less through life. Instead of yielding to this, he joined with Henry Bristowe Wilson and Rowland Williams, who had been similarly attacked, in the production of the volume known as *Essays and Reviews*. This appeared in 1860 and gave rise to a strange outbreak of fanaticism. Jowett's loyalty to those who were prosecuted on this account was no less characteristic than his persistent silence while the augmentation of his salary as Greek professor was withheld. This petty persecution was continued until 1865, when, through the discoveries of two historical inquirers, Edward Freeman and Charles Elton, Christ Church was induced to raise the endowment from £40 a year to £500. Meanwhile Jowett's influence at Oxford had steadily increased. It culminated in 1864, when the country clergy, provoked by the final acquittal of the Essayists, had voted in Convocation against the endowment of the Greek chair. Jowett's pupils, who were now drawn from the university at large, supported him with the enthusiasm which young men feel for the victim of injustice. In the midst of other labours Jowett had been quietly exerting his influence so as to conciliate all shades of liberal opinion, and bring them to bear upon the abolition of the theological test, which was still required for the M.A. and other degrees, and for university and college offices. He spoke at an important meeting upon this question in London on 10th June 1864, which laid the ground for the University Tests Act of 1871. In connexion with the Greek professorship Jowett had undertaken a work on Plato which grew into a complete translation of the Dialogues, with introductory essays. At this he laboured in vacation time for at least ten years. But his interest in theology had not abated, and his thoughts found an outlet in occasional preaching. The university pulpit, indeed, was closed to him, but several congregations in London delighted in his sermons, and from 1866 until the year of his death he preached annually in Westminster Abbey, where Stanley had become dean in 1863. Three volumes of selected sermons have been published since his death. The years 1865–70 were occupied with assiduous labour. Amongst his pupils at Balliol were men destined to high positions in the State, whose parents had thus shown their confidence in the supposed heretic, and gratitude on this account was added to other motives for his unsparing efforts in tuition. His friends were multiplying, and to one friend, Mr Robert Lowe (afterwards Lord Sherbrooke), he owed the occasion which led, in 1870, to his election as Master of Balliol. From the vantage-ground of the Mastership the *Plato* was published in 1871. It had a great and well-deserved success. While scholars criticized particular renderings (and there were many small errors to be removed in subsequent editions), it was generally agreed that he had succeeded in making *Plato* an English classic. The sale, for a work of such dimensions, was unexpectedly rapid, and the call for a new edition soon made a fresh demand upon his time and energy.

BENJAMIN JOWETT.
(From a photograph by Elliott and Fry, London.)

If ever there was a beneficent despotism, it was Jowett's rule as Master. Since 1866 his authority in Balliol had been really paramount, and various reforms in college had been due to his initiative. The opposing minority were now powerless, and the younger fellows who had been his pupils were more inclined to follow him than others would have been. There was no obstacle to the continued exercise of his firm and reasonable will. He still knew the undergraduates individually, and watched their progress with a vigilant eye. His influence in the university was less assured. The pulpit of St Mary's was no longer closed to him, but the success of Balliol in the Schools gave rise to jealousy in other colleges, and old prejudices did not suddenly give way; while a new movement in favour of "the endowment of research" ran counter to his immediate purposes. Meanwhile, the tutorships in other colleges, and some of the headships also, were being filled with Balliol men, and Jowett's former pupils were prominent in both Houses of Parliament and at the Bar. He continued the practice, which he had commenced in 1848, of taking with him a small party of undergraduates in vacation time, and working with them in one of his favourite haunts, at Askrigg in Wensleydale, or Tummel Bridge, or later at West Malvern. The new hall (1876), the organ there, entirely his gift (1885), and the cricket ground (1889), remain as external monuments of the Master's activity. Neither business nor the many claims of friendship interrupted literary work. The six or seven weeks of the long vacation, during which he had pupils with him, were mainly employed in writing. The translation of Aristotle's *Politics*, the revision of the *Plato*, and, above all, the translation of Thucydides many times revised, occupied many years. The edition of the *Republic*,

undertaken in 1856, remained unfinished, but was continued with the help of Professor Lewis Campbell. Other literary schemes of larger scope and deeper interest were long in contemplation, but were not destined to take effect —an *Essay on the Religions of the World*, a *Commentary on the Gospels*, a *Life of Christ*, a volume on *Moral Ideas*. Such plans were frustrated, not only by his practical avocations, but by his determination to finish what he had begun, and the fastidious self-criticism which it took so long to satisfy. The book on *Morals* might, however, have been written, but for the heavy burden of the vice-chancellorship, which he was induced to accept in 1882, by the hope, only partially fulfilled, of securing many improvements for the university. The vice-chancellor was *ex officio* a Delegate of the Press, where he hoped to effect much; and a plan for draining the Thames valley, which he had now the power of initiating, was one on which his mind had dwelt for many years. Though his aims were often balked, he made a great impression; but some of his friends will always regret that a time so precious should not rather have been devoted to some work of moral and spiritual import which might have been a possession for the world at large. The exhausting labours of the vice-chancellorship were followed by an illness (1887); and after this he seems to have relinquished the hope of producing any great original writing. His literary industry was thenceforth confined to his Commentary on the *Republic* of Plato, and some essays on Aristotle which were to have formed a companion volume to the translation of the *Politics*. The essays which should have accompanied the translation of Thucydides were never written. He died on the 1st of October 1893, at the age of seventy-six. The funeral was one of the most impressive ever seen in Oxford. The pall-bearers were seven Heads of colleges and the Provost of Eton, all old pupils. Balliol chapel was filled to overflowing with a distinguished gathering. Amongst the many wreaths was one from Miss Florence Nightingale, inscribed "To the genius of friendship." Jowett never married.

Theologian, tutor, university reformer, a great Master of a college, Jowett's best claim to the remembrance of succeeding generations was his greatness as a moral teacher. Very many of those who towards the end of the 19th century were the salt of the nation owed much of what they were to his precept and example, his penetrative sympathy, his insistent criticism, and his unwearying friendship. To name a mere fraction of what can never be known in full, the list of his pupils and lifelong friends includes a Speaker of the House of Commons, three Indian Viceroys, two Cabinet Ministers, four judges, several canons, and a dean. Seldom have ideal aims been so steadily pursued with so clear a recognition of practical limitations. As a theologian Jowett's work was transitional, and yet has an element of permanence. As has been said of another thinker, he was "one of those deeply religious men who, when crude theological notions are being revised and called in question, seeks to put new life into theology by wider and more humane ideas." In earlier life he had been a zealous student of Kant and Hegel, and to the end he never ceased to cultivate the philosophic spirit; but he had little confidence in metaphysical systems, and sought rather to translate philosophy into the wisdom of life. As a classical scholar, his scorn of littlenesses sometimes led him into the neglect of *minutiæ*, but he had the higher merit of interpreting ideas. His place in literature will not be recognized until the essays which lie buried in the five volumes of his *Plato* have been published separately. It will then be found that his worth, as a teacher of his countrymen, extends far beyond his own generation.

See *The Life and Letters of Benjamin Jowett*, by ABBOTT and CAMPBELL, 1897; *Benjamin Jowett*, by LIONEL TOLLEMACHE, 1895. (L. C.)

Jub, or JUBA, an important river of East Africa, flowing south across the Galla and Somali countries from the outer margin of the Abyssinian highlands. Of its three principal head-streams, the largest appears to be that known as the Ganana, itself formed by the junction of the Ganale Guracha (Black Ganale, a rushing stream 100 yards wide) and the Ganale Gudda (Great Ganale). The latter, the most remote source of the Jub, rises in 7½° N., 39°–40° E., at the foot of the mountains which traverse the country of the Arussi Gallas—of which Mount Fakez rises to a height of 10,000 feet—and is swelled by the junction of various streams rising in the same mountains. In the vicinity of its sources the river flows at an altitude of 7400 feet. In 4° 12′ N. and about 42° E. the Ganana is joined on the left by the Web, which rises in the Worgoma mountains (7° N., 40° E.), and some 40 miles from its source passes, first through a cañon 500 feet deep, and then through a series of remarkable underground caves hollowed out of a quartz mountain, and, with their arches and white columns, presenting the appearance of a pillared temple. At the point of junction the Ganana or Jub is a swift river 85 yards wide, but at the Buntal ferry, 10 miles lower down, it widens to 200 yards, the altitude being here only 590 feet. Just above the ferry, the Daua, the third head-stream of the Jub, enters from the west. It rises between 6° and 7° N., but has few feeders, and in its lower course is only 40 yards wide and from 2 to 3 feet deep. In its middle course it traverses a mountainous country by a deep and narrow gorge. Below the Daua the Jub receives no tributary of importance. It first flows in a valley bounded, especially towards the west, by the escarpments of a high plateau, and containing the towns of Lugh (in 4°, the centre of active trade), Bardera (population about 1200), and Saranli—the two last on opposite sides of the stream, in 2° 20′, a crossing-place for caravans. Beyond 1° 45′ the country becomes more level and the course of the river very tortuous. On the west a series of small lakes and backwaters receive water from the Jub during the rains. Just south of the equator the emissaries of the long, branching lake Deshekwama or Hardinge, fed by the Lakjhera river, enter from the west, and in 0° 15′ S. the Jub enters the sea across a dangerous bar, which has only one fathom of water at high tide. Below 2° 35′ N., at which rapids occur, the lower Jub is navigable for a shallow-draught steamer, having a general depth of from 4 to 12 feet, though shallower in places. Just above its mouth it is a fine stream 250 yards wide, with a current of 2½ knots. The country through which the Jub and its branches flow is generally arid, except in the mountainous districts near its head-waters. Here some tropical forest occurs, but otherwise the surface away from the river banks is either bare or covered with thorny scrub. On the lower river the Gosha district on the west bank, between 0° and 1° N., still contains forest, but it is being rapidly cleared for cultivation. The lower Jub was ascended in 1865 in a steamer by Baron von der Decken, who met his death at Bardera, but the system of the river remained otherwise almost unknown until after 1890. In 1891 a survey of its lower course was executed by Captain Dundas, while in 1892–93 its head-streams were explored by the Italians Bóttego and Grixoni, the former of whom disproved the supposed connexion of the Omo (see RUDOLF, LAKE) with its system. It has since been further explored by Ruspoli, by Bóttego's second expedition, and by Donaldson Smith and others.

See especially DUNDAS in *Geog. Journal*, March 1893; BÓTTEGO, *Il Giuba Esplorato*. Rome, 1895. (E. HE.)

Jubbulpore, or JABALPUR, a city, district, and division of British India, Central Provinces. The city is 616 miles north-east of Bombay by rail, and 220 miles south-west of Allahabad. Population (1881), 75,705; (1891), 84,481; (1901), 89,708, showing an increase of 6 per cent., compared with 12 per cent. in the preceding decade. Jubbulpore is a modern town, well laid out, with fine artificial lakes in the suburbs. Formerly the capital of the Saugor and Nerbudda territories, it is now the headquarters of the Nerbudda military district, with cantonments for a battery of artillery, a European infantry and a Bombay native infantry regiment. It is also one of the most important railway centres in India, being the junction of the Great Indian Peninsula and the East Indian systems. It has a steam cotton-mill, with 154 looms and 15,300 spindles, employing 700 hands, and pottery works, employing 336 hands, with an out-turn valued at Rs.85,000. The Government college, educating for the science course of the Allahabad University, had 93 students in 1896–97; there were three aided high schools with 1547 pupils, a law class, an engineering class, and normal schools for male and female teachers. There is a Government school of industry for Thug and Dacoit approvers, where tents and carpets are turned out on a large scale. There are four printing-presses, issuing two English newspapers, and several clubs and libraries. A native association, established in 1869, supports an orphanage, with help from Government. A zenana mission manages 13 schools for girls. Waterworks were constructed in 1882, out of a loan advanced by a native banker, and a drainage scheme is under construction. The district of JUBBULPORE lies on the watershed between the Nerbudda and the Sone, but mostly within the valley of the former river, which here runs through the famous gorge known as the Marble Rocks. Area, 3948 square miles. The population in 1881 was 687,233; in 1891, 748,146, showing an increase of 9 per cent.; average density, 189 persons per square mile. In 1901 the population was 680,485, showing a decrease of 9 per cent., due to the results of famine. The land revenue was Rs.9,42,740, the incidence of assessment being under 8 annas per acre; cultivated area (1897–98), 889,320 acres, of which 2819 were irrigated; number of police, 762; boys at school (1896–97), 9935, being 17·6 per cent. of the male population of school-going age; girls at school, 1519, being 2·7 per cent.; registered death-rate (1897), 61·26 per thousand. The principal crops are wheat, rice, pulse, and oil-seeds. A good deal of iron smelting with charcoal is carried on in the forests. The district is traversed by the main railway from Bombay to Calcutta, and by new branches of two other lines which meet at Katni junction. Jubbulpore suffered severely in the famine of 1896–97, the distress being aggravated by immigration from the adjoining native states. Fortunately the famine of 1900 was less severely felt here. The division of JUBBULPORE lies mainly among the Vindhyan and Satpura hill systems. It comprises the five following districts: Jubbulpore, Saugor, Damoh, Seoni, and Mandla. Area, 19,040 square miles; population (1881), 2,201,633; (1891), 2,375,642, showing an increase of 8 per cent.; average density, 124 persons per square mile, ranging from 189 in Jubbulpore to 67 in Mandla.

Jujuy, a province in the north-west of the Argentine Republic, bounded on the N. and W. by Bolivia, and on the E. and S. by the Argentine province of Salta. The official area at the census of 1895 was 18,977 square miles. Population (1869), 40,379; (1900), 94,405. The province, which is divided into thirteen departments, contained in 1895, 3103 farms, and 19,898 acres planted with cereals. The capital, JUJUY, on the Rio Grande, has a population of about 5000, and is connected with Buenos Aires by rail.

Jullien, Louis Antoine (1812–1860), musical conductor, was born at Sisteron, Basses Alpes, France, on the 23rd of April 1812, and studied at the Paris Conservatoire. His fondness for the lightest forms of music cost him his position in the school, and after conducting the band of the Jardin Turc, he was compelled to leave Paris to escape his creditors, and came to London, where he formed a good orchestra and established promenade concerts. Subsequently he travelled to Scotland, Ireland, and America with his orchestra. For many years he was a familiar figure in the world of popular music in England, and his portly form with its gorgeous waistcoats occurs very often in the early volumes of *Punch*. He brought out an opera, *Pietro il Grande*, at Covent Garden, in 1852, on a scale of magnificence that ruined him, for the piece was a complete failure. He was in America until 1854, when he returned to London for a short time; ultimately he went back to Paris, where, in 1859, he was arrested for debt and put into prison. He lost his reason soon afterwards, and died 14th March 1860.

Jullundur, or JALANDHAR, a city of British India, giving its name to a district and to a division in the Punjab. The city is 260 miles by rail north-west of Delhi. Population (1881), 52,119; (1891), 66,202, showing an increase of 27 per cent.; municipal income (1897–98), Rs.67,040. It is a cantonment for artillery and a European and native infantry regiment. There are an American Presbyterian mission, Government normal school, and high schools supported by Hindu bodies. It has five printing-presses, issuing four vernacular periodicals. The registered death-rate in 1897 was 30 per thousand. The district of JULLUNDUR occupies the lower part of the tract known as the Jullundur Doab, between the rivers Sutlej and Bias, except that it is separated from the Bias by the state of Kapurthala. Area, 1223 square miles. The population in 1881 was 789,555; in 1891, 907,583, showing an increase of 15 per cent.; average density, 633 persons per square mile, being the highest in the province. In 1901 the population was 917,896, showing an increase of only 1 per cent. The land revenue and rates were Rs.16,30,134, the incidence of assessment being R.1:11:4 per acre, again considerably the highest in the province; cultivated area (1896–97), 721,527 acres, of which 398,815 were irrigated from private wells; number of police, 257; number of schools (1896–97), 421, with 12,526 pupils, the proportion of boys at school to male population of school-going age being 13·9 per cent.; registered death-rate (1897), 25·7 per thousand. The district is crossed by the main line of the North-Western Railway from Phillour towards Amritsar—49 miles in all. There are 157 miles of metalled road and 80 miles of navigable river, but no Government canal. The division of JULLUNDUR comprises the five districts of Kangra, Hoshiarpur, Jullundur, Ludhiana, and Ferozepore, all lying along the river Sutlej. Area, 19,008 square miles. The population in 1881 was 3,787,945; in 1891, 4,217,664, showing an increase of 11 per cent.; average density, 222 persons per square mile.

Jumilla, a town of Spain, in the province of Murcia. The trade and local industries have considerably increased, and include linen, wine, safran, esparto grass, and phosphorite from mines in the neighbourhood. On a hill close to the town several old sepulchres were discovered in 1892. Population, 15,633.

Junagarh, a native state of India, within the Gujarat division of Bombay, extending inland from the southern coast of the peninsula of Kathiawar. Area,

3283 square miles; population (1881), 387,499; (1891), 484,190; estimated gross revenue, Rs.26,62,500, of which Rs.3,99,350 was expended on public works in 1897–98; tribute to the British Government and the Gaekwar of Baroda, Rs.65,604; but a considerable sum is also received as tribute from minor states in Kathiawar. The state is traversed by a railway from Rajkot to the seaport of Verawal. It includes the sacred mountain of Girnar and the ruined temple of Somnath. The town of JUNAGARH is 60 miles by rail south from Rajkot. Population (1881), 24,679; (1891), 31,640, showing an increase of 29 per cent., due to the progressive administration of the Nawab. The modern town is handsomely built and laid out. In November 1897 Lord Sandhurst, Governor of Bombay, laid the foundation-stones of a new hospital as well as of a library and museum. The high school had 460 pupils in 1896–97. There are three printing-presses, one of which issues an official gazette.

Juneau, formerly HARRISBURG, a mining settlement on the continental shore of Gastineau Channel, south-east Alaska, in 58° 16′ N. and 134° 20′ W., opposite Douglas Island and the properties of the Treadwell mine on the island shore. It was settled in 1880 by two prospectors named Joseph Juneau and Richard Harris. Its prosperity is due to the mines of gold and silver in the adjacent Silver Bow basin and those of Douglas Island. The latter comprise mills of 880 stamps and one of the largest and most profitable of low-grade ore deposits. It has a custom-house, U.S. court-house, several churches, a hospital and schools; but, owing to want of room for growth between the precipitous mountains and the water, and to other causes, Douglas, on the island of the same name, and Skagway, the port for the Yukon mines, are overtaking Juneau, and bid fair to outgrow it in population and business. Population, 2650 (including 450 Indians).

Jung-Bunzlau, the chief town of a government district in Bohemia, 30 miles north-north-east of Prague. It has a garrison of 879 men, and has an important corn trade, textile industries, and manufactures of sugar, starch, soap, beer and spirits, and flour. Population (1890), 11,518; (1900), 13,479, mostly Czech and Roman Catholic.

Junin, an interior department of Central Peru, contained a population of 394,393 in 1896. The provinces are Cerro de Pasco, Tarma, Jauja, and Huancayo, and the principal towns, Tarma (6000), Jauja (15,000), and Pasco (15,000).

Junker, Wilhelm (1840–1892), German explorer, was born at Moscow on the 6th April 1840. He studied medicine at Dorpat, Göttingen, Berlin, and Prague, but did not practise this profession for long. After a series of short journeys to Iceland, Tunis, and Lower Egypt, he remained almost continuously in Africa from 1875 to 1886, making Khartum the base of his expeditions into the interior. He joined marauding bands sent out by the Egyptians into the Mahdi's country, and was an unwilling witness of many scenes of great atrocity. Junker, unlike most explorers, was a leisurely traveller and a careful observer; his main object was to study the peoples with whom he came into contact, and to collect specimens of plants and animals, and the result of his investigations in these particulars is given in his *Reisen in Afrika* (3 vols. Vienna, 1889–91), a work of high merit. But perhaps the greatest service he rendered to geographical science was his investigation of the area intersected by the tributaries of the Nile, when he successfully combated Schweinfurth's hydrographical theories and established the identity of the Wellé and Mobangi. On the outbreak of the Mahdi's insurrection in 1884 he was cut off and isolated, and an expedition, fitted out in 1885 by his brother in St Petersburg, failed to reach him; he succeeded, however, unaided, in reaching Zanzibar in December 1886, and thence returned to Germany. In 1887 he received the gold medal of the Royal Geographical Society in London. As an African explorer Junker is entitled to the highest rank, and must be classed with such men as Speke and Nachtigal. He died at St Petersburg on the 13th February 1892.

Jura, a department on the eastern frontier of France, bordering on Switzerland.

Area, 1951 square miles. The population decreased from 281,292 in 1886 to 259,212 in 1901. Births in 1899, 5624, 284 of them illegitimate; deaths, 5626; marriages, 1933. There were in 1896 1001 schools, with 45,000 pupils, and the illiterate composed less than 1 per cent. of the population. Out of 1,052,706 acres of cultivated land in 1896, 390,440 were plough-land and 37,060 vineyards. In 1899 wheat returned a value of £446,000; oats, £132,000; barley, £64,000; vines, £220,000—from the vineyards of Arbois. The natural pastures and grass lands on the high plateaux yielded in 1899 a value of £538,000. The live stock included (1899) 155,940 cattle, 13,840 horses, 15,650 sheep, and 48,160 pigs. The dairy produce yielded a revenue of not less than £800,000. The mining industry in 1898 registered 2000 metric tons of peat, 4000 tons of iron, and 21,400 tons of rock-salt. The extensive industry in metals produced in 1898, 18,000 metric tons of iron and 19,000 tons of steel, valued at £281,000. The other industries are in a backward state.

Jurien de la Gravière, Jean Baptiste Edmond (1812–1892), French admiral, son of Admiral Jurien, who served through the Revolutionary and Napoleonic wars and was a peer of France under Louis Philippe, was born on 19th November 1812. He entered the navy in 1828, was made a commander in 1841, and captain in 1850. During the Russian war he commanded a ship in the Black Sea. He was promoted to be rear-admiral on 1st December 1855, and appointed to the command of a squadron in the Adriatic in 1859, when he absolutely sealed the Austrian ports with a close blockade. In October 1861 he was appointed to command the squadron in the Gulf of Mexico, and two months later the expedition against Mexico. On 15th January 1862 he was promoted to be vice-admiral. During the Franco-German war of 1870 he had command of the French Mediterranean fleet. In 1871 he was appointed "director of charts." As having commanded in chief before the enemy, the age limit was waived in his favour, and he was continued on the active list. He had been given the Cross of the Legion of Honour in 1854, and the rank of Officer of the order in 1865; he received the Grand Cross in 1876. He died on 4th March 1892. He was a voluminous author of works on naval history and biography, most of which first appeared in the *Revue des Deux Mondes*. Among the most noteworthy of these are *Guerres Maritimes sous la République et l'Empire*, which was translated by Lord Dunsany under the title of *Sketches of the last Naval War; Souvenirs d'un Amiral*, that is, of his father, Admiral Jurien; *La Marine d'Autrefois* (1865), largely autobiographical; *La Marine d'Aujourd'hui* (1872). In 1866 he was elected a member of the Academy. (J. K. L.)

Jurua. See AMAZON.

Jutland, in Danish, *Jylland*, the ancient Chersonese or Cimbric peninsula, the continental portion of the kingdom of Denmark. It stretches from Kolding and Ribe northwards to the Skaw (*Skagen*), and embraces nine counties (Vejle, Aarhus, Randers, Aalborg, Hjörring, Thisted, Viborg, Ringkjöbing, and Ribe), with an aggregate area of 9762 square miles. Population (1880), 868,511; (1890), 942,120; (1900), 1,063,792. Although in ancient times well wooded, the greater portion of the interior consisted for centuries of barren drift-sand, which grew

nothing but heather; but since 1866, chiefly through the instrumentality of the patriotic Heath Association, assisted by annual contributions from the State, a very large proportion of this region has been more or less reclaimed for cultivation. The means adopted are (i.) the plantation of trees; (ii.) the making of irrigation canals and irrigating meadows, amounting by 1901 to over 100 canals of a total length of 236 miles, and close upon 16,500 acres of meadows; (iii.) exploring for, extracting, and transporting loam, for which purpose short light railways (over 30 miles at the end of 1900) have been built; (iv.) and, since 1889, the experimental cultivation of fenny districts. The activity of the association takes the form partly of giving gratuitous advice, partly of experimental attempts, and partly of model works for imitation. The State also makes annual grants directly to owners who are willing to place their plantations under State supervision, for the sale of plants at half price to the poorer peasantry, for making protective or sheltering plantations, and for free transport of marl or loam. At the end of 1900 the Heath Association exercised supervision over some 124,280 acres of heath, while the State administered another 112,350 acres (including *klit* or barren lands); and private owners had in their own hands an additional 27,280 acres of heath. Of all this area of 263,900 acres, about one-half was planted with trees. The species of timber almost exclusively planted are the "red fir" (*Picea excelsa*) and the "mountain pine" (*Pinus montana*). In this way the total area of barren dunes, heaths, and fens has been reduced from 2850 square miles in the middle of the 19th century to 1314 square miles at its end, or a gain to cultivation of close upon 1,000,000 acres; and the population has increased at a more rapid rate than in any other part of the Danish kingdom. In 1860 the population of the three administrative districts of Viborg, Ringkjöbing, and Ribe, in which the heaths are mostly situated, numbered 181,000, or 44·3 inhabitants to the square mile, but by 1890 had increased to 249,000, or 60·9 inhabitants to the square mile, and by 1900 to 313,764, or 76·7 to the square mile. The coasts being flat, and the seas off them shallow, and storms being frequent, a chain of lifeboat stations has been established all round North Jutland. Between the first organization of the lifeboat service in 1852 and 1899 there were 3047 wrecks on the coasts of Denmark, *i.e.*, mostly off Jutland, or an average of 63·4 every year. During the same period 7171 persons were rescued from drowning, or an average of 149·4 lives saved annually.

The particulars about the Heath Association have been kindly communicated by Hr. Borch, the manager of the Association in Aarhus. See further various pamphlets of the Heath Association (in Danish); also *Oldsagn paa Alheden*, *E Bindstouw*, and other works by S. S. BLICHER (*Samlede Noveller og Skizzer*, 4 vols. 1882), a son of the heath country; *Aarbog for Dansk Kulturhistorie* (Aarhus, 1891 *et seq.*); *Geografiske Billeder fra Heden* (1867–1868), and other works by E. M. DALGAS, the founder of the Heath Association; or the summary by A. OPPERMANN, "Dalgas og Hedeplantningen," in *Tilskueren* (1894, p. 425 *et seq.*). (J. T. BE.)

END OF FIFTH VOLUME.

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TO

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OF

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A

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ANDERSON, W., F.R.C.S., the late; Comp. of the Order of the Rising Sun (Japan); Professor at Royal Academy; Chairman of Council of the Japan Society; Medical Director, Imperial Naval Medical College, Tokio; author of 'The Pictorial Arts of Japan,' 'Japanese Wood Engravings,' 'Cat. of Chinese and Japanese Pictures in British Museum.' (W. AN.)

ANDERSON, Lt.-Col. W. P.; Chief Engineer and Superintendent of Lights, Department of Marine and Fisheries, Ottawa, Canada. (W. P. A.)

ANDREWS, Hon. Elisha Benjamin, LL.D.; Chancellor of the University of Nebraska; late Superintendent of Schools of the City of Chicago; formerly President of Brown University; author of 'Institutes of General History,' 'Institutes of Economics,' 'History of the United States,' etc. (E. B. A.)

ANSTRUTHER-THOMSON, Major W., F.G.S., F.S.A.; Inspector of Concentration Camps, S.A. (W. A.-T.)

ARCHER, William; dramatic critic of 'World' (London), 1884 onwards; edited and translated Ibsen's 'Prose Dramas'; author of 'Life of Macready,' 'Masks or Faces,' 'The Theatrical World,' 'Study and Stage,' 'America To-day, 1900,' 'Poets of the Younger Generation,' etc. (W. A.)

ARMSTRONG, Edmund Archibald, Barrister-at-Law, Inner Temple. (E. A. AR.)

ARMSTRONG, Henry Edward, Ph.D., LL.D., F.R.S.; Professor of Chemistry at the City and Guilds of London Central Institute, South Kensington; author of 'Carbon,' etc., in Ninth Edition of 'Ency. Brit.,' 'Introduction to the Study of Organic Chemistry.' (H. E. A.)

ARMSTRONG, Sir Walter; Director of the National Gallery of Ireland; author of 'Sir Joshua Reynolds,' 'Thomas Gainsborough,' 'Sir Henry Raeburn,' 'Alfred Stevens,' 'Peter de Wint,' 'Velasquez,' 'Scottish Painters,' 'J. M. W. Turner,' etc., and co-editor of 'Bryan's Dictionary of Painters.' (W. AR.)

ASHWORTH, Philip A., Dr. Juris, of the Inner Temple, Barrister-at-Law; editor of Taswell-Langmead's 'Constitutional History of England,' translator of Gneist's 'History of the English Constitution,' etc. (P. A. A.)

ASKWITH, Rev. Edward Harrison, M.A., B.D.; Chaplain of Trinity College, Cambridge; author of 'Christian Conception of Holiness,' 'Epistle to the Galatians,' etc. (E. H. A.)

ASTON, Major George Grey, R.M.A.; late Professor of Fortification, Royal Naval College, Greenwich. (G. G. A.)

ASTON, William George, B.A., M.A., Hon. D.Lit., C.M.G.; student interpreter in Japan, 1864; interpreter and translator to British Legation at Yedo, 1870; assistant Japanese Secretary, Yedo, 1875-82; acting Consul, Hiogo, 1880-83; Consul-General for Corea, 1884; Japanese Secretary, Tokio, 1886; author of 'A Grammar of the Japanese Spoken Language,' 'A Grammar of the Japanese Written Language,' 'A Translation of the Nihongi, or Annals of Ancient Japan,' 'History of Japanese Literature,' etc. (W. G. AS.)

ATWATER, Wilbur Olin, Ph.D.; Professor of Chemistry, Wesleyan University, U.S.A.; Special Agent of the U.S. Department of Agriculture in charge of Nutrition investigations. (W. O. A.)

AVES, Ernest, M.A.; formerly Sub-Warden of Toynbee Hall; author of papers on sociology and economics. (E. A*.)

AXON, William Edward Armitage, LL.D.; late Dep. Librarian Manchester Free Libraries; author of 'Manchester' in Ninth Edition of 'Ency. Brit.,' 'The Annals of Manchester,' 'Manchester a Hundred Years Ago,' 'Lancashire Gleanings,' 'Stray Chapters in Literature,' 'Folk-lore and Archæology,' etc. (W. E. A. A.)

B

BACON, Edwin Monroe, M.A.; editor of 'Time and the Hour' (Boston, U.S.A.); sometime editor-in-chief of the 'Boston Globe,' the 'Boston Advertiser,' and the 'Boston Post'; author of 'Boston Illustrated,' 'Bacon's Dictionary of Boston,' 'Boston of To-day,' etc. (E. M. B.)

BADEN-POWELL, Maj. Baden F. S.; inventor of man-lifting kites; late President Aëronautical Society; author of 'In Savage Isles and Settled Lands,' many articles on ballooning, etc. (B. F. S. B.-P.)

BAGWELL, Richard, M.A.; author of 'Ireland' in the Ninth Edition of the 'Ency. Brit.,' 'Ireland under the Tudors,' 'A Plea for National Education,' etc. (R. BA.)

BAINES, Jervoise Athelstane, C.S.I.; Hon. Sec. (gold medallist) and Vice-President Royal Statistical Society; Census Commissioner under Government of India, 1889-93; employed at India Office and as secretary to Royal Commission on Opium, 1894-95; author of Official Reports on Provincial Administration, on Indian Census Operations, 1881-91, on Indian Progress, 1894, many papers, ethnographic and statistical, for London societies. (J. A. B.)

BAKER, Henry Frederick, M.A., F.R.S.; Fellow and Lecturer of St John's College, Cambridge; University Lecturer in Mathematics. (H. F. BA.)

BALCARRES, Lord, M.P., F.S.A., F.S.A.S.; Trustee of National Portrait Gallery, London; Hon. Sec. Society for Protection of Ancient Buildings; Vice-Chairman of National Trust. (B.)

BALDRY, Alfred Lys, artist; author of 'Albert Moore: his Life and Works,' 'The Life and Works of Marcus Stone, R.A.,' 'Sir John Everett Millais,' 'Hubert von Herkomer,' etc. (A. L. B.)

BALDWIN, Hon. Simeon Eben, A.M., LL.D.; Judge of the Supreme Court of Errors of Connecticut; Professor of Constitutional and Mercantile Law, Corporations, and Wills, Yale University; sometime President of the American Bar Association and American Social Science Association; author of 'Baldwin's Connecticut Digest,' 'Cases on R.R. Law,' 'Modern Political Institutions,' etc. (S. E. B.)

BALDWIN, W. H., Jr.; President of the Long Island R.R. Co., U.S.A. (W. H. B.)

BALE, Edwin, R.I.; Art Director, Cassell and Company; Hon. Sec. Artists' Committee for Promoting Art Copyright Bill, etc. (E. BA.)

BALFOUR, Isaac Bayley, M.D., D.Sc., M.A., F.R.S., F.L.S.; Regius Keeper of Royal Botanic Garden, Edinburgh; Professor of Botany, University of Edinburgh; Transit of Venus Expedition to Rodriguez, 1874; Regius Professor of Botany, University of Glasgow, 1879-84; explored island of Socotra, 1880; Sherardian Professor of Botany, University of Oxford, and Fellow of Magdalen College, 1884-88; author of 'Botany of Rodriguez,' 'Botany of Socotra,' editor of 'Annals of Botany.' (I. B. B.)

BANCROFT, Frederic, Ph.D.; Chief of Bureau of Rolls and Library, U.S. Department of State; author of 'Life of William H. Seward,' etc. (F. BA.)

BANISTER, G. H., M.I.C.E., M.I.M.E.; late Assistant to Superintendent of the Royal Carriage Department, Woolwich; Whitworth Scholar. (G. H. BA.)

BARCLAY, Thomas, LL.B., Ph.D.; member of the Institute of International Law; Vice-President of the International Law Association; Examiner in Jurisprudence and International Public and Private Law to the University of Oxford, 1900; member of the Supreme Council of the Congo Free State; Vice-President of the Franco-Scottish Society; President of the British Chamber of Commerce in Paris, 1899-1900; Knight of the Legion of Honour and of the Order of Leopold; author of 'Companies in France,' and other law books, all the articles on International Law in the 'Encyclopedia of the Law of England,' etc. (T. BA.)

BARING, The Hon. Maurice; Attaché to the British Embassy, Paris, 1899; Third Secretary to the British Embassy, Rome, 1902. (M. BA.)

BARLOW, Major H. W. W., R.A.; Secretary to Chief Superintendent, Royal Ordnance Factories, Woolwich. (H. W. B.)

BARNES, William Emery, D.D.; Fellow of Peterhouse, Cambridge; Hulsean Professor of Divinity, Cambridge; assist. editor of 'Journal of Theological Studies'; Lecturer in Hebrew at Clare Coll. Camb., 1885-94; in Hebrew and Divinity at Peterhouse, 1889-1901; author of 'The Genuineness of Isaiah xxiv.-xxvii.,' 'Canonical and Uncanonical Gospels,' 'The Peshitta Text of Chronicles,' I. II. Chronicles, with Introduction and Notes (Cambridge Bible). Isaiah (Churchman's Bible). (W. E. B.)

BARNETT, Rev. Samuel Augustus, M.A.; Canon of Bristol; Founder and Warden of Toynbee Hall, Whitechapel; President of the Sunday Society; Chairman Whitechapel Board of Guardians, 1894; Chairman of Children's Country Holiday Fund; Chairman Pupil Teachers' Scholarship Fund; author of 'Practicable Socialism' with Mrs Barnett, 'Service of God.' (S. A. B.)

BARRETT, F. N., editor of the 'American Grocer' (New York). (F. N. B.)

BARTLET, Rev. J. Vernon, M.A.; Professor of Church History, Mansfield College, Oxford; author of 'Early Church History,' 'The Apostolic Age,' etc. (J. V. B.)

BARTLEY, George Christopher Trout, M.P.; Assistant-Director of Science Division of Science and Art Department, London, till 1880; established National Penny Bank, 1875; author of 'A Square Mile in the East of London,' 'Schools for the People,' 'Provident Knowledge Papers,' 'The Seven Ages of a Village Pauper,' 'The Parish Net. (G. C. T. B.)

BARWICK, G. F.; Assistant Keeper of Printed Books and Superintendent of Reading-room, British Museum; author of 'International Exhibitions,' 'The Laws Regulating Printing and Publishing in Spain,' and translator of various works of travel, etc. (G. F. B.)

BASSETT, John Spencer, Ph D.; Professor of History, Trinity College, N.C.; author of 'Constitutional Beginnings of North Carolina,' 'Slavery and Servitude of the Colony of North Carolina,' 'Anti-Slavery Leaders of North Carolina,' 'Slavery in the State of North Carolina.' (J. S. BA.)

BASTABLE, C. F., M.A., LL.D.; Professor of Political Economy, Dublin University, 1882; author of 'Money' in Ninth Edition of 'Ency. Brit.,' 'Theory of International Trade,' 'Commerce of Nations,' 'Public Finance,' 'Dictionary of Political Economy,' and 'Economic Journal. (C. F. B.)

BATHER, Francis Arthur, M.A., D.Sc., F.G.S.; Natural History Museum, South Kensington; Hon. Member Soc. Linneenne de Normandie; author of 'Concise Knowledge of Natural History,' 'The Genera and Species of Blastoidea,' 'Echinoderma' (in Lankester's 'Zoology'), 'The Crinoidea of Gottland,' etc. (F. A. B.)

BAUERMAN, H., F.G.S.; Lecturer on Metallurgy, Ordnance College, Woolwich; author of 'Bismuth,' 'Coal,' 'Fuel,' 'Furnace,' etc., in Ninth Edition of 'Ency. Brit.,' 'A Treatise on the Metallurgy of Iron,' 'Text-book of Systematic Mineralogy,' etc. (H. B.)

BEALBY, J. T., B.A.; sometime acting editor of 'Scottish Geographical Magazine'; author of 'A Daughter of the Fen,' and numerous geographical magazine articles; joint author of 'Stanford's Compendium: Europe'; translator of Sven Hedin's 'Through Asia.' (J. T. BE.)

BEDDARD, Frank Evers, M.A., F.R.S.; Prosector of Zoological Soc. of England since 1884, and Vice-Sec. since 1898; formerly Lecturer on Biology at Guy's Hospital; has been Examiner in Zoology and Comparative Anatomy, University of London, and of Morphology at Oxford; now Examiner in the University of New Zealand; naturalist to 'Challenger' Expedition Commission, 1882-84; author of 'Worm' in Ninth Edition of 'Ency. Brit.,' 'Animal Coloration,' 'Text-book of Zoogeography,' 'A Monograph of the Oligochæta,' 'Structure and Classification of Birds.' (F. E. B.)

BELL, Charles Frederic Moberly; asst. manager of 'The Times'; formerly correspondent of 'The Times' in Egypt; author of 'Khedives and Pashas,' 'Egyptian Finance,' 'From Pharaoh to Fellah,' etc. (C. F. M. B.)

BELL, Dr Louis, Boston, U.S.A.; author of 'The Elements of Practical Electricity,' 'Power Distribution for Electric Railroads,' 'Electric Power Transmission,' etc. (L. BL.)

BELL, Malcolm; author of 'Rembrandt,' 'Sir E. Burne-Jones,' etc. (M. BE.)

BELLAIRS, Carlyon; Lieutenant R.N.; writer of articles on naval subjects. (C. W. BE.)

BELLINGER, Hon. Charles Byron; Judge of the U.S. District Court, District of Oregon. (C. B. B*.)

BELTRAMI, Luca; architect; author of 'Storia della facciata di St Maria del Fiore in Firenza,' 'La Basilica Ambrosiana primitiva e la ricostruzione compiuta nel secolo IX,' etc. (L. BI.)

BÉNÉDITE, Léonce; Conservator, Musée du Luxembourg, Paris; author of 'Alphonse Legros'; editor of 'Bulletin des Musées,' etc. (L. BE.)

BENSON, Arthur Christopher, M.A., F.R.Hist. Soc.; Master at Eton College since 1885; author of 'Memoirs of Arthur Hamilton,' 'Archbishop Laud: a Study,' 'Poems,' 'Lyrics,' 'Essays,' 'Lord Vyet and other Poems,' 'Fasti Etonenses,' 'Life of Archbishop Benson,' 'The Professor, and other Poems.' (A. C. BE.)

BERG, Sigvard Johnson, A.M.I.C.E., Switzerland. (S. J. B.)

BERNARD, Rev. John Henry, D.D.; Fellow of Trin. Coll., Dublin; Archbishop King's Lecturer in Divinity, University of Dublin; member of University Council, 1892; Vice-Warden, Alexandra Coll., Dublin, for higher education of women, 1894; Secretary of Royal Irish Academy, 1899; Commissioner of National Education, Ireland, 1897; part-editor of 'Kant's Critical Philosophy for English Readers,' translator of 'Kant's Kritik of Judgment,' joint-author of 'The Literature of the Second Century,' editor of 'The Pilgrimage of St Silvia of Aquitania,' 'The Pastoral Epistles of St Paul,' 'The Works of Bishop Butler,' etc. (J. H. BE.)

BERNSTEIN, Eduard; German Socialistic politician and writer; late editor of the 'Social Democrat'; author of 'On the History and Theory of Socialism,' 'The Communistic and Democratic-Socialistic Movements in England during the 17th Century,' etc. (E. BN.)

BERRY, George Andreas, M.B., F.R.C.S., F.R.S. Edin.; Vice-Pres. Ophthalmological Soc.; author of 'Diseases of the Eye,' 'The Elements of Ophthalmoscopic Diagnosis,' 'Subjective Symptoms in Eye Diseases,' etc. (G. A. BE.)

BESANT, Sir Walter, M.A., F.S.A., the late; Secretary Palestine Exploration Fund, 1868-85; Hon. Sec. Palestine Exp. Fund; First Chairman Society of Authors, 1884-85; Chairman Society of Authors, 1887-1892; author of 'Froissart' in Ninth Edition of 'Ency. Brit.,' 'Studies in Early French Poetry,' 'Rabelais,' Lives of 'Coligny,' 'Whittington,' 'Edward Palmer,' and 'Richard Jefferies,' 'London,' 'Westminster,' 'South London,' many Novels with the late James Rice. Novels alone: 'The Revolt of Man,' 'All Sorts and Conditions of Men,' 'Beyond the Dreams of Avarice,' 'The Orange Girl,' etc. (W. BE.)

BHOWNAGREE, Sir Mancherjee Merwanjee, K.C.I.E., M.P.; State Agent, Bombay, for the territory of Bhavnagar, 1873; author of 'History of the Constitution of the East India Company,' Gujerati translation of 'Her Majesty's Life in the Highlands,' etc. (M. M. BH.)

'BICKERDYKE, John' (Charles Henry Cook), M.A.; writer on angling and sporting subjects; President of Thames Re-stocking Association, and the Fly-Fishers' Club, 1899-1900; editor of the angling department of the 'Field'; author of 'Angling in Salt Water,' 'The Book of the All Round Angler,' 'Thames Rights and Thames Wrongs,' 'Days in Thule with Rod, Gun, and Camera,' 'Sea-Fishing,' 'Days of My Life in Water, Fresh and Salt,' 'Wild Sports in Ireland,' 'Letters to Young Sea-Fishers,' etc. ('J. B.')

BIDWELL, Shelford, M.A., Sc.D., F.R.S.; barrister; President of Physical Society, England, 1897-99; author of 'Curiosities of Light and Sight,' and numerous memoirs on physical subjects. (S. BI.)

BINDLOSS, Harold; Secretary Royal Mersey Yacht Club. (H. BS.)

BINYON, Laurence; assistant in the British Museum, Department of Printed Books, 1893; transferred to Department of Prints and Drawings, 1895; author of 'Lyric Poems,' 'Poems,' 'London Visions,' 'The Praise of Life,' 'Porphyrion and other Poems,' 'Western Flanders,' 'Odes,' 'Catalogue of English Drawings in the British Museum.' (L. B.)

BIRD, Christopher John, C.M.G.; Principal Under Secretary of the Colony of Natal, and a Member of the Civil Service Board. (C. J. BI.)

BIRDWOOD, Sir George Christopher Molesworth, M.D., K.C.I.E., C.S.I., LL.D.; special assistant in Revenue and Statistics Department India Office, 1871-99; author of 'Incense' in Ninth Edition of 'Ency. Brit.,' 'Economic Vegetable Products of the Bombay Presidency,' 'The Industrial Arts of India,' 'Report on Old Records of the India Office,' 'First Letter Book of East India Company,' Appendix on the Aryan Fauna and Flora to Max-Muller's 'Biography of Words,' etc. (G. B.)

BIRKBECK, William John, M.A., F.S.A.; author of 'Russia and the English Church.' (W. J. BI.)

BIRKINBINE, John, M.E.; President of the Franklin Institute and the Pennsylvania Forestry Association; sometime President American Institute of Mining Engineers, and editor 'Journal of Iron Workers.' (J. BI*.)

BIRRELL, Augustine, K.C.; Hon. Fellow, Trinity Hall, Cambridge; LL.D. St Andrews (Honorary); Quain Professor of Law, University Coll. London, 1896; M.P. (L.) Fifeshire W., 1889-1900; author of Obiter Dicta, 1884, 1887; Life of Charlotte Brontë, 1885; Res Judicatae, 1892; Men, Women, and Books, 1894; Lectures on the Duties and Liabilities of Trustees, 1896; editor of Boswell's Life of Johnson, 1897; Sir Frank Lockwood, 1898; Collected Essays, 1900. (A. BI.)

BISHOP, Mrs Isabella L. (Miss Isabella Bird), F.R.G.S., Hon. F.R.S.G.S.; Hon. Member of Oriental Society, Pekin; first lady Fellow of the Royal Geographical Society; author of 'The Englishwoman in America,' 'Six Months in the Sandwich Islands,' 'A Lady's Life in the Rocky Mountains,' 'Unbeaten Tracks in Japan,' 'The Golden Chersonese,' 'Journeys in Persia and Kurdistan,' 'Among the Tibetans,' 'Korea and her Neighbours,' 'The Yangtze Valley and Beyond,' 'Pictures from China,' etc. (I. L. B.)

BLAIR, Andrew A.; chief chemist of the U.S. Geological Survey, Division of Mining and Geology, Tenth Census of the United States; author of 'The Chemical Analysis of Iron,' etc. (A. A. B.)

BLAKE, Rev. John Frederick, M.A., F.G.S.; sometime Professor of Natural Science, University College, Nottingham; author of 'British Fossil Cephalopoda,' 'The Geological

Society of London,' 'Astronomical Myths,' 'Yorkshire Lias,' etc. (J. F. BL.)

BLAKE, Prof. William Phipps, Ph.B.; Director School of Mines, University of Arizona, and territorial geologist of Arizona; author of 'Geological Reconnaissance of California,' 'Silver Ores and Silver Mines,' etc. (W. P. B.)

BLÖNDAL, Sigfús, of the University Library, Copenhagen. (S. BL.)

BLOUNT, Bertram, F.C.S., F.I.C.; consulting chemist to the Crown Agents for the Colonies; Hon. President Cement Section of International Assoc. for Testing Materials, Buda-Pesth. (B. BL.)

BLOWITZ, Henri Georges Stephane Adolphe Opper de; 'The Times' correspondent in Paris; Professor of German at Tours, Limoges, Poitiers, and Marseilles; entered on service of 'The Times,' July 1871; inaugurated constant telegraphic communications and obtained the concession from 9 P.M. to 3 A.M. of a special wire for 'The Times' from 9 May 1874; officer of the Legion of Honour; Doctor of Philosophy; officer of the Institute of France; author of 'Feuilles Volantes,' 'L'Allemagne et la Provence,' 'Le Mariage royal d'Espagne,' 'Une Course à Constantinople.' (DE B.)

BLUNT, Capt. Charles Jasper, R.A.; Chief Ordnance Officer, Guernsey; served in the Chitral campaign, etc. (C. J. B.)

BODLEY, John Edward Courtenay, M.A.; private secretary to President of Local Government Board, 1882-85; secretary to Royal Commission on Housing of the Working Classes, 1884-85; author of 'France': vol. i. 'The Revolution and Modern France,' vol. ii. 'The Parliamentary System,' (French ed. 1901), 'L'Anglomanie et les traditions françaises.' (J. E. C. B.)

BOLTZMANN, Ludwig; Professor of Theoretical Physics, University of Vienna; Hon. Member Royal Academy of Sciences, Berlin; author of 'Lectures on the Theory of Gas,' 'Lectures on Maxwell's Theory of Electricity and Light'; editor of 'Maxwell's Physical Forces.' (L. Bo.)

BONAR, James, M.A., LL.D.; senior Examiner Civil Service Commission, Westminster; junior Examiner in H.M. Civil Service Commission, 1881; senior Examiner, *ibidem,* end of 1895; President of Section F of British Association, 1898; author of 'Malthus and his Work,' 'Ricardo's Letters to Malthus,' 'Philosophy and Political Economy,' 'Catalogue of Adam Smith's Library' (part), 'Ricardo's Letters to Trower.' (J. B*.)

BONNEY, Rev. Thomas George, D.Sc., LL.D., F.R.S.; late Professor of Geology, University Coll. London; Hon. Canon of Manchester; Fellow of St John's Coll. Camb.; Hulsean Lecturer (Camb.), 1884; President Geological Society, 1884-86; Boyle Lecturer, 1890-92; Rede Lecturer (Camb.), 1892; Vice-President Royal Society, 1899; author of 'The Alpine Regions,' 'The Story of our Planet,' 'Charles Lyell and Modern Geology,' 'Ice-Work, 'Volcanoes,' etc. (T. G. B.)

BOSCO, Augustus; Professor of Statistics, University of Rome. (A. Bo.)

BOULENGER, George A., F.R.S., F.Z.S.; assistant, Dept. of Zoology, Brit. Museum, since 1882; author of numerous works on Zoology. (G. A. B.)

BOURCHIER, James David, M.A.; sometime Scholar of King's College, Cambridge; Correspondent of 'The Times' at Athens. (J. D. B.)

BOURGET, Paul, poet, critic, and novelist; member of French Academy since 1894; officer of the Legion of Honour, 1895; author of La Vie inquiète, 1874; Edel, 1878; Les Aveux, 1882; Essais de Psychologie, 1883; Nouveaux Essais de Psychologie, 1885; Études et Portraits, 1887; Pastels, 1889; Physiologie de l'Amour moderne, 1890; Sensations d'Italie, 1891; Nouveaux Pastels, 1891; Outre Mer, 1895; L'Irréparable, 1884; Cruelle Enigme, 1885; Un Crime d'Amour, 1886; André Cornélis, 1887; Mensonges, 1887; Le Disciple, 1889; Un cœur de femme, 1890; La Terre Promise, 1892; Cosmopolis, 1892; Un Scrupule, 1894; Un Idylle Tragique, 1896; Voyageuses, 1897; Recommencements, 1897; Complications Sentimentales, 1898; La Duchesse Bleue, 1898; Drames de Famille, 1900; Un Homme d'Affaires, 1900; Le Fantôme. (P. B*.)

BOURNE, Gilbert Charles, M.A., D.Sc., F.L.S.; Fellow and Tutor of New Coll. Oxford; assistant to Linacre Professor of Comparative Anatomy, Oxford, 1887-88; Director, Marine Biological Association, United Kingdom, 1889-1890; assistant to Linacre Professor at Oxford, 1892-1900; University Lecturer in Comparative Anatomy, 1898; author of various memoirs on Comparative Anatomy, an 'Introduction to Study of Comp. Anatomy of Animals,' articles Anthozoa and Ctenophora, in Lankester's 'Zoology,' etc. (G. C. B.)

BOURNE, Henry Eldridge; Professor of History, College for Women, Western Reserve University, U.S. (H. E. B.)

BOWER, Frederick Orpen, Sc.D., F.R.S., F.L.S.; Regius Professor of Botany, University of Glasgow, since 1885; author of 'A Course of Practical Instruction in Botany,' 'Practical Botany for Beginners,' etc. (F. O. B.)

BOWLEY, A. L.; author of 'Elements of Statistics,' 'Wages in the United Kingdom in the Nineteenth Century,' etc. (A. L. Bo.)

BOYD, Charles Walter, B.A. (Edin.); journalist; sometime private secretary in South Africa to Dr Jameson and Mr Cecil Rhodes. (C. W. B*.)

BRABROOK, Edward William, C.B., F.S.A., V.P.S.S., V.P.R.S.L.; V.P. Royal Archæological Institute since 1900; Chief Registrar of Friendly Societies since 1891; President Anthropological Institute, 1895-97; President Folk-Lore Society, 1901; Foreign Associate, Society of Anthropology of Paris, 1901; author of 'Building Societies,' 'Friendly Societies,' 'Savings Banks' in Ninth Edition of 'Ency. Brit.,' 'Provident Societies and Industrial Welfare,' 'History of Royal Society of Literature.' (E. W. B.)

BRADFORD, John R., M.D., D.Sc., F.R.C.P., F.R.S.; member of Senate of University of London; physician to University Coll. Hospital London; Professor of Materia Medica and Therapeutics, University College, London; Professor Supt. of the Brown Institution; author of papers on medical and scientific subjects in Proc. Roy. Soc. and in Transactions of medical societies, etc. (J. R. B.)

BRÆKSTAD, H. L.; Anglo-Norwegian journalist; translator of standard Norwegian works. (H. L. B.)

BRAMWELL, Capt. G. A.; School of Signalling, Aldershot; Deputy-Assistant-Adjutant-General for signalling. (G. A. BR.)

BRANNER, John Casper, Prof., Ph.D., LL.D.; Geologist, Imperial Geolog. Commission, Brazil, 1875-1877; Agent U.S. Department of Agriculture in Brazil, 1882-83; acting President, Stanford University, U.S.A., 1898-99; Fellow of Geolog. Soc. of London and Société Géologique de France; member of various scientific societies of North and South America; author of numerous publications on Brazil. (J. C. BR.)

BRANTLY, William Theophilus; reporter of the Maryland Court of Appeals; ex-secretary of State of Maryland; author of 'Maryland' in Ninth Edition of 'Ency. Brit.,' 'Law of Personal Property.' (W. T. B.)

BRASSEY, Lord, 1st Baron, K.C.B., D.C.L.; Knight of St John of Jerusalem; Commander of Legion of Honour, 1889; President Statistical Society, 1879-80; Civil Lord of Admiralty, 1880-83; Secretary to Admiralty, 1883-85; Chairman of Opium Commission; President of the Institution of Naval Architects, 1893-95; Governor of Victoria, 1895-1900; author of 'Work and Wages,' 'Naval Annual,' 'British Navy,' 'British Seamen,' 'British Work and Foreign Wages,' etc. (BR.)

BRETT, Michael, Barrister, Middle Temple. (M. BT.)

BRICKDALE, C. Fortescue, Barrister, Lincoln's Inn; author of 'The Law and Practice regarding the Registration of Deeds in the County of Middlesex,' 'Notes on Land Transfer,' 'Registration of Title to Land,' part author of 'The Land Transfer Acts, 1875 and 1897,' etc. (C. F. BR.)

BRIDGE, Vice-Admiral Sir Cyprian Arthur George, K.C.B.; Commander-in-Chief, China station; member of Committee on Heavy Guns, 1878; of War Office Committee on Machine Guns, 1879; of Ordnance Committee, 1881; Director of Naval Intelligence, 1889-94; Commander-in-Chief Australian station, 1895-98; author of 'Signals' in Ninth Edition of 'Ency. Brit.' (C. A. G. B.)

BRINKLEY, Capt. F., R.A.; proprietor and editor of the 'Japan Mail,' Yokohama; edited 'Japan'; translated 'The History of Japan'; compiled 'An Unabridged Japanese and English Dictionary,' etc. (F. BY.)

BROADFOOT, Major William, R.E.; author of the Badminton 'Billiards'; edited 'Career of Major George Broadfoot, C.B., in Afghanistan and the Punjaub,' etc. (W. BR.)

BROOME, Lady, widow of the late Sir F. Napier Broome, Governor of West Australia; author of 'Station Life in New Zealand,' etc. (M. A. B.)

BROOMHALL, G. J. S., editor of 'Corn Trade Year-Book,' etc. (G. J. S. B.)

BROWNE, Edward Granville, M.A., M.B.; Fellow of Pembroke College, Cambridge, and Professor of Persian; editor of 'The Episode of the Bab,' etc. (E. G. B.)

BROWNLOW, Rt. Rev. William Robert [the late], D.D., M.A., R.C. Bishop of Clifton; provost, and domestic prelate to Pope Leo XIII.; co-editor of 'English Roma Sotterranea'; author of 'Early Christian Symbolism'; Memoirs of Melise Brownlow, Sir James Marshall, and Mother Rose Columba Adams, O.P.; Lectures on Slavery and Serfdom, on Church History, on Sacerdotalism, on the Catacombs, and other Archæological subjects; translation of 'Cur Deus Homo,' and 'Vitis Mystica.' (✠ W. R. B.)

BRUNTON, Sir Thomas Lauder, M.D., Sc.D., LL.D. (Edin. and Aberd.), F.R.S.; physician to St Bartholomew's Hospital, London; author of 'The Bible and Science,' 'Text-Book of Pharmacology, Therapeutics, and Materia Medica,' 'Disorders of Digestion,' 'Lectures on the Action of Medicines.' (T. L. B.)

BRYAN, George Hartley, Sc.D., F.R.S.; Professor of Pure and Applied Mathematics in the University College of North Wales; Fellow of Peterhouse, 1889-95; gold medal Inst. Naval Architects, 1901. (G. H. BR.)

BRYANT, Hon. Edgar E., LL.D.; Justice of the Circuit Court of Arkansas, 1890-97; author of 'Speeches and Addresses,' etc. (E. E. B.)

BRYCE, Rt. Hon. James, P.C., D.C.L., LL.D., F.R.S., M.P.; Regius Professor of Civil Law at Oxford, 1870; Under-Secretary of State for Foreign Affairs, 1886; Chancellor of Duchy of Lancaster (with seat in Cabinet), 1892; President of Board of Trade, 1894; Chairman of Royal Commission on Secondary Education, 1894; member of Senate of London University, 1893; corresponding member of Institute of France, 1891; foreign member of Royal Academies of Turin and Brussels, 1896; corresponding member of Società Romana di Storia Patria, 1885; honorary Fellow of Trinity and Oriel Colleges, Oxford; president of the Alpine Club; author of 'Emperor and Empire,' 'Justinian,' 'Procopius,' 'Theodora,' in Ninth Edition of 'Ency. Brit.,' 'The Holy Roman Empire,' 'The Trade Marks Registration Act,' 'Transcaucasia and Ararat,' 'The American Commonwealth,' 'Impressions of South Africa,' etc. (J. BR.)

BRYDON, J. M., the late; architect; designed various Government Offices, Chelsea Town Hall and Polytechnic, Bath Municipal Buildings, etc. (J. M. BY.)

BUCHANAN, John Young, M.A., F.R.S.; chemist and physicist of the 'Challenger' Expedition; later, Lecturer in Geography, University of Cambridge; author of 'Lake,' 'Mediterranean,' in Ninth Edition of 'Ency. Brit.' (J. Y. B.)

BUCKLEY, Rev. James Monroe, D.D., LL.D.; editor of 'The Christian Advocate' (New York); author of 'Travels in three Continents,' 'Faith Healing,' 'Christian Science and Kindred Phenomena,' 'Supposed Miracles,' etc. (J. M. BU.)

BÜRDE, Lieut. Johannes, late of the German army, 51st Infantry Regiment; author of 'Problems of Applied Tactics, with Solutions,' 'Tactical Problems,' etc. (J. BE.)

BURDETT, Sir Henry, K.C.B.; founder and editor of the 'Hospital'; late superintendent of the Queen's Hospital, Birmingham, and of the Seamen's Hospital, Greenwich; late secretary Share and Loan Department, London Stock Exchange; author of 'Burdett's Official Intelligence of British, American, and Foreign Securities,' 'The National Debt,' 'Local Taxation in England and Wales,' 'The Patriotic Fund,' 'Hospitals and Asylums of the World,' 'The Relative Mortality of Large and Small Hospitals,' 'Burdett's Hospitals and Charities, a Year-book of Philanthropy,' 'Hospitals and the State,' 'Unhealthiness of Public Institutions,' 'A Practical Scheme for Old Age Pensions,' 'The Registration of Nurses,' 'The Nursing Profession, how and where to Train,' 'Housing of the Poor,' etc. (H. BT.)

BURN, Rev. A. E., B.D.; Examining Chaplain to the Bishop of Lichfield; author of 'The Athanasian Creed,' 'An Introduction to the Creeds and to the Te Deum,' etc. (A. E. B.)

BURNSIDE, Rev. Frederick, M.A.; Hon. Canon St Albans; Rural Dean of Hertford; Hon. editor of the 'Official Year-Book of the Church of England'; compiler of 'The Official Parochial Register of Church Services,' etc. (F. BU.)

BURNSIDE, William, M.A., F.R.S.; Professor of Mathematics, Royal Naval College, Greenwich. (W. BU.)

BURROUGHS, John, author of 'Wake Robin,' 'Signs and Seasons,' 'Birds and Poets,' 'Fresh Fields,' 'Whitman: A Study,' etc. (J. BU.)

BURROWS, Rev. Winfrid Oldfield, M.A.; Vicar of Holy Trinity, Leeds; formerly Principal of Leeds Clergy School and Tutor of Christ Church, Oxford. (W. O. B.)

BURTON, Clarence Monroe, LL.D.; author of 'Life of Cadillac, founder of Detroit,' 'Revisited Landmarks of Detroit,' etc. (C. M. B.)

BURTON, William, F.C.S.; author of Cantor Lectures on 'Material and Design in Pottery,' etc. (W. B*.)

BUTLER, Alfred Joshua, M.A.; Fellow of Brasenose College, Oxford; author of 'Tyrol' in Ninth Edition of 'Ency. Brit.' (A. J. B.)

BUTLER, Prof. Nicholas Murray, Ph.D.; Pres. Columbia University, New York; author of 'The Meaning of Education,' etc.; editor of the 'Educational Review' and of the 'Great Educators' series. (N. M. B.)

C

CABLE, George Washington, A.M., D.L.; author of 'New Orleans' in Ninth Edition of 'Ency. Brit,' 'Old Creole Days,' 'The Grandissimes,' 'Dr Sevier, 'John March, Southerner,' etc. (G. W. CA.)

CAILLARD, Sir Vincent Henry Penalver, K.B.; Assistant Commissioner for England on Montenegrin Frontier Commission, 1879; on Arab Tabia Commission, 1879; attached to Sir Beauchamp Seymour, Naval Demonstration, Dulcigno, 1880; service for Intelligence Department, 1882; attached Headquarters Staff Egyptian Campaign, 1882; appointed President Ottoman Public Debt Council, 1883; and Financial Representative of England, Holland, and Belgium in Constantinople; medal and bronze star, Egyptian campaign; Grand Cordons Medjidie and Osmanie; gold medals of Liakat and Nishan-i-Imtiaz; Grand Cordon of Ordre pour le mérite civile. (V. H. P. C.)

CALLENDAR, Hugh Longbourne, LL.D., F.R.S.; Professor of Physics, Royal Coll. of Science, London; Professor of Physics, M'Gill Coll. Montreal, 1893-98. (H. L. C.)

CAMP, Walter, Newhaven, U.S.A., author of 'Book of College Sports,' 'American Football,' etc. (W. CA.)

CAMPBELL, J. G. D., M.A.; H.M.'s Inspector of Schools; educational adviser to the King of Siam, 1899-1901. (J. G. D. C.)

CAMPBELL, Rev. Lewis, M.A., LL.D.; emeritus Professor of Greek, University of St Andrews; Hon. Fellow of Balliol Coll. Oxford; Gifford Lecturer, St Andrews, 1894-95; author of 'Plato,' 'Sophocles' in Ninth Edition of 'Ency. Brit.,' 'The Christian Ideal,' part 'Life of James Clerk-Maxwell,' 'Sophocles in English Verse,' 'Aeschylus in English Verse,' 'Guide to Greek Tragedy'; edition of 'Plato's Republic' (with late Professor Jowett), 'Life of Benjamin Jowett' (with E. Abbott), 'Religion in Greek Literature,' 'Letters of B. Jowett' (with E. Abbott), 'The Nationalization of the Old English Universities.' (L. C.)

CANA, F. R. (F. R. C.)

CARLYLE, E. I., M.A., F.R.Hist.Soc.; Fellow of Merton College, Oxford; assist. editor to the 'Dictionary of National Biography.' (E. I. C.)

CAROE, William Douglas, M.A., F.S.A.; Architect to Ecclesiastical Commission, to the Dean and Chapter of Canterbury, etc.; Fellow and Member of the Council R.I.B.A.; part author of 'Sefton.' (W. D. C.)

CARSON, Howard A., formerly chief engineer of the Metropolitan (Greater Boston, U.S.A.) Sewerage Commission and now chief engineer of the Boston Transit Commission; in charge of the building of the Boston Subway and the East Boston Tunnel; sometime President of the Boston Society of Civil Engineers. (H. A. C.)

CARTER, Albert Charles Robinson; assistant editor of 'The Year's Art,' 1887; editor, 1894; editor of 'The Year's Music,' 1898; contributor to 'The Art Journal' since 1889; art critic of 'Manchester Courier'; art critic for 'Pall Mall Gazette'; writer of 'The Art Annual, 1900, on War Artists.' (A. C. R. C.)

CARVER, Thomas Gilbert, M.A., K.C.; author of 'On the Law relating to the Carriage of Goods by Sea.' (T. G. C.)

CASE, Thomas, M.A.; Waynflete Professor of Moral and Metaphysical Philosophy, Oxford; Fellow of Magdalen; formerly Fellow and Tutor of B.N.C., and C.C.C.; author of 'Materials for History of Athenian Democracy from Solon to Pericles,' 'Realism in Morals,' 'Physical Realism,' 'St Mary's Clusters.' (T. CA.)

CASTLE, Egerton, M.A., F.S.A.; author of 'Schools and Masters of Fence,' 'Consequences,' 'English Book-Plates,' 'The Light of Scarthey,' 'The Jerningham Letters,' 'The Pride of Jennico,' 'The Bath Comedy, 'Young April,' 'Marshfield the Observer,' 'The Secret Orchard,' etc. (E. CA.)

CHADWICK, Capt. French Ensor, in command of U.S. cruiser 'New York,' flagship N. Atlantic Squadron; Chief of Staff of Rear-Admiral Sampson in the Spanish-American War. (F. E. CH.)

CHALMERS, Mackenzie Dalzell, C.S.I., M.A.; assistant parliamentary counsel to Treasury, England; counsel to Board of Trade; Judge of County Courts, 1884; acting Chief Justice, Gibraltar, 1893; Commissioner of Assize, 1895; member of the Statute Law Committee, and Board of Faculty of Law of Oxford; law member of the Viceroy's Council in India; author of contributions to 'Dictionary of Political Economy and 'Encyclopædia Britannica,' 'Digest of the Law of Bills of Exchange,' 'Digest of the Law of Sale,' etc. (M. D. CH.)

CHAMBERLAIN, Hon. Joshua Lawrence, A.M., LL.D.; Brigadier-General in the U.S. Civil War; Governor of Maine, 1866-71, and President of Bowdoin College, 1871-83; author of 'Maine' in Ninth Edition of 'Ency. Brit.,' 'Maine: Her Place in History,' 'American Ideals,' etc. (J. L. C.)

CHANEY, Henry James, Superintendent Standards Department Board of Trade; Secretary to Royal Commission on Standards, 1867-70; represented Great Britain at International Conference on the Metric System, 1901; author of 'Treatise on Weights and Measures.' (H. J. C.)

CHANNING, Edward, Ph.D.; Professor of History, Harvard University; author of 'History of the United States,' 'Town and County Government in the English Colonies of North America,' 'Narragansett Planters,' etc.; collaborator with the late Dr Justin Winsor on the 'Narrative and Critical History of America.' (E. CH.)

CHANUTE, Octave, late President American Society of Civil Engineers; honorary member Institution of Civil Engineers, Great Britain; author of 'Kansas City Bridges,' 'Progress in Flying Machines,' etc. (O. C.)

CHAPMAN, Alfred, M.I.C.E.; designer and constructor of sugar machinery. (A. CH.)

CHARLES, Rev. Robert Henry, M.A., D.D.; Professor of Biblical Greek, Trin. Coll. Dublin; author of 'Book of Enoch,' translated from the Ethiopic and edited 'Ethiopic Text of Book of Jubilees, edited from four MSS.,' 'Book of the Secrets of Enoch,' 'Apocalypse of Baruch,' translated from the Syriac and edited 'The Assumption of Moses,' 'The Doctrine of a Future Life,' 'Jowett Lectures for 1898-99.' (R. H. C.)

CHATAWAY, James Vincent, M.L.A., the late; Secretary for Agriculture, Queensland. (J. V. C.)

CHIROL, Valentine; B.Lit. University of Paris; foreign editor of 'The Times'; author of 'The Far Eastern Question,' ''Twixt Greek and Turk,' etc. (V. C.)

CHISHOLM, G. G., M.A., B.Sc.; author of 'The Commerce of the British Empire,' joint-author of 'Europe' in Stanford's 'Compendium of Geography and Travel'; edited Longman's 'Gazetteer of the World.' (G. G. C.)

CHISHOLM, Hugh, B.A.; formerly scholar C.C.C., Oxford; Barrister-at-Law of the Middle Temple; assistant editor of the 'St James's Gazette,' 1892-97; editor, 1897-1900. Contributor to 'Fortnightly Review,' 'National Review,' 'The Times,' 'Standard,' etc.; Joint-editor of the New Volumes of the 'Encyclopædia Britannica.' (H. CH.)

CHREE, Charles, M.A., Sc.D., LL.D., F.R.S.; Fellow of King's College, Camb.; Superintendent Observatory Department, National Physical Laboratory. (C. CH.)

CHRISTY, S. B., Ph.B.; Professor of Mining and Metallurgy and Dean of the Faculty of the College of Mining, University of California. (S. B. C.)

CHURCH, Arthur Herbert, M.A., D.Sc., F.R.S., F.S.A.; Professor of Chemistry, Royal Academy of Arts; Professor of Chemistry in the Royal Agricultural Coll. Cirencester; Lecturer, Cooper's Hill; President of Mineralogical Society, 1898-1901; author of 'Guano,' 'Hemp,' 'Irrigation,' in Ninth Edition of 'Ency. Brit.,' 'Precious Stones,' 'English Earthenware,' 'English Porcelain,' 'The Laboratory Guide,' 'Food Grains of India,' 'Food,' 'Josiah Wedgwood,' 'Colour,' etc. (A. H. C.)

CHURCH, Col. George Earl; Member of the Council Roy. Geog. Soc.; President of the Geog. Section, British Association, 1898; author of 'South America, an outline of its Physical Geography,' etc. (G. E. C.)

CIST, Henry Martyn, A.M., Cincinnati, U.S.A.; author of 'Army of the Cumberland,' 'Life of Major-General George H. Thomas'; editor of 20 Annual Reports of the Society of the Army of the Cumberland. (H. M. C.)

CLARK, Charles Hopkins, editor of 'Hartford Courant,' Conn., U.S.A. (C. H. CL.)

CLARK, George A., B.L.; Secretary to the Leland Stanford Junior University, Secretary of the U.S. Fur Seal Commission, 1896-1898. (G. A. C.)

CLARKE, Colonel Sir George Sydenham, K.C.M.G., F.R.S.; Governor of Victoria, Australia, since 1901; served Egyptian expedition, 1882; Sudan expedition, 1885; Suakin, in Intelligence Department and as Assistant Political Officer; Secretary Colonial Defence Committee; Secretary to Royal Commission on Navy and Army Administration; Superintendent Royal Carriage Factory, 1894-1901; member of Committee on War Office Reorganization, 1900-1901; author of 'Practical Geometry and Engineering Drawing,' 'The Principles of Graphic Statics,' 'Plevna, 'Fortification Past, Present, and Future,' 'The Navy and the Nation,' 'Imperial Defence,' 'Russia's Sea-power,' etc. (G. S. C.)

CLAUSEN, George, A.R.A., R.W.S.; medals: Paris 1889, Chicago 1893, Brussels 1897, Paris 1900. (G. CL.)

CLAUSON, Captain John Eugene, R.E., B.A. London; Secretary Colonial Defence Committee, War Office, London. (J. E. C.)

CLAYDEN, Peter William, the late; President Inst. Journalists, London; a President International Congress of the Press, Antwerp, 1894; English member International Bureau of Press; Treasurer, Institute of Journalists' Orphan Fund; author of 'Scientific Men and Religious Teachers,' 'England under Lord Beaconsfield,' 'Early Life of Samuel Rogers,' 'Rogers and his Contemporaries,' 'England under the Coalition,' etc. (P. W. C.)

CLERC, F. L., Denver, Colorado, U.S.A. M. Amer. Soc. of Mining Engineers. (F. L. C.)

CLERK, Dugald, M.I.C.E., F.C.S.; Consulting Engineer; Originator of the 'Clerk' type of Gas Engine; author of 'The Theory of the Gas and Oil Engine,' 'Notes on Motive Power Inventions,' etc. (D. CL.)

CLIFFORD, Hugh Charles, C.M.G.; British Resident, Pahang; nominated by Colonial Office to post of Governor North Borneo and Labuan under Chartered Company, 1900; Resident, Pahang, 1901; Acting Resident, Negri Sembilan, Sept. 1901; author of 'In Court and Kampong,' 'Studies in Brown Humanity,' 'Since the Beginning,' 'In a Corner of Asia,' joint-author with Sir Frank Swettenham of a Dictionary of the Malay Language. (H. CL.)

CLODD, Edward; author of 'The Childhood of the World,' 'The Childhood of Religions,' 'Jesus of Nazareth,' 'Myths and Dreams,' 'Story of Creation,' 'Story of Primitive Man,' 'Primer of Evolution,' 'Pioneers of Evolution,' 'Tom Tit Tot, an Essay on Savage Philosophy in Folk-Tale,' 'Grant Allen,' 'Story of the Alphabet,' etc. (E. CL.)

COBHAM, C. Delaval, M.A., B.C.L.; British Commissioner, Larnaca, Cyprus; editor of 'Bibliography of Cyprus,' and 'Excerpta Cypria'; translator of Mariti's 'Travels in Cyprus.' (C. D. C.)

COCKBURN, Hon. Sir John Alexander, K.C.M.G., M.D.; Fellow King's College, London; Mayor of Jamestown, S. Australia; member of House of Assembly, S. Australia; Minister of Education, 1885-87; Premier and Chief Secretary, 1889-90; Chief Secretary, 1892; Minister of Education and Agriculture, 1893-98; one of the representatives of South Australia at the Federal Conferences in 1890, 1891, 1897, and 1898; Agent-General for South Australia to 1901. (J. A. Co.)

COGHLAN, T. A., A.M.I.C.E.; Government Statistician of New South Wales; author of 'The Mining Industry of New South Wales,' 'A Statistical Account of the Seven Colonies of Australasia'; has also written on the Agriculture, Fauna, and Timber Resources of New South Wales. (T. A. C.)

COLCLOUGH, John George, B.A.; late Secretary of the British Chamber of Commerce, Paris; author of 'Ulster,' 'The Law of Contract,' 'Twenty-five Years of Anglo-French Trade,' etc. (J. G. C.)

COLE, Alan S.; Asst. Sec. (Art) Board of Education; Ex. for Art, S. Kensington; author of 'Ancient Needle Point and Pillow Lace,' 'Tapestry and Embroidery,' etc.; and editor 'Studies from the Museums,' various descriptive catalogues of Tapestry, Embroidery, Lace, and Egyptian textiles at S. Kens. Mus., etc. (A. S. C.)

COLLINS, Rev. William Edward, M.A.; Professor of Ecclesiastical History, King's

Coll., London; Examining Chaplain to the Bishop of St Albans; author of 'The English Reformation and its Consequences,' 'The Nature and Force of the Common Law,' 'Unity, Catholic and Papal,' etc. (W. E. Co.)

COLOMB, Sir John Charles Ready, K.C.M.G., M.P.; author of 'Protection of Commerce in War,' 'Imperial Strategy,' 'The Distribution of our War Forces,' 'Colonial Defence and Colonial Opinions,' 'The Defence of Great and Greater Britain,' 'Naval Intelligence and Protection of Commerce,' 'The Use and Application of Marine Forces,' 'Imperial Federation, Naval and Military,' 'British Defence,' etc. (J. C. R. C.)

COLVIN, Sir Auckland, K.C.S.I., K.C.M.G., C.I.E.; Grand Cordons of Osmanieh and Medjidieh; Comptroller-Gen. Egypt; Financial Adviser to Khedive; Financial member of Viceroy's Council, India; Lieut.-Gov. North-West Provinces and Oudh; author of 'John Russell Colvin,' etc. (A. Co.)

COLYAR, H. A. de; of the Middle Temple, Barrister-at-Law; author of 'Law of Guarantees' and 'Principal and Surety.' (H. A. DE C.)

COMSTOCK, Brig.-Gen. Cyrus Ballon; U.S.A., retired; Board of Engineers for Fortifications, U.S. Army; chief engineer, Army of the Potomac, 1862-63; President of the Mississippi River Commission; author of 'Primary Triangulation of the U.S. Lake Survey.' (C. B. C.)

CONATY, Right Rev. Bishop Thomas James, S.T.D., J.C.D.; Rector of the Catholic University of America. (✠ T. J. C.)

CONWAY, Sir William Martin, M.A.; Slade Professor of Fine Arts, Cambridge; Professor of Art, Univ. Coll. Liverpool, 1885-88; Hon. Sec. Art Congress, 1888-90; President of the Alpine Club; author of 'Dawn of Art in the Ancient World,' a series of Climbers' Guide-books to the Pennine and Lepontine Alps, etc., 'Climbing and Exploration in the Karakoram-Himalayas,' 'The Alps from End to End,' 'The First Crossing of Spitsbergen,' 'With Ski and Sledge over Arctic Glaciers,' 'The Bolivian Andes.' (W. M. C.)

COOK, Theodore Andrea, M.A., F.S.A.; author of 'Old Touraine,' 'Rouen,' 'A History of the English Turf,' joint-author of 'Ice-Sports.' (T. A. Co.)

COOKE, Charles Wallwyn Radcliffe-, B.A.; author of 'A Treatise on the Agricultural Holdings (England) Act,' 'Four Years in Parliament with Hard Labour,' 'A Book about Cider and Perry'; President, National Association of English Cider-makers. (C. W. R. C.)

COOLIDGE, Rev. William Augustus Brevoort, M.A., F.R.G.S.; Fellow of Magdalen College, Oxford; Professor of English History, St David's College, Lampeter, 1880-81; Corresponding Member of the Swiss Hist. Society, 1891; author of 'Jura,' 'Switzerland' (History, Geography, and Statistics), 'Tell,' 'Valais,' 'Zurich' in Ninth Edition of 'Ency. Brit.'; joint author of 'Guide du Haut Dauphiné,' 'Guide to the Central Alps of the Dauphiny,' 'Guide to the Lepontine Alps,' 'The Mountains of Cogne,' 'The Adula Alps,' 'The Range of the Todi,' 'Guide to Grindelwald,' 'Guide to Switzerland'; editor of 'Alpine Journal,' 1880-89. (W. A. B. C.)

COPEMAN, Sydney Monckton, M.A., M.D.; Medical Inspector, Local Government Board; Member of the Council Epidemiological Society; author of 'Vaccination: its Natural History and Pathology,' 'Bacteriology of Vaccine Lymph,' etc. (S. M. C.)

CORRADINI, Enrico; late editor of 'La Naziona,' Florence; author of 'La Civia Romanzo,' etc. (E. Co.)

COTTON, James Sutherland, M.A.; Hon. Secretary of the Egypt Exploration Fund; late editor of 'The Academy,' London; Fellow and Lecturer of Queen's Coll. Oxford; author of 'Warren Hastings' in Ninth Edition of 'Ency. Brit.,' 'Decennial Report on the Moral and Material Progress of India,' 'India,' 'Elphinstone,' 'Quinquennial Report on Education in India'; editor of 'Paterson's Practical Statutes,' 'The Official Gazetteer of India.' (J. S. Co.)

COX, General Jacob Dolson, LL.D., the late; Governor of the State of Ohio (1866-67); U.S. Secretary of the Interior (1869-70); Major-General U.S. Volunteers in the Civil War; Brigade-Commander under General Sherman in the Atlanta campaign; author of 'Atlanta: the March to the Sea,' 'Battle of Franklin,' etc. (J. D. Co.)

CRACKANTHORPE, Montague Hughes, K.C., D.C.L.; late member General Council of the Bar and Council of Legal Education; late Chairman Incorporated Council of Law Reporting; Honorary Fellow St John's Coll. Oxford; representative of General Council of Bar at International Congress of Advocates, Brussels, 1897; representative of the same Council at International Congress of the Société de Législation Comparée, Paris, 1900; acting Chairman of the International Commission on Criminal Sentences; author of many legal, social, and political articles. (M. H. C.)

CRAIES, W. F.; Barrister, Inner Temple; edited 'A Collection of Statutes relating to Criminal Law,' 'A Treatise on the construction and effect of Statute Law,' 'The Laws of Insurance,' etc. (W. F. C.)

CRANE, Walter, A.R.W.S.; silver medal, Paris, 1889; silver medal, Society of Arts; gold medal, Munich, 1895; first and present President Arts and Crafts Ex. Society (England), 1888; member of Council of Art, Board of Education, and examiner in Design; Hon. Member Dresden Academy of Fine Arts; appointed British Commissioner for the Turin International Exhibition of Decorative Art, 1902; Director of Design, Manchester Municipal School of Art, from 1893-96 (resigned); Hon. Art Director, Reading College, 1898; Principal of the Royal College of Art, South Kensington, 1898-99 (resigned); author and illustrator of 'Baby's Opera,' 'Baby's Banquet,' 'The Sirens Three,' 'Flora's Feast,' 'Queen Summer,' 'Claims of Decorative Art,' 'Renascence, 1891,' 'Decorative Illustration of Books,' 'Spenser's Fairie Queene,' 'The Shepherd's Calendar,' 'Line and Form,' 'A Masque of Days,' etc. (W. Cr.)

CRAWFORD, Francis Marion; author of many novels, including 'Mr Isaacs,' and 'Saracinesca'; and of 'Ave Roma Immortalis, 'Life of Pope Leo XII.,' 'Constantinople,' etc. (M. Cr.)

CREAK, Capt. Ettrick William, R.N., C.B., F.R.S.; late Superintendent of Compasses, Hydrographic Department, Admiralty, London. (E. W. C.)

CREIGHTON, Charles, M.A., M.D. Aberdeen; author of 'History of Epidemics in Britain,' 'Jenner and Vaccination,' etc. (C. C.)

CREWE, Earl of, P.C., M.A., F.S.A.; President of the Literary Fund; assist. priv. sec. to Sec. for Foreign Affairs, 1883-84; Lord-Lieut. of Ireland, 1892-95; author of 'Stray Verses,' articles on Ireland, etc. (C.)

CRIMP, Santo, M.I.C.E.; the late; author of 'Sewage Disposal Works'; joint author of 'Tables and Diagrams for use in designing sewers and water mains,' etc. (S. Cr.)

CRITCHELL, James Troubridge; London Correspondent of the 'Brisbane Courier,' 'North Queensland Herald,' etc.; author of 'Preliminary Enquiry into the Markets of the European Continent,' 'Guide to Queensland,' etc. (J.T.Cr.)

CROOKES, Sir William, F.R.S.; Past President of the Chemical Society, Great Britain; Past President of the Institution of Electrical Engineers; editor of 'Chemical News,' President of the British Association for the Advancement of Science, 1898; editor of 'Quarterly Journal of Science'; Professor of Chemistry, Training Coll., Chester, 1855; author of 'Assaying' in Ninth Edition of 'Ency. Brit.'; 'Select Methods in Chemical Analysis,' 'Manufacture of Beetroot-Sugar in England,' 'Handbook of Dyeing and Calico-Printing,' 'Dyeing and Tissue Printing,' 'Kerl's Treatise on Metallurgy,' with Ernst Rohrig, 'Wagner's Chemical Technology,' 'Auerbach's Anthracen and its Derivatives,' 'Ville's Artificial Manures,' 'A Solution of the Sewage Question,' 'The Profitable Disposal of Sewage,' 'The Wheat Problem,' etc. (W. C.)

CROSS, Charles Robert, B.Sc.; Professor of Physics and Director of Rogers Laboratory, Massachusetts Institute of Technology; Director of Rumford Committee, American Academy of Arts and Sciences. (C. R. Cr.)

CROZIER, Capt. T. H., R.A.; Professor of Artillery, Ordnance College, Woolwich. (T. H. C.)

CRUMP, Charles George, B.A.; of H.M. Record Office; editor 'The History of the Life of Thomas Ellwood,' 'The Works of Walter Savage Landor,' etc. (C. G. Cr.)

CUNDALL, F.; Sec. and Librarian, Institute of Jamaica; author of 'Studies in Jamaica History,' 'The Story of the Life of Columbus and Discovery of America'; edited 'Bibliotheca Jamaicensis,' etc. (F. Cu.)

CUNNINGHAM, J. T., M.A.; late Fellow of University Coll., Oxford; lecturer for Fisheries, Tech. Instruction Com. of Cornwall; late Asst. Professor of Natural History, Edinburgh; also Naturalist to Marine Biological Assoc. of the U.K.; author of 'Treatise on Common Sole,' 'Marketable Marine Fishes of the British Isles,' 'Sexual Dimorphism,' etc. (J. T. C.)

CURRAN, Rev. J. Milne; author of 'Geology of Sydney and the Blue Mountains,' 'A Contribution to the Geology and Petrography of Bathurst,' etc. (J. M. Cu.)

D

DABNEY, Charles William, Ph.D.; Pres. Univ. of Tennessee; assistant U.S. Secretary Agriculture, 1893-97, etc. (C. W. D.)

DABNEY, Richard Heath, A.M., Ph.D.; Professor of Historical and Economical Science, University of Virginia; author of 'The Causes of the French Revolution,' 'John Randolph: a Character Sketch.' (R. H. D.)

DALBY, W. Ernest, M.A., B.Sc., M.I.C.E., M.I.M.E., Assoc. M.I. Nav. Architects; Professor of Mechanical Engineering and Applied Mathematics, City and Guilds Technical College, Finsbury. (W. E. D.)

DALE, T. F.; author of 'The Game of Polo, part-editor of 'Riding and Polo.' (T. F. D.)

DALL, Hon. William Healey, A.M.; naturalist, U.S. National Museum; author of 'Alaska and its Resources,' 'Tribes of the Extreme North-west,' etc. (W. H. D.)

DALLAS, J. M. M.; late Secretary of the Edinburgh Draughts Club. (J. M. M. D.)

DANNREUTHER, Edward, Professor Royal Coll. Mus.; author of 'Musical Ornamentation,' 'Liszt's Études,' 'Richard Wagner.' (E. Da.)

DARWIN, George Howard, M.A., LL.D., D.Sc., F.R.S.; Plumian Professor of Astronomy and Experimental Philosophy, Cambridge; Fellow of Trin. Coll. Camb.; author of 'Tides,' in Ninth Edition of 'Ency. Brit.' 'Reports to B.A. on Harmonic Analysis of Tidal Observations,' 'Memoirs on the Effects of Tidal Friction on the Earth and on the Moon,' Phil. Trans. Roy. Soc., 'The Tides and Kindred Phenomena in the Solar System,' etc. (G. H. D.)

DARWIN, Leonard, Major, late R.E.; Intelligence Dept. War Office, 1885-90; served on several scientific expeditions, including Transit of Venus of 1874 and 1882; author of 'Bi-metallism.' (L. D.)

DAVENPORT, Cyril James H., F.S.A.; British Museum; silver medal Society of Arts, 1900; binding editor to the Anglo-Saxon Review; author of 'The English Regalia,' 'Royal English Bookbindings,' 'Cantor Lectures on Decorative Bookbindings,' 'English Embroidered Bookbindings,' 'Life of T. Berthelet.' (C. D.)

DAVEY of Fernhurst, Lord, D.C.L., F.R.S.; Lord of Appeal in Ordinary; Solicitor-General, 1886; Lord Justice of Appeal, 1893. (D.)

DAVIDS, T. W. Rhys, LL.D., Ph.D.; Secretary and Librarian Royal Asiatic Society; Professor of Pali and Buddhist Literature, Univ. Coll. London; author of 'Buddhism,' 'Jains,' 'Lamaism,' in Ninth Edition of 'Ency. Brit.,' 'Buddhism,' 'Buddhist Birth Stories,' 'Buddhist Suttas from the Pali,' 'Hibbert Lectures,' 1881, etc. (T. W. R. D.)

DAVIDSON, William Leslie, M.A., LL.D.; Professor of Logic and Metaphysics, Aberdeen University; author of 'English Words Explained,' 'Theism as grounded in Human Nature,' 'A Philosophical Centenary: Reid and Campbell,' 'Christian Ethics.' (W. L. D.)

DAVIES, A. Llewelyn, B.A.; Barrister, Inner Temple; Assistant Reader in Common Law under the Council of Legal Education. (A. Ll. D.)

DAVIES, Henry Walford, Mus. Doc. (Camb.), A.R.C.M. (Lond.); organist and director of the choir, Temple Church, London; formerly organist and choirmaster, St Anne's, Soho; teacher of counterpoint, R.C.M., 1895. (H. W. D.)

DAVIS, John Patterson, Ph.D., A.M.; assistant in History and Economics, University of Michigan, 1894-1895; now Attorney-at-Law, Nampa, Idaho; author of 'The Union Pacific Railway,' etc. (J. P. D.)

DAVIS, William Morris, Professor Physical Geography, Harvard University; author of 'Physical Geography' and numerous scientific publications. (W. M. D.)

DAWKINS, William Boyd, M.A., D.Sc., F.R.S., F.S.A., F.G.S., A.M.I.C.E.; Professor of Geol. and Palæontology in Owens College, Manchester; geologist on Geological Survey of Great Britain, 1861-69; author of 'Cave' in Ninth Edition of 'Ency. Brit.,' 'Cave Hunting,' 'Early Man in Britain,' 'British Pleistocene Mammalia.' (W. B. D.)

DAWSON, George Mercer, LL.D., F.R.S., the late; Director Geological Survey of Canada; Geologist and Naturalist to H.M. North American Boundary Commission, 1873-75; one of

H.M. Behring Sea Commissioners, 1891, and under the Behring Sea Joint Commission Agreement, 1892; author of numerous scientific and technical reports printed by the Canadian Government, and scientific and other papers. (G. M. D.)

DAY, Lewis F.; English Designer and Art Lecturer; Med. Paris Exhibition (1900); Examiner for Art, Board of Education; author of 'Windows—Stained and Painted Glass,' 'The Anatomy of Pattern,' 'The Distribution of Ornamental Design,' 'Nature in Ornament,' etc. (L. F. D.)

DAYOT, Armand; Inspector of Fine Arts, Ministry of Fine Arts, France; author of 'Un siècle d'art,' 'La Révolution Française, d'après des peintures, sculptures, etc.,' 'Les maîtres de la caricature Française au XIX^e siècle,' etc. (A. Da.)

DEACON, George Frederick, M.I.M.E.; Member of Council of Institution of Civil Engineers, London; investigated schemes for water-supply of Liverpool; projected the Vyrnwy scheme; carried out part of it in conjunction with the late Thomas Hawksley; President Association of Municipal and County Engineers, 1878; President Engineering Section Sanitary Institute, 1894; President Mechanical Science Section, British Association, Toronto, 1897. (G. F. D.)

DEANS, Richard Storry, LL.B.; Barrister-at-Law, Gray's Inn. (R. S. D.)

DENNING, W. F., F.R.A.S.; Gold Medal, R.A.S.; President Liverpool Ast. Society, 1877-78; author of 'Telescopic Work for Starlight Evenings,' 'The Great Meteoric Shower,' etc. (W. F. D.)

DE VILLIERS, John Abraham J.; British Museum. (J. A. J. de V.)

DE VINNE, Theodore Low, printer and typographist, New York; head of the firm of Theodore L. de Vinne and Co.; author of 'Printers' Price List,' 'Invention of Printing,' 'Historic Types,' etc. (T. L. de V.)

DEWAR, James, M.A., Hon. LL.D. (Glasgow, St Andrews, Edin.), D.Sc. (Victoria), F.R.S., F.R.S.Ed., F.I.C., F.C.S.; Professorial Fellow of Peterhouse, Camb.; Jacksonian Professor of Experimental Philosophy, Cambridge; Fullerian Professor of Chemistry, Royal Institution, London; Vice-President of the Royal Society; a Director of the Davy-Faraday Research Laboratory; President British Association for 1902; co-inventor with Sir Frederick Abel of cordite; late member of the Government Explosives Committee; author of 'Alum,' etc. in Ninth Edition of 'Ency. Brit.,' numerous papers contributed to the proceedings of the Royal Societies of London and Edinburgh, the Royal Institution, the British Association, the Chemical Society, etc. (J. Dr.)

DIBDIN, Charles, F.R.G.S., A.V.I.; Knight of St John of Jerusalem in England; Hon. Corresponding Member of Institutions de Prévoyance, France; Secy. of the Royal National Lifeboat Institution, England; Hon. Secy. of the Civil Service Lifeboat Fund. (C. Di.)

DIBDIN, Lewis Tonna, K.C., D.C.L. (Durham), F.S.A.; author of 'Church Courts,' 'City Livery Companies,' 'Brewer's Endowment and Establishment,' 'Monasticism in England,' 'Hanson's Death Duties.' (L. T. D.)

DICEY, Edward, C.B., B.A.; editor of 'The Observer' (London), 1870-89; author of 'Rome in 1860,' 'Cavour,' 'The Morning Land,' 'England and Egypt,' 'Victor Emmanuel,' 'Bulgaria, the Peasant State,' 'The Story of the Khedivate,' etc. (E. D.)

DICKEY, Rev. Charles A., D.D.; President of the Presbyterian Hospital in Philadelphia; Moderator of the General Assembly of the Presbyterian Church in the U.S., 1900. (C. A. D.)

DICKSON, Henry Newton, B.Sc., F.R.S.E., F.R.G.S.; late Vice-President Royal Meteorological Society; Lecturer in Physical Geography, Oxford; author of 'Meteorology: the Elements of Weather and Climate,' etc. (H. N. D.)

DIXON, Capt. J. Whitly, R.N.; conservator of the river Humber; late Staff Commander of the Medway Fleet Reserve; author of 'Mariner's Compass in an Iron Ship,' etc. (J. W. D.)

DOBSON, George; Petersburg; author of 'Russia's Railway Advance and Central Asia,' etc. (G. D.)

DOBSON, Henry Austin, Principal, H.M. Board of Trade, to 1901; author of 'Hogarth' in Ninth Edition of 'Ency. Brit.'; 'Proverbs in Porcelain,' 'Old-World Idylls,' 'At the Sign of the Lyre,' 'Collected Poems,' 'Thomas Bewick and his Pupils,' Lives of Fielding, Steele, Goldsmith, Horace Walpole, William Hogarth, 'Four Frenchwomen,' 'Eighteenth Century Vignettes,' 'A Paladin of Philanthropy,' etc. (A. D.)

DODD, Lieut.-Col. John Richard, M.B., F.R.C.S., R.A.M.C.; Medical Officer, Royal Arsenal, Woolwich. (J. R. D.)

DOUGLAS, James, LL.D.; member and Vice-President Am. Inst. of Mining Engineers; member Am. Philosoph. Soc., Am. Geolog. Soc., Society of Arts, London, etc.; formerly Professor of Chemistry, Morrin College, Quebec; author of 'Canadian Independence,' 'Imperial Federation and Annexation,' numerous technical articles and reports, etc. (J. Ds.)

DOUGLAS, Robert Kennaway, Keeper of Oriental Printed Books and MSS. at the British Museum; Professor of Chinese, King's Coll. London; appointed China Consular Service, 1858; retired, and appointed assistant in charge of Chinese Library, British Museum, 1865; author of 'Canton,' 'China,' 'Jenghiz Khan,' 'Manchuria,' etc., in Ninth Edition of 'Ency. Brit.,' 'The Language and Literature of China,' 'Confucianism and Taoism,' 'China,' 'A Chinese Manual,' 'The Life of Li Hung-Chang,' 'China.' (R. K. D.)

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DOWSON, J. Emerson, M.I.C.E., M.I.M.E.; Inventor of the Dowson Gas Plant; part author of 'Tramways,' 'Decimal Coinage,' etc. etc. (J. E. Do.)

DREYER, John Louis Emil, Director Armagh Observatory; assist. Astronomer at Dublin University Observatory, 1878-82; author of 'Observatory,' 'Sextant,' 'Time,' 'Transit Circle,' in Ninth Edition 'Ency. Brit.,' 'Second Armagh Catalogue of 3300 Stars,' 1886, 'New General Catalogue of Nebulæ and Clusters of Stars,' 'Tycho Brahe'; co-editor 'Copernicus: an International Journal of Astronomy,' 1881-84. (J. L. E. D.)

DRIESCH, Hans A. E., Ph.D. Jena; Stazione Zoologica, Naples; author of 'Analytical Theory of Organic Development,' 'Biology,' etc. (H. A. E. D.)

DRIVER, Rev. Samuel Rolles, D.D., D.Litt.; Regius Professor of Hebrew, and Canon of Christ Church, Oxford; member of Old Testament Revision Company; author of 'Isaiah,' 'Notes on the Hebrew Text of the Books of Samuel,' 'An Introduction to the Literature of the Old Testament,' various commentaries; joint-editor of the 'Holy Bible, with various renderings and readings from the best authorities,' 'A Hebrew and English Lexicon of the Old Testament.' (S. R. D.)

DUFF, Rt. Hon. Sir Mountstuart Elphinstone Grant, P.C., M.A., D.L., G.C.S.I., F.R.S.; Under-Secretary of State for India, 1868-74; Under-Secretary for the Colonies, 1880-81; Governor of Madras, 1881-86; Member of Senate University of London, 1891; President Royal Geographical Society, 1889-93; President Royal Historical Society, 1892-99; author of 'Miscellanies, Political and Literary,' 'Memoir of Sir H. S. Maine,' 'Ernest Renan,' 'Memoir of Lord de Tabley,' 'Notes from a Diary.' (M. G. D.)

DUFFIELD, William Bartleet; of the Inner Temple, Barrister-at-Law. (W. B. Du.)

DU FIEF, J.; Secrétaire, Société Royale Belge de Géographie, Bruxelles; author of 'Atlas du Belgique,' 'Les decouvertes maritimes des Portugais au XV^e siècle,' 'Les Expeditions Belges au Katenga,' etc. (J. du F.)

DUNCAN, Louis, Ph.D.; sometime President of the American Institute of Electrical Engineers, and Associate Professor of Electricity, Johns Hopkins University, Baltimore. (L. Du.)

DUNCAN, P.; Secretary's Department, Inland Revenue Office, London. (P. D.)

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DYER, Sir William Turner Thiselton-, M.A., B.Sc., LL.D., Ph.D., K.C.M.G., C.M.G., C.I.E., F.R.S.; Director, Royal Gardens, Kew; Fellow, University of London, 1887-90; V P.R.S. 1896-97; joint-author of 'Biology' in Ninth Edition of 'Ency. Brit.,' 'Flora of Middlesex,' edited English edition of Sachs' 'Text-book of Botany,' 'Flora Capensis,' etc. (W. T. T.-D.)

E

EARDLEY-WILMOT, Rear-Admiral Sydney M., R.N.; author of 'The British Navy, Past and Present,' 'The Next Naval War,' 'Our Flags: Their Origin, Use, and Traditions,' 'The Development of Navies during the Last Half Century,' etc. (S. M. E.-W.)

EATON, Fred. A.; Secretary to the Royal Academy, London; edited Thausing's 'Albert Durer: His Life and Works.' (F. A. E.)

EDGINGTON, Charles, M.A.; President Oxford University Speed Skating Club; holder since 1898 of the world's speed record for the hour (19 m. 348 yds.). (C. E.)

EDGEWORTH, Francis Ysidro, M.A.; D.C.L.; Professor of Political Economy, Oxford, Fellow of All Souls' Coll. Oxford; Fellow of King's Coll. London; editor of the 'Economic Journal'; author of 'Mathematical Psychics,' etc. (F. Y. E.)

EDWARDS, William Seymour, Attorney and Counsellor-at-law, U.S.A.; author of 'Coals and Cokes in West Virginia.' (W. S. E.)

EGERTON, H. E.; author of 'A Short History of British Colonial Policy,' 'Sir Stamford Raffles,' 'Essays on Christ's Hospital,' etc. (H. E. Eg.)

ELIOT, Charles William, LL.D., D.C.L.; President of Harvard University; author of 'American Contributions to Civilization,' 'Educational Reform,' etc. (C. W. E.)

ELIOT, Whately, M.I.C.E.; conducted survey of the coast of New Zealand; late Engineer to Peterhead Harbour Board; Resident Engineer Eastham section of the Manchester Ship Canal; Superintendent Civil Engineer, Keyham Dockyard Extension, etc. (W. E.)

ELLINGTON, E. B., M.I.C.E.; Member of the Council M.E.; Member of the Société des Ingénieurs Civils de France; Chief Engineer London and Liverpool Hydraulic Power Companies, etc.; inventor of numerous improvements in hydraulic machinery. (E. B. E.)

ERNST, Gen. Oswald Herbert; Brigadier-General U.S.A.; member of the U.S. Isthmian Canal Commission; Engineer in charge of Western River Improvements, 1878-86, and of Harbour Improvements on Texas Coast, 1886-89; Superintendent U.S. Military Academy, 1893-98; author of 'Manual of Practical Military Engineering,' etc. (O. H. E.)

EVANS, Hon. Henry Clay; U.S. Commissioner of Pensions, Washington. (H. C. E.)

EVERETT, Commander Allan F., R.N.; Signal School, H.M.S. 'Victory,' Portsmouth. (A. F. E.)

EVERETT, Joseph David, M.A., D.C.L., D.Sc., F.R.S.; late Professor of Natural Philosophy, Queen's Coll. Belfast; Assist. to Professor of Mathematics, Glasgow, 1864-67; author of 'Centimètre-Gramme-Second System of Units,' English edition of 'Deschanel's Physics,' 'Elementary Text-Book of Physics,' 'Outlines of Natural Philosophy.' (J. D. E.)

EWART, James Cossar, M.D., F.R.S.; Regius Professor of Natural History, Edinburgh; Professor Natural History, Aberdeen, 1878-82; member Fishery Board for Scotland; author of 'The Locomotor System of the Echinoderms' (with the late G. J. Romanes), 'On the Progress of Fish Culture in America,' 'On Whitebait,' 'On the Preservation of Fish,' 'The Development of the Limbs of the Horse.' (J. C. E.)

EWING, James Alfred, M.A., B.Sc., F.R.S., M.I.C.E.; Professor of Mechanism and Applied Mechanics, Cambridge; Fellow of King's College, Cambridge; Professor of Mechanical Engineering at the Imperial University, Tokyo, Japan, 1878-83; author of 'Pneumatic Despatch,' 'Seismometer,' 'Sewerage,' 'Siemens,' 'Steam Engine,' 'Strength of Materials' in Ninth Edition of 'Ency. Brit.,' 'Treatise on Earthquake Measurement,' 'Magnetic Induction in Iron and other Metals,' 'The Steam Engine and other Heat Engines,' etc. (J. A. E.)

EXETER, Bishop of, Right Rev. Herbert Edward Ryle, D.D., B.A.; Warburton Lecturer 1899-1903; Fellow King's College, Cambridge, 1881; Divinity Lecturer at

Emmanuel College, Cambridge, 1881-84; at King's College, 1882-86; Principal of St David's College, Lampeter, 1886-88; Professorial Fellow of King's College, Cambridge, 1888; examining chaplain to late Bishop of St Asaph, 1887-89, and to Bishop of Ripon, 1889; Hon. Canon of Ripon, 1895; Chaplain to the Queen, 1898-1901; Hulsean Professor of Divinity, Cambridge University, 1887-1901, and President of Queens' College, Cambridge, 1896-1901; author of 'The Canon of the Old Testament,' 'The Early Narratives of Genesis,' 'Commentary on Ezra and Nehemiah,' 'Philo and Holy Scripture,' etc. (H. E. R.)

F

FAIRBAIRN, Andrew Martin, M.A., D.D., LL.D.; Principal Mansfield Coll. Oxford; Principal of Airedale Coll. 1877-1886; Chairman of Congregational Union of England and Wales, 1883; Member of Royal Commission on Secondary Education, 1894-95; author of 'Arminius,' 'Independents,' in Ninth Edition of 'Ency. Brit.,' 'Studies in the Life of Christ,' 'The City of God,' 'Religion in History and in Modern Life.' 'Catholicism, Roman and Anglican,' 'The Philosophy of the Christian Religion,' etc. (A. M. F.)

FAIRBROTHER, William Henry, M.A., Lecturer in Philosophy, Lincoln College, Oxford; author of 'Philosophy of Thomas Hill Green.' (W. H. F*.)

FAIRLIE, John A., Ph.D.; Asst. Prof. of Administrative Law, Univ. of Michigan; author of 'Municipal Government.' (J. A. FA.)

FARRAR, Very Rev. Frederic William, D.D., F.R.S.; Dean of Canterbury; Hulsean Lecturer at Cambridge; Bampton Lecturer at Oxford; Chaplain to the Speaker of the House of Commons, 1890-95; author of 'Jesus Christ' in Ninth Edition of 'Ency. Brit.,' 'The Life of Christ,' 'The Life of St Paul,' 'The Early Days of Christianity,' 'Darkness and Dawn,' 'The Bible, its Meaning and Supremacy,' etc. (F. W. F.)

FAUNCE, W. H. P., A.M., D.D.; President of Brown University, Providence, R I. (W. H. P. F.)

FAUR, G., of the Egyptian Hall, London. (G. FA.)

FERGUSON, J.; editor of the 'Ceylon Observer,' 'Tropical Agriculturist,' etc.; author of 'Handbook to Ceylon,' manuals on Coffee, Tea, Gold, Gems, etc. (J. F.)

FERRERO, Baron Augusto; editor of 'La Tribuna,' Rome; author of 'Nostalgie d'Amore'; edited 'From Florence to Rome: A Political Diary of 1870-71,' etc. (A. FE.)

FFOULKES, Miss C. Jocelyn; translator of Morelli's 'Italian Painters,' etc. (C. J. F*.)

FIDLER, H.; Civil Engineer, head of Technical Staff Department of Civil Engineer-in-Chief, Admiralty; editor of 'A Manual of Construction,' etc. (H. F.)

FIELD, Capt. A. Mostyn, R.N.; F.R.A.S, F.R.G.S., F.R.Met.S.; has worked for the Hydrographic Survey in various parts of the world. (A. M. F*.)

FILON, Pierre Marie Augustin; agrégé és lettres; French Critic; tutor to the late Prince Imperial; literary editor of the 'Revue Bleue'; author of 'Le Mariage de Londres,' 'Histoire de la Littérature Anglais,' 'English Profiles,' and works on the French and English drama. (A. FI.)

FISHER, Alexander; English teacher and specialist in the art of enamelling; author of technical articles in the 'Magazine of Art,' the 'Studio,' etc. (A. FI*.)

FISHER, George Park, D.D., LL.D.; Professor of Ecclesiastical History, Yale; author of 'The Reformation,' 'History of the Christian Church,' 'The Colonial Era,' etc. (G. P. F.)

FISKE, John, LL.D., the late; author of 'Discovery of America,' 'American Revolution,' 'The Mississippi Valley in the Civil War,' 'Cosmic Philosophy,' etc. (J. FI.)

FITCH, Charles H., in charge of the Indian Territory Section, U.S. Geological Survey. (C. H. F.)

FITCH, Sir Joshua Girling, M.A., LL.D.; Chief Inspector of Training Colleges, retired 1894; H.M. Inspector of Schools, 1863; Chevalier of the Legion of Honour; Governor of St Paul's School, London, and Girton College, Cambridge; author of 'Lectures on Teaching,' 'The Arnolds and their Influence on English Education,' 'Educational Aims and Methods.' (J. G. F.)

FITZGERALD, Vice-Adml. Charles Cooper Penrose; Superintendent, Pembroke Dockyard; second in command of the China Station, 1898-1899; author of 'Boat Sailing,' 'Life of Sir George Tryon.' (C. C. P. F.)

FITZGERALD, J. D.; Barrister-at-Law of N.S.W., Journalist, and Alderman of the Corporation of Sydney. (J. D. F.)

FITZMAURICE-KELLY, James; corresponding member of the Spanish Academy; author of 'A History of Spanish Literature,' 'The Life of Miguel de Cervantes Saavedra,' etc. (J. F.-K.)

FLANNERY, Sir Fortescue, M.Inst.C.E., M. Inst. Marine Engineers; Consulting Engineer; sometime President of the Institution of Marine Engineers. (F. F*.)

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FORD, Worthington Chauncey, Public Library, Boston, U.S.A.; Chief of Bureau of Statistics, U.S. Department of State, 1885-89, and of Bureau of Statistics, U.S. Treasury Department, 1893-98; author of 'American Citizen's Manual,' etc. (W. C. F.)

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FORTIER, Alcée, Litt.D.; Professor of Romance Language, Tulane University, New Orleans; sometime President of the Modern Language Association of America, and of the American Folk-Lore Society; President of the Louisiana Historical Society since 1894; author of 'Louisiana Studies,' 'Louisiana Folk Tales,' etc. (A. FO.)

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FOSTER, Sir Michael, D.C.L., D.Sc., LL.D., K.C.B., F.R.S., M.P.; Professor of Physiology, Cambridge; secretary R.S.; President British Ass., 1899; author of 'Physiology' in Ninth Edition of 'Ency. Brit.,' 'Text-Book of Physiology,' 'Lectures on History of Physiology'; joint-editor of 'Scientific Memoirs of Thomas Henry Huxley,' etc. (M. F.)

FOWLER, G. H., Ph.D. Leipsic; late Hon. Secretary, Marine Biological Association, Plymouth; edited 'The Hydromedusa,' and 'The Leptomedusa,' Marshall's 'The Frog,' Erichson's 'Scientific Progress in Entomology.' (G. H. FO.)

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FRY, Rt. Hon. Sir Edward, B.A., D.C.L., LL.D., F.R.S., F.S.A., F.L.S.; Judge of High Court, Chancery Division, 1877-83; Lord Justice of Appeal, 1883-92; Fellow University of London and Univ. Coll. London; Hon. Fellow of Balliol Coll. Oxford; presided over the Royal Commission on the Irish Land Acts, 1897-98; author of 'Quakers' in Ninth Edition of 'Ency. Brit.,' 'The Specific Performance of Contracts,' 'British Mosses,' 'James Hack Tuke,' etc. (E. F.)

FULTON, Robert Burwell, A.M., LL.D.; Chancellor of the University of Mississippi; author of 'Mississippi, State' in Ninth Edition of 'Ency. Brit.' (R. B. F.)

G

GADOW, Hans Friedrich, Ph.D., Hon. M.A. Cambridge, F.R.S.; Strickland Curator and Lecturer on Zoology, Cambridge; British Museum, Natural History Department, 1880-82; author of 'In Northern Spain,' 'A Classification of Vertebrata,' 'Aves in Bronn's Animal Kingdom,' 'Amphibia and Reptiles,' and papers in Royal Society Philosophical Transactions and other scientific periodicals. (H. F. G.)

GALLWEY, Lt.-Col. Henry Lionel, C.M.G., D.S.O.; Deputy Commissioner and Consul, Niger Coast Protectorate; Acting Consul-General, 1896-98, Oil Rivers Protectorate; in command of a Haussa company during operations in Benin country, including capture of Benin City, 1897, etc. (H. L. G.)

GAMBLE, F. W., editor of 'Junior Course of Practical Zoology,' 'Flatworms and Mesozoa,' etc. (F. W. GA.)

GANNETT, Henry; Chief Geographer U.S. Geological Survey; Chief Geographer 10th, 11th, and 12th U.S. Censuses; author of 'Idaho,' etc., in Ninth Edition of 'Ency. Brit.,' 'Dictionary of Altitudes,' 'Statistical Atlas of the U.S.,' etc. (H. G*.)

GARCKE, Emile, M.I E.E., F.S.S.; Manager of the Brush Electrical Engineering Co.; Chairman Elect. Sect. London Chamber of Commerce, 1884-88; Member of Council, Tramways and Light Railways Assoc.; author of 'Manual of Electrical Undertakings,' joint-author of 'Factory Accounts.' (E. GA.)

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GARNETT, Richard, LL.D., C.B.; Assistant in Library of British Museum, 1851; Superintendent of Reading Room, 1875; Keeper of Printed Books, 1890-1899; edited the British Museum Catalogue from 1881 to 1890; author of 'Alexander VI.,' 'Anthology,' 'Augustan History,' 'Byzantine Historians,' 'Chateaubriand,' 'Hazlitt,' 'Leigh Hunt,' etc., in Ninth Edition of 'Ency. Brit.,' 'Relics of Shelley,' 'Life of Carlyle,' 'Life of Emerson,' 'Twilight of the Gods,' 'Life of Milton,' 'Age of Dryden,' 'William Blake,' 'A History of Italian Literature,' 'Life of Edward Gibbon Wakefield.' (R. G.)

GARNETT, William, M.A., Hon. D.C.L. Durham; Sec. Technical Education Board, London Co. Council; Whitworth Scholar (first); Demonstrator in Physics, Cambridge; Prof. of Math., Physics and Mechanics, University Coll., Nottingham; Principal, Durham Coll. of Science, Newcastle-upon-Tyne; author of 'Dynamics,' 'Energy,' 'Evaporation,' 'Hydrometer' in the Ninth Edition of 'Ency. Brit.,' 'Elementary Dynamics,' 'Elementary Mechanics,' etc. (W. G.)

GARSTANG, Walter, M.A., F.Z.S.; late Fellow of Lincoln Coll., Oxford; Naturalist in charge of Fishery Investigations, Marine Biol.

Assoc.: delegate of H.M. Gov. to Internat. Conf. on Exploration of the Sea, Christiania, 1901; medallist of the Société Centrale d'Agriculture et de Pêche, Paris; author of numerous memoirs on Marine Biology, etc. etc. (W. GA.)

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HOWELL, William H., Ph.D., M.D.; Dean of the Medical Faculty and Professor of Physiology, Johns Hopkins University. (W. H. H.)

HUBBARD, Wilfranc. (W. Hd.)

HUDSON, James Fairchild, editor of the 'Pittsburg Dispatch'; author of 'Railways of the Republic,' etc. (J. F. H.)

HUGHES, Rev. Hugh Price, M.A.; Pres. Wesleyan Conference, 1898-99; editor of 'Methodist Times'; Past Pres. of National Council of Evangelical Free Churches; author of 'Social Christianity,' 'Ethical Christianity,' etc. (H. P. H.)

HUGHES, Rupert, A.M.; formerly assistant editor of the 'Criterion,' New York; author of 'American Composers,' 'Gyges Ring,' etc. (R. Hu.)

HULL, Commander Thomas A., R.N., F.R.G.S.; employed in the search for Sir John Franklin, survey of Palestine, Corfu, etc.; late Superintendent of Admiralty charts; author of 'Practical Nautical Surveying'; editor and reviser 'The Pilot's Handbook for the English Channel,' and 'The Practice of Navigation and Nautical Astronomy,' etc. (T. A. H.)

HUMMEL, J. J., F.I.C.; Professor of Dyeing, Yorkshire Coll., Leeds; author of 'The Dyeing of Textile Fabrics.' (J. J. H.)

HUNT, Rev. William, M.A.; examiner in History, 1877 to 1880, Oxford; author of 'The English Church, 597 to 1066,' 'The Church of England in the Middle Ages'; editor with E. A. Freeman of 'Historic Towns,' etc. (W. Hu.)

HUNT, Hon. William H., Governor of Porto Rico; sometime Justice of the Supreme Court of Montana. (W. H. H*.)

HUNTER, Sir Robert, M.A.; Solicitor to the Post Office; author of 'The Preservation of Open Spaces and of Footpaths and Other Rights of Way.' (R. H*.)

HUNTER, Walter, M.I.C.E., M.I.M.E.; engineering director of the Grand Junction Water Works Co., and joint engineer of the Staines Reservoir Joint Committee. (W. H*.)

HUTCHINSON, Horatio Gordon, B.A.; amateur golf champion, 1886-87; author of 'Golf' in Badminton Library, 'Creatures of Circumstance,' 'The Book of Golf and Golfers,' 1899. (H. G. H.)

HUTTON, Rev. Arthur Wollaston, M.A.; Rector of Spridlington, 1873-76; received into Roman Catholic Church by Dr Newman, 1876; resumed clerical functions in the Church of England, 1898; author of 'Our Position as Catholics in the Church of England,' 'The Anglican Ministry,' 'Cardinal Manning'; edited Arthur Young's 'Tour in Ireland,' 1892, Maitland's 'Essays on the Reformation,' Newman's 'Lives of the English Saints,' etc. (A. W. Hu.)

I

IDE, Hon. Henry Clay, Member of U.S. Philippine Commission; formerly U.S. Commissioner to Samoa, and later Chief Justice of Samoa. (H. C. I.)

ILBERT, Sir Courtenay Peregrine, K.C.S.I., C.I.E.; Clerk of the House of Commons; formerly Parl. Counsel to the Treasury, 1899-1902; Legal Member of Council of Governor-General of India, 1882-86; Assistant Parl. Counsel to the Treasury, 1886-99; Member of Statute Law Committee; author of 'The Government of India,' 'Legislative Method and Forms.' (C. P. I.)

INAMA-STERNEGG, Karl Theodor von; Professor of Political Science, Vienna; President of the Austrian Royal Statistical Central Commission; author of 'Outlines of Germanic Philology,' 'Economy,' etc. (K. T. I.-S.)

IRVINE, William Fergusson; Hon. Sec. Record Society of Lanc. and Chesh., author of 'Notes on the Ancient Parish of Bidston'; editor 'Liverpool in King Charles II.'s Time,' etc. (W. F. I.)

J

JACKS, Rev. L. P. (L. P. J.)

JACKSON, Lieut.-Col. Louis, R.E.; late instructor in Fortification, R.M.A., Woolwich; instructor in Fortification and Military Engineering, School of Military Engineering, Chatham; Assoc. Memb. of Ordnance Committee, etc. (L. J.)

JACOB, Francis, M.I.E.E., F.P.S. Lond.; chief electrician to Messrs Siemens Bros. and Co. (F. Ja.)

JAMES, Edmund Janes, A.M., Ph.D.; President North-Western University; late Professor of Public Administration and Director of the Extension Division, University of Chicago; past Pres. Am. Acad. of Political and Social Science; author of 'Our Legal Tender Decisions,' 'The Education of Business Men,' etc. (E. J. J.)

JAMES, Lionel; War Correspondent of 'The Times' in South Africa. (L. J*.)

JAMIESON, George, C.M.G.; Director of the Pekin Syndicate and Yangtse Valley Company; Consul and Judge of Supreme Court, Shanghai, 1891; Consul-Gen., 1897-99; author of various papers on the Revenue and Statistics of China; prize essay on Bimetallism. (G. J.)

JEBB, Sir Richard Claverhouse, Litt.D., D.C.L., LL.D., M.P.; Regius Professor of Greek, Camb.; Hon. Professor Ancient History, Roy. Acad., since 1898; Fellow and Lecturer of Trinity College, 1863; Public Orator of the University, 1869; Professor of Greek, University of Glasgow, 1875-89; Lecturer at Johns Hopkins University, Baltimore, 1892; Member of Royal Commission on Secondary Education, 1894; of Royal Commission on Irish University Education, 1901; Member of Consulting Committee of Board of Education, 1900; Fellow of London University, 1897; Member of London University Commission, 1898; Bampton Lecturer, 1899; author of 'Aristophanes,' 'Demosthenes,' 'Euripides,' etc., in Ninth Edition of 'Ency. Brit.,' 'Sophocles,' 'Electra' in Catena Classicorum, 'Ajax,' 'Characters of Theophrastus,' 'Attic Orators,' 'Modern Greece,' 1880; 'Bentley,' 'Sophocles,' with Critical Notes, Commentary, and Translation; 'Humanism in Education,' etc. (R. C. J.)

JEFFERSON, Joseph, LL.D.; actor; author of 'Autobiography,' etc. (J. J*.)

JEKELFALUSSY, Józef von Jekel- und Margitfalva, Dr. Juris, the late; Director-General of the Royal Hungarian Statistical Bureau; Member of the Royal Hungarian Academy of Sciences; edited 'The Millennium of Hungary and its People,' etc. (J. Je.)

JENKS, Jeremiah Whipple, Ph.D.; Professor of Political Science, Cornell University; Member of the U.S. Committee to investigate Trusts; author of 'Henry C. Carey,' 'Road Legislation for the American State,' and numerous magazine contributions in Germany, England, and the United States. (J. W. J.)

JENKYNS, Sir Henry, the late, K.C.B.; Parliamentary Counsel to Treasury. (H. Je.)

JERVIS-SMITH, Rev. Frederick J., M.A., F.R.S.; University Lecturer in Mechanics; Millard Lecturer, Trinity College, Oxford; Member of Com. on Explosions, Home Office, 1895-96; received Medal French Exhibition for Dynamometer; silver medal Inventions Exhibitions for Integrator. (F. J. J.-S.)

JEUNE, Rt. Hon. Sir Francis Henry, K.C.B., K.B.; appointed a Judge of the High Court, 1891; President of Probate, Divorce, and Admiralty Division; Judge-Advocate-Gen., 1892. (F. H. J.)

JEUNE, Lady; contributor to leading reviews and magazines; author of 'Lesser Questions,' etc. (M. J.)

JOHNSTON, Sir Harry Hamilton, G.C.M.G., K.C.B.; Special Commissioner, Commander-in-Chief and Consul-General for Uganda Protectorate; explored Portuguese West Africa and River Congo, 1882-83; commanded Scientific Expedition of Royal Society to Mt. Kilimanjaro, 1884; H.M. Vice-Consul in Cameroons, 1885; Acting Consul in Niger Coast Protectorate, 1887; Consul for province of Mozambique, 1888; expedition to Lakes Nyasa and Tanganyika (founding of the British Central Africa Protectorate), 1889; author of 'River Congo,' 'Kilimanjaro,' 'History of a Slave,' 'Life of Livingstone,' 'British Central Africa,' etc. (H. H. J.)

JORDAN, David Starr, Ph.D., LL.D.; President of Leland Stanford Junior University; sometime Assistant to the U.S. Fish Commission, and Professor of Zoology, and President of Indiana University; Commissioner and Expert for the United States to investigate the Fur Seal Question, 1896-97; author of 'Vertebrate Animals of Northern U.S.,' 'Fisheries of North and Middle America,' 'Factors of Organic Evolution,' etc. (D. S. J.)

JORDAN, Richard; Draughts Champion of Scotland, 1896, and of the World since 1896. (R. J.)

JUDSON, Harry Pratt, A.M., LL.D.; Professor of Political Science, and Dean of the Faculties of Arts, Science, and Literature, University of Chicago; author of 'Europe in the Nineteenth Century,' 'Growth of the American Nation,' etc. (H. P. J.)

K

KAN, C. M.; Professor of Geography, University of Amsterdam; author of 'Holland' in Ninth Edition of the 'Ency. Brit.,' 'A History of Discoveries in the Indian Archipelago,' editor 'The International Colonial Review,' etc. (C. M. K.)

KARAGEORGEVITCH, Bojidar, Prince; artist and art critic. (B. K.)

KEANE, Augustus Henry, F.R.G.S.; Emeritus Professor of Hindustani, Univ. Coll. London; late Vice-President Anthrop. Institute; author of 'Kirghiz,' 'Soudan,' 'Somali,' 'Yoruba,' etc., in Ninth Edition of 'Ency. Brit.' Stanford's 'Asia,' 'Africa,' 'Ethnology,' 'Man, Past and Present,' etc. (A. H. K.)

KELSEY, C. H., President of the Title Guaranty and Trust Company, New York. (C. H. K.)

KELTIE, John Scott, F.S.S., F.S.A. (Scot.), LL.D. St Andrews; Secr. Royal Geog. Soc.; Knight of Swedish Order of North Star, 1898; Hon. Memb. Geographical Societies of Paris, Berlin, Rome, Brussels, Amsterdam, Geneva, Lisbon, Buda-Pest, Philadelphia, etc.; for several years sub-editor of 'Nature'; inspector of geographical education, R.G.S., 1884; Librarian R.G.S., 1885; President Geographical Section, Brit. Ass., 1897; author of 'Finland,' 'Sir John Franklin,' etc., in Ninth Edition of 'Ency. Brit.,' 'History of Scottish Highlands and Clans,' 'Applied Geography,' 'The Partition of Africa'; editor of 'Statesman's Year Book' since 1880; editor of the 'Geographical Journal'; joint-editor of 'World's Great Explorers' Series, and 'The Systematic Atlas.' (J. S. K.)

KEMPE, Harry Robert, A.M.I.C.E., M.I.E.E.; principal technical officer, Postal Telegraph Dept., England; author of 'Handbook of Electrical Testing,' 'The Electrical Engineer's Pocket Book,' 'The Engineer's Year Book,' etc. etc. (H. R. K.)

KENNEDY, Sir Charles Malcolm, K.C.M.G., C.B.; Head of Commercial Department, Foreign Office, 1872-93; Lecturer on International Law, Univ. Coll. Bristol; Commissioner in the Levant, 1870-71; at Paris, 1872-86; Plenipotentiary, Treaty of the Hague, 1882; author of 'Kennedy's Ethnological and Linguistic Essays' (editor), 'Diplomacy and International Law.' (C. M. K*.)

KENNEDY, Hon. Sir William Rann; Judge of the King's Bench Division of the High Court of Justice; Fellow, and afterwards Hon. Fellow of Pembroke Coll. Camb. (W. R. K.)

KEYNES, John Neville, M.A., D.Sc.; University Lecturer in Moral Science, Cambridge, 1884; Member of the Council of the Senate of the University of Cambridge; author of 'Studies and Exercises in Formal Logic,' 'Scope and Method of Political Economy.' (J. N. K.)

KHNOPFF, Fernand: chevalier de l'ordre de Leopold, de St Michel de Bavière; Vice-Pres. de Cercle artistique et littéraire de Bruxelles, etc. (F. K*.)

KIDD, Benjamin; formerly of Inland Revenue Department; author of 'Social Evolution,' 1894 (translations: German, 1895; Swedish, 1895; French, 1896; Russian, 1897; Italian, 1898; Czech, 1900; Danish, 1900); The Control of the Tropics, 1898. (B. K*.)

KIRK, Edward C., D.D.S.; Dean of the Department of Dentistry, and Professor of Clinical Dentistry, University of Pennsylvania; Member of the National Dental Association and the American Academy of Dental Science; editor of 'The American Text-book of Operative Dentistry,' and of 'The Dental Cosmos' Magazine. (E. C. K.)

KNIGHT, Major John G. D., Corps of Engineers, U.S.A., A.M.; Commandant U.S. Engineer School; in charge of U.S. Engineer Depot, 1895-1901, of Torpedo Defence, E. entrance N.Y. Harbour, 1898-1901; on Board of U.S. Torpedo System, 1896-1901. (J. G. D. K.)

KNOTT, Cargill Gilston, D.Sc.; Lecturer on Applied Mathematics, Edinburgh University; Assistant to Professor of Natural Philosophy, Edinburgh University, 1879-83; Prof. of Physics, Imperial University, Japan, 1883-91; conducted Magnetic Survey of Japan, 1887; awarded Keith Prize (Roy. Soc. Edin.) for work on magnetic strains, 1897; author of 'Ice,' 'Pneumatics,' in Ninth Edition of 'Ency. Brit.,' 'Physics,' etc. (C. G. K.)

KNOWLING, Richard John, D.D.; Professor of New Testament Exegesis in King's College, London, 1894; Fellow, 1899; Examiner for Hall-Houghton Prizes at Oxford, 1897, and in Theology at Durham, 1895-96; Select Preacher at Cambridge, 1895; author of 'Witness of the Epistles,' 'Acts of the Apostles,' etc. (R. J. K*.)

KOREN, John; author of 'Economic Aspects of the Liquor Problem,' etc. (J. K.)

KRAUS, Professor Dr F. X., the late; Professor of Ecclesiastical History at the University of Freiburg in Bresigau. (F. X. K.)

KROPOTKIN, Prince Peter Alexeivitch; Gold Medal of Russian Geographical Society, 1864; crossed North Manchuria from Transbaikalia to the Amur, 1864; Secretary to Physical Geography Section of Geographical Society; author of 'Lithuanians,' 'Nijni-Novgorod,' 'Nova Zembla,' 'Poland,' 'Siberia,' 'Tomsk,' 'Warsaw,' etc., in Ninth Edition of 'Ency. Brit.,' 'General Sketch of the Orography of East Siberia,' 'In Russian and French Prisons,' 'Recent Science in Nineteenth Century,' 'The State, its Part in History,' 'Memoirs of a Revolutionist.' (P. A. K.)

L

LABBE, Alphonse, Docteur ès sciences; chief of the Laboratory of Zoology, University of Paris; author of 'La Cytologie expérimentale,' 'Recherches zoologiques et biologiques sur les parasites du sang des vertèbres,' etc. (A. L*.)

LAMB, Horace, M.A., LL.D., F.R.S.; Chairman of Convocation, and of the General Board of Studies, Victoria University; Professor of Mathematics, Owens Coll., Victoria Univ., Manchester; member of Council of the Royal Society, 1894-96; President of the Manchester Literary and Philosophical Society, 1899-1901; Fellow and Assistant Tutor, Trinity Coll., Camb., 1872-75; Professor of Mathematics, University of Adelaide, 1875-85; author of 'Motion of Fluids,' 'Hydrodynamics,' 'Infinitesimal Calculus.' (H. Lb.)

LANE-POOLE, Stanley, M.A., Litt.D.; Professor of Arabic at Trin. Coll. Dublin; employed in Coin Department of British Museum, 1874-92; sent by Government on archæological missions to Egypt, 1883, and Russia, 1886; employed by Egyptian Government on archæological research at Cairo, 1895-97; corr. member of the Imperial Russian Archæological Society; lecturer at the Royal Institution, 1900; author of 'Catalogue of the Oriental andIndian Coins in the British Museum,' 'Lord Stratford de Redcliffe,' 'E. W. Lane,' 'Saladin,' 'Histories of the Moors in Spain,' 'Turkey,' 'The Barbary Corsairs,' 'The Mahommedan Dynasties,' 'The Mogul Emperors,' 'Egypt in the Middle Ages,' 'Egypt,' 'The Art of the Saracens of Egypt,' 'Cairo,' etc., edited 'Lane's Arabic Lexicon,' 'Arabian Society in the Middle Ages,' 'Life of General Chesney.' (S. L.-P.)

LANESSAN, J. M. A. de; Agr. de la faculté de Médicine; French Minister of Marine; formerly Governor-General of Indo-China; author of 'La Tunisie,' 'L'expansion coloniale de la France,' 'L'Indo-Chine française,' 'Du Protoplasme végétal,' 'La Matière, la Vie et les êtres vivants.' (J. M. A. de L.)

LANG, Andrew, M.A., LL.D.; Hon. Fellow of Merton Coll., Oxford; author of 'Apparitions,' 'Ballad,' 'Family,' 'Molière,' in Ninth Edition of 'Ency. Brit.,' 'Oxford,' 'Helen of Troy,' 'Custom and Myth,' 'Myth, Ritual, and Religion,' 'Life, Letters, and Diaries of Sir Stafford Northcote,' 'Pickle the Spy,' 'The Book of Dreams and Ghosts,' Translations of 'Odyssey' (with Professor Butcher), and 'Iliad' (with Myers and Walter Leaf); 'The World's Desire' (with Rider Haggard), 'The Making of Religion,' 'The Companions of Pickle,' 'A History of Scotland from the Roman Occupation,' 'Prince Charles Edward,' 'Magic and Religion,' 'The Mystery of Mary Stuart,' etc. (A. L.)

LANG, W. H., M.B., D.Sc.; lecturer in botany, Queen Margaret's Coll., Glasgow; author of 'Memoirs on Morphology,' 'The Development of the Higher Cryptogams,' etc. (W. H. L.)

LANKESTER, Edwin Ray, M.A., LL.D., F.R.S.; Hon. Fellow of Exeter Coll., Oxford; Correspondent of the Institute of France; Director of the Natural History Department of the British Museum; Fullerian Professor of Physiology and Comparative Anatomy in the Royal Institution of London, 1898-1900; Fellow and Lecturer, Exeter Coll., 1872; Professor of Zoology and Compar. Anat. Univ. Coll., London, 1874-90; Regius Professor Natural History, Edinburgh, 1882; Linacre Professor of Comparative Anatomy, Oxford, 1891-1898; Royal Medallist Royal Society, 1885; Vice-President Royal Society, 1896; Founder (1884), President (1892) Marine Biological Association (Plymouth Laboratory); Correspondent of the Institute of France; Corr. Mem. Imp. Acad. Sciences, St Petersburg; For. Mem. Royal Bohemian Society of Sciences, of the New York Academy of Sciences, of the Academy of the Lincei of Rome, of the Royal Belgian Academy, and of the Academy of Sciences of Philadelphia; editor since 1869 of 'Quarterly Journal of Microscopical Science'; author of 'Hydrozoa,' 'Mollusca,' 'Mussel,' 'Polyzoa,' 'Protozoa,' 'Vertebrata,' 'Zoology,' in Ninth Edition of 'Ency. Brit.,' 'A Monograph of Cephalaspidian Fishes,' 'Comparative Longevity,' 'Developmental History of the Mollusca,' 'Degeneration,' 'The Advancement of Science,' 'Zoological Articles'; joint-editor of 'Scientific Memoirs of Thomas Henry Huxley.' (E. R. L.)

LARMOR, Joseph, M.A., D.Sc., Sec. R.S.; Fellow of St John's Coll., Camb.; University Lecturer in Mathematics; Professor of Natural Philosophy, Queen's Coll., Galway, and in the Queen's University in Ireland, 1880-1885, and formerly Fellow of the Royal University; Examiner in Mathematics and Natural Philosophy in the Univ. of London; lately President of the Cambridge Philosophical Society; Treasurer of the London Mathematical Society; author of 'Æther and Matter,' and various Memoirs on Mathematics and Physics. (J. L*.)

LAUGHTON, John Knox, M.A.; Professor Modern History, King's Coll., London; Secretary of the Navy Records Society; served in Baltic during the Russian War, 1854-55; in China, 1856-59; afterwards in Mediterranean and Channel; Mathematical and Naval Instructor, Royal Naval College, Portsmouth, 1866-73; also at Greenwich, and lecturer on Meteorology, 1873-85; Pres. R. Met. Soc. 1882-1884; Honorary Fellow, Caius College, Cambridge, 1895; author of 'Farragut,' 'Fitzroy,' in Ninth Edition of 'Ency. Brit.,' 'Physical Geography in its Relation to the Prevailing Winds and Currents,' 'Studies in Naval History,' 'Nelson and his Companions in Arms,' 'Life of Henry Reeve,' 'Sea Fights and Adventures,' 'Letters and Despatches of Lord Nelson,' 'Defeat of the Spanish Armada.' (J. K. L.)

LAWRENCE, Rt. Rev. William, D.D., S.T.D.; Bishop of Massachusetts; sometime Professor of Homiletics and Pastoral Theology, and Dean Episcopal Theological School, Cambridge, U.S.A.; author of 'Life of Amos A. Lawrence,' 'Proportional Representation in the House of Clerical and Lay Delegates,' 'Visions and Service.' (W. L.)

LAYARD, George S.; English art writer; author of 'Charles Keene,' 'Mrs Lynn Linton,' 'Portraits of Cruikshank by Himself,' 'Tennyson and his Pre-Raphaelite Illustrators,' etc. (G. S. L.)

LECLÈRE, Léon; Professor of Universal History and History of Philosophy, University of Brussels. (L. L.)

LEE, Sidney, B.A., Litt.D.; editor of Dictionary of National Biography and Supplement; Clark Lecturer in English Literature, Trin. Coll., Cambridge, 1901; author of 'Stratford-on-Avon from the Earliest Times to the Death of Shakespeare,' 'Lord Herbert of Cherbury's Autobiography, with a continuation of his Life,' 'A Life of William Shakespeare.' (S. L.)

LEE-WARNER, Sir William, K.C.S.I., M.A.; Secretary in the Political and Secret Departments of the India Office; Fellow of the University of Bombay; entered Indian Civil Service, 1869; political agent at Kolhapur; Under-Secretary in Foreign Office of India; Secretary to the Government of Bombay in Political and Judicial Departments; Chief Commissioner of Coorg and Resident in Mysore; additional member of the Viceroy's Council; served on Education Commission, the Financial Commission, etc.; author of 'The Protected Princes of India,' 'The Citizen of India.' (W. L.-W.)

LEGGE, J. G.; Chief Inspector of Reformatory and Industrial Schools, Home Office. (J. G. L.)

LEGGE, Robin H.; editor of 'Music in the Nineteenth Century.' (R. H. L.)

LEONARD, Rt. Rev. Abiel, A.M., S.T.D.; Bishop of the Diocese of Salt Lake. (A. Le.)

LEVEY, George Collins, C.M.G.; London Correspondent of 'Melbourne Age'; editor and proprietor of 'Melbourne Herald,' 1863-68; editor and contributor to 'Melbourne Age,' 1869-81; Secretary to Commissioners for Victoria at the Exhibitions in London, Paris, Vienna, Philadelphia, Melbourne, 1873, 1876, 1878, 1880-81; Executive Commissioner, Amsterdam, 1883; Secretary Royal Commission, Hobart Exhibition, 1894-95; Secretary Colonial Adelaide Exhibition, 1887; Committee of Royal Commission to Paris Exhibition, 1900; member of Board of Advice to Agent-General of Victoria; author of 'Handbook to Australasia,' 'Australian Encyclopædia.' (G. C. L.)

LEWES, Vivian B., F.I.C., F.C.S.; Professor of Chemistry, Royal Naval College; Chief Superintending Gas Examiner to the Corporation of the City of London. (V. B. L.)

LEWIS, Charlton T., Ph.D.; President N.Y. Prison Association, N.J. State Charities Aid Association; Chairman of Commission to revise Penal Laws of New Jersey; Lecturer on Life Insurance, Harvard and Columbia Universities, and on Principles of Insurance, Cornell University; author of 'History of Germany,' Essays, Addresses, etc. (C. T. L.)

LEYLAND, John; writer on naval questions. (J. Ld.)

LIAS, Rev. John James, M.A.; Professor of Modern Literature, St David's Coll., Lampeter, 1871-1880; examining chaplain to Bishop of Llandaff, 1887-98; Chancellor of Llandaff Cathedral; author of 'Science in Relation to Miracles,' 'The Nicene Creed,' 'A Plea for Rationality in Ceremonial,' etc. (J. J. L*.)

LIDDELL, F. F., M.A.; Fellow of All Souls College, Oxford; Barrister, Lincoln's Inn; editor of 'Manual of Military Laws.' (F. F. L.)

LIGHTFOOT, T. B., M.I.C.E., M.I.M.E.; author of 'The Mechanical Refrigeration of Air,' 'Preservation of Foods by Cold,' etc. (T. B. L.)

LILLIE, Arthur; champion Grand National Croquet Club, 1872; author of 'Croquet,' 'Croquet Up to Date,' etc. (A. Li.)

LITTLEJOHN, Henry Harvey, M.B., B.Sc., F.R.C.S. Ed.; Lecturer in Medical Jurisprudence, School of Medicine of the Royal College of Physicians and Surgeons of Edinburgh. (H. H. L.)

LLOYD, Lt.-Col. E. M., R.E.; author of 'Vauban, Montalembert, Carnot: Engineer Studies,' etc. (E. M. L.)

LLOYD, Henry Demarest, author of 'Wealth against Commonwealth,' 'Labor Co-partnership,' etc. (H. D. L*.)

LOCH, Charles Stewart, B.A.; Secretary to the Council of the London Charity Organization Society since 1875; Member Royal Commission on Aged Poor, 1893-95; Dunkin Trust Lecturer, Manchester College, Oxford, 1896; Vice-President Royal Statistical Society, 1894, 1895, 1897, 1901; author of 'Charity Organization,' 'Old Age Pensions and Pauperism.' (C. S. L.)

LOCOCK, Col. Herbert, C.B.; retired Colonel of Royal Engineers; Assist. Director of Works at Headquarters, 1881-86; Depy. Inspector-General of Fortifications at Headquarters, 1887-96. (H. Lo.)

LODGE, Oliver Joseph, F.R.S., D.Sc., LL.D.; Principal of the University of Birmingham; Professor of Physics, University Coll., Liverpool, 1881-1900; author of 'Elementary Mechanics,' 'Modern Views of Electricity,' 'Pioneers of Science,' 'Signalling without Wires,' etc. (O. J. L.)

LORD, J. K., Professor of the Latin Language and Literature, Dartmouth College,

N.H.; author of 'New Hampshire' in Ninth Edition of 'Ency. Brit.' (J. K. L*.)

LOUIS, Prof. Henry, The Durham College of Science, Newcastle-upon-Tyne, England; author of 'A Handbook of Gold Milling,' etc. (H. L*.)

LOUIS, Paul; French statistician; staff of the 'Revue Blanche.' (P. L.)

LOVE, Augustus E. H., M.A., F.R.S.; Sedleian Professor of Natural Philosophy, Oxford, since 1899; Fellow of St John's Coll., Camb.; University Lecturer in Mathematics. (A. E. H. L.)

LOW, A. P.; of the Geological Survey of Canada; author of 'Report on the Exploration of the Labrador Peninsula,' etc. (A. P. Lo.)

LOW, Hon. Seth, LL.D.; Mayor of New York City; formerly President of Columbia University; Mayor of Brooklyn, 1881-85; President of the Archæological Institution of America. (S. L*.)

LOW, Sidney James, M.A., L.C.C.; Lecturer on History, King's College, 1883-86; editor of the 'St James's Gazette,' 1888-97; co-editor of the 'Dictionary of English History'; author of contributions to 'Nineteenth Century,' 'Fortnightly Review,' 'National Review,' etc. (S. J. L.)

LOWE, Major F. M., R.A.; Senior Experimental Officer, Shoeburyness, 1884; Asst. Inspector, Army Inspection Dept., 1888; Gunnery Instructor, Brit. N. America, 1893; Gunnery Instructor, Coast Defence School, and Asst. Superintendent of Experiments at Shoeburyness. (F. M. L*.)

LUGARD, Brig.-Gen. Sir Frederick John Dealtry, K.C.M.G., C.B., D.S.O.; High Commissioner of Northern Nigeria; served Afghan War, 1879-1880; Soudan Campaign, 1885; Burma Campaign, 1886-1887; commanded expedition against slave traders on Lake Nyassa, 1888; employed by British East African Company; in command of Exploration of the Sabakhi, and Administrator of Uganda, 1889-92; employed by Royal Niger Company, 1894-95; West Charterland, 1896-97; H.M. Commissioner Hinterland of Nigeria and Lagos, 1897-99; Commandant of West African Frontier Force, 1897-99; author of 'Our East African Empire.' (F. D. L.)

LUMMIS, Charles Fletcher, editor of the 'Land of Sunshine' magazine, Los Angeles, California; author of 'The Right Hand of the Continent' (California), and numerous publications dealing with the western and south-western States; formerly editor of the Los Angeles 'Daily Times.' (C. F. L.)

LUNGE, George, Ph.D.; Professor of Technical Chemistry at the Polytechnic, Zürich; author of 'Acid and Alkali Manufacture,' etc. (G. L.)

LUSHINGTON, Sir Franklin, M.A., the late; Chief Police Magistrate for London; author of 'Wagers of Battle.' (F. L*.)

LYALL, Sir Alfred Comyn, K.C.B., G.C.I.E., Hon. D.C.L. Oxford, and LL.D. Cambridge; Member of Council of Secretary of State for India since 1888; Lieut.-Gov. North-West Provinces, India, 1882-87; author of 'British Dominion in India,' 'Asiatic Studies,' 'Life of Warren Hastings.' (A. C. L.)

LYDEKKER, Richard, B.A., F.R.S., F.G.S., F.Z.S.; Geological Survey of India, 1874-82; author of 'Geology of Kashmir,' 'Catalogues of Fossil Mammals, Reptiles, and Birds in British Museum,' 'Phases of Animal Life,' 'Royal Natural History,' 'A Manual of Palæontology' (with late Professor A. Nicholson), 'The Great and Small Game of Europe, N. and W. Asia, and America,' 'Descriptions of South American Fossil Animals.' (R. L*.)

LYNES, G. B., A.M.; sub-editor of the New Volumes of 'Ency. Brit.'; formerly literary editor of the 'Baltimore News,' and instructor in History and Acting Librarian, Union College, Schenectady, N.Y.; author of 'A Course in Modern European History,' etc. (G. B. L.)

LYONS, H. G.; Major R.E.; Director of the Survey Department, Egypt; editor of 'A Handbook of Travellers in Egypt;' author of 'Report on the Island and Temples of Philæ,' etc. (H. G. L.)

M

MACALISTER, Alexander, M.A., M.D., D.Sc., LL.D., F.R.S., F.S.A.; Member of Senate of Royal University of Ireland; Professor of Anatomy, Cambridge University, since 1883; Fellow of St John's College; Professor of Zoology, University of Dublin, 1869; Professor of Anatomy and Chirurgery, Dublin, 1877; author of 'Phrenology,' 'Physiognomy,' 'Stigmatization,' in Ninth Edition of 'Ency. Brit.,' 'Introduction to Animal Morphology,' 'Morphology of Vertebrate Animals,' 'Text-Book of Human Anatomy,' etc. (A. MA.)

MacALISTER, Donald, M.A., M.D., B.Sc., F.R.C.P., Fellow and Senior Tutor of St John's Coll., Camb.; University Lecturer in Medicine; Physician to Addenbrooke's Hospital; Univ. Memb. and Business Chairman General Medical Council; Chairman of British Pharmacopœia Committee; Examiner in Medicine, Univ. Birmingham, and R. Coll. Physicians, London; Hon. President International Congress of Hygiene, Madrid, 1898; Lecturer in Natural Philosophy, St Bartholomew's Hospital, 1879; Goulstonian Lecturer, Royal College of Physicians, 1887; first Croonian Professor, 1888; Thomson Lecturer, Aberdeen, 1889; Examiner Victoria Univ. 1896-98; author of 'Ziegler's Pathological Anatomy,' 'Nature of Fever,' 'Advanced Study and Research in Cambridge,' 'The Practitioner' (with editorial committee), 'The British Pharmacopœia,' etc. (D. M*.)

MACAULAY, W. H., M.A.; Fellow and Lecturer of King's Coll., Cambridge; late University Lecturer in Applied Mechanics, Cambridge. (W. H. M.)

MacCOLL, D. S., M.A.; painter; art critic of the 'Saturday Review.' (D. S. M.)

MacCORMAC, Sir William, Bt., the late; President of the Royal College of Surgeons, 1896-1901; Serjeant-Surgeon to King Edward VII. (W. MAC C.)

MACDONELL, John, C.B., LL.D.; Master of the Supreme Court; author of 'The Law of Master and Servant,' etc. (J. M†.)

MACFARLANE, J.; formerly assistant, British Museum. (J. M'F.)

MACGREGOR, Sir William, K.C.M.G., C.B., M.D. Aberdeen, B.Sc. Camb., LL.D. Aberdeen; Governor of Lagos; Resident Surgeon and Resident Physician Glasgow Royal Infirmary, and Royal Lunatic Asylum, Aberdeen; Assistant Government Medical Officer, Seychelles, 1873; Surgeon Civil Hospital, Port Louis, Mauritius, 1874; Chief Medical Officer, Fiji, 1875; late Receiver-General and Administrator of the Government, and Acting High Commissioner and Consul-General for the Western Pacific; Administrator of British New Guinea, 1888; Lieut.-Governor, 1895. (W. M'G.)

MACKAY, Rev. G. F. (G. F. M*.)

MACKAY, T.; author of 'Methods of Social Reform.' (T. M*.)

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MACMAHON, Major Percy Alexander, R.A., Sc.D., F.R.S.; Professor of Artillery, Woolwich; President of London Mathematical Society, 1894-96; accompanied Government Expedition to observe eclipse of sun, Norway, 1896; author of numerous papers on Pure Mathematics, etc. (P. A. M.)

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MACMORRAN, Alexander, K.C., A.M.I.C.E.; became editor of 'Justice of the Peace,' 1879, and has so continued; author of editions of 'Lumley's Public Health,' works on 'The Public Health (London) Act, 1891,' the 'Local Government Act, 1888,' the 'Local Government Act, 1894,' the 'London Government Act, 1899,' 'Poor Law Orders,' 'Poor Law Statutes,' etc. (A. M'M.)

MAC MUNN, Charles Alexander, M.A. M.D., F.C.S., F.R.M.S.; Hon. Pathologist and Physician, Wolverhampton General Hospital; author of 'The Spectroscope in Medicine,' 'Outlines of Clinical Chemistry,' etc. (C. A. MAC M.)

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MacWILLIAM, Robert, Professor at Gill Coll., Somerset East, Cape Colony. (R. M'W.)

MAGNUS, Sir Philip; Superintendent of Technological Examinations and Secretary of Examinations Department, City and Guilds of London Institute; organising Director and Secretary of City and Guilds of London Institute, 1880-88; member Royal Commission on Technical Instruction, 1881-84; is Member of the Senate and Fellow of the London University; Vice-President and Fellow of College of Preceptors; Member of the Mathematical and Physical Societies; author of 'Technical Education' in Ninth Edition of 'Ency. Brit.,' 'Lessons in Elementary Mechanics,' 'Hydrostatics and Pneumatics,' 'Industrial Education.' (P. M*.)

MAITLAND, Frederic William, LL.D., D.C.L. (Oxford, Glasgow, Cracow); Professor of English Law, Cambridge; Reader of English Law at Cambridge, 1884; Corresponding Member of Roy. Prussian Academy; author of 'Justice and Police,' 'Bracton's Note-Book,' 'History of English Law' (with Sir F. Pollock), 'Domesday Book and Beyond,' 'Township and Borough,' 'Canon Law in England,' etc. (F. W. M.)

MAITLAND, J. A. Fuller, M.A., F.S.A.; musical critic of 'The Times'; author of 'Life of Robert Schumann,' 'Masters of German Music,' 'The Musician's Pilgrimage,' Spitta's 'Life of Bach' (joint-translation with Mrs C. Bell); edited the Appendix to Grove's 'Dictionary of Music and Musicians,' 'English County Songs' (with Miss L. E. Broadwood), 'The Fitzwilliam Virginal Book' (with W. B. Squire). (J. A. F. M.)

MANSON, Edward; Barrister, Middle Temple; author of 'Law of Trading Companies,' 'The Law of Debentures and Debenture Stock,' 'Practical Guide to Company Law,' etc. (E. MA.)

MANSON, James Alexander; sub-editor of the New Volumes of the 'Ency. Brit.'; dramatic critic, 'Weekly Dispatch,' 1890-92; literary editor of the 'Daily Chronicle,' 1891; author of 'In Memoriam edition of Burns's Poetical Works,' 'Valour for Victoria,' 'Sir Edwin Landseer' (Makers of British Art Series), etc. (J. A. M.)

MARKBY, Sir William, K.C.I.E., D.C.L.; Fellow of All Souls College, Oxford, and of Balliol College; judge of High Court, Calcutta, 1866-78; Reader in Indian Law, Oxford, 1878-1900; author of 'Lectures on Indian Law,' 'Elements of Law considered with Reference to General Principles of Jurisprudence.' (W. MA.)

MARKHAM, Sir Clements Robert, K.C.B., F.R.S.; President of the Royal Geographical Society, of the International Geographical Congress, 1894-99, and of the Hakluyt Society, and of the Geographical, Elizabethan, and Royal Society Clubs; entered the Navy in 1844; served in the Arctic Expedition of 1850-51; geographer to the Abyssinian Expedition; Assistant Secretary in the India Office, 1867-77; author of 'Geography' (historical), 'Peru,' 'Polar Regions,' in Ninth Edition of 'Ency. Brit.'; 'Life of the Great Lord Fairfax,' 'The Fighting Veres,' 'History of Peru,' 'History of Persia,' 'History of the Abyssinian Expedition,' Lives of Columbus, John Davis, and Major Rennell, 'The Paladins of Edwin the Great'; edited volumes for the Hakluyt Society, the Navy Records Society, the Roxburghe Club, etc. (C. R. M.)

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MARTEL, Major C. P., R.A.; Sec. to the Ordnance Committee; late Professor of Artillery, Ordnance Coll. (C. P. M.)

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MARZIALS, Frank Thomas; Accountant-General of the Army since 1898; entered War Office during Crimean war; author of 'Lives of Dickens and Victor Hugo,' collaborating also in the 'Life of Thackeray,' 'Life of Gambetta,' etc. (F. T. M.)

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MATHEWS, George Ballard, M.A., F.R.S.; late Professor of Mathematics, University Coll. of Wales; formerly Fellow of St John's Coll., Cambridge; author of 'A Treatise on Bessel Functions' (part), 'Theory of Numbers,' etc. (G. B. M.)

MATTHEWS, Brander, LL.B., D.C.L., A.M.; Professor of English, Columbia University; author of 'French Dramatists of the Nineteenth Century,' 'Introduction to the Study of American Literature,' 'Aspects of Fiction and Other Ventures in Criticism,' etc. (B. M.)

MATTHEWS, George Edward, A.B.; editor of 'The Buffalo Express,' Buffalo, N.Y. (G. E. M.)

MAURICE, Maj.-Gen. Sir John Frederick, K.C.B.; commanded Woolwich District, 1895-1901; Ashanti Campaign, 1873-74; South Africa, 1879; Zulu Campaign, 1880; Egyptian Expedition, 1882; Intelligence Dept. War Office; Sudan, 1884; A.Q.M.G.; Nile, 1885; Professor of Military History, Staff College, Aldershot, 1892-93; commanding R.A., Colchester, 1893-95; Maj.-Gen., Dec. 1895; author of 'War,' in Ninth Edition of 'Ency. Brit.,' 'Life of Frederick Denison Maurice,' 'Hostilities without Declaration of War,' 'Balance of Military Power in Europe,' 'War,' 'National Defences.' (J. F. M*.)

MAUS, Octave; editor of 'L'Art Moderne,' Brussels. (O. M*.)

MAXWELL, William H., A.M.I.C.E.; Borough and Waterworks Engineer, Tunbridge Wells Corporation; author of 'The Removal and Disposal of Town Refuse,' 'Destructors and Steam Production,' etc. (W. H. Ma.)

MAYO-SMITH, Richmond, Ph.D., the late; Professor of Political Economy, Columbia University, New York; author of 'Emigration and Immigration,' 'Sociology and Statistics,' etc. (R. M.-S.)

MEAD, Hon. Elwood; in charge of Irrigation Investigations, U.S. Department of Agriculture. (E. M*.)

MEAKIN, Budgett, author of 'The Moorish Empire,' etc. (B. M*.)

MEISSAS, Gaston; memb. Société de Géographie; author of 'Marseilles,' and (part) of 'Paris,' in the Ninth Edition of the 'Ency. Brit.,' 'Grands Voyageurs de notre Siècle,' etc. (G. Me.)

MERCATELLI, Luigi, late war correspondent in Abyssinia of 'La Tribuna.' (L. Me.)

MERRIFIELD, Webster, LL.D.; President and Professor of Political Economy, State University of North Dakota. (W. Ms.)

MERRILL, Hon. Frederick James Hamilton, Ph.D.; Director of N.Y. State Museum, Albany, N.Y., N.Y. State Geologist; Fellow Am. Ass. Adv. Science and Geol. Soc. of America; Member Am. Inst. Mining Engineers, Am. Soc. of Naturalists, Nat. Geol. Soc., etc. (F. J. H. M.)

MIDDLETON, R. E., M.I.C.E., M.I.M.E.; Fellow of the Sanitary Inst., Fellow of Surveyors' Inst., etc.; late Engineer-in-Charge of Surveying of Forth Bridge; Instructor in Surveying, Central Tech. Coll., S. Kensington; Lecturer on Waterworks, Engineering and Sewage, Univ. Coll., London; part author of 'A Treatise on Surveying,' etc. (R. E. M.)

MIJATOVICH, Chedomille; Senator of the kingdom of Servia since 1875; Envoy Extraordinary and Minister Plenipotentiary of the King of Servia to the Court of St James, 1895-1900; transferred to Constantinople, 1900; Minister of Finance and Commerce of Servia, 1873; Minister of Foreign Affairs and Finance, 1880; Servian Minister to the Court of St James, 1884; Servian Plenipotentiary for the conclusion of peace with Bulgaria, 1886; Member of Royal Servian Academy of Science; corresponding member of South Slavonic Academy; hon. member of Royal Hist. Soc. London; author of several publications in Servian on Political Economy, Finances, History of Commerce, and History of Servia in Fifteenth Century; novels—'Rayko of Rassina,' 'Ikoniya, the Mother of the Vezier, etc.,' 'Constantine the last Emperor of the Greeks,' 'Ancestors of the House of Orange.' (C. Mi.)

MILL, Hugh Robert, D.Sc. (Edin.), LL.D. (St Andrews), F.R.S.G.S., F.R.G.S., F.R.Met.Soc.; Director of British Rainfall Organization, and editor of 'Symons' Meteorological Magazine' since 1901; Hon. Corresponding Member of the Geographical Societies of Paris, Berlin, Amsterdam, Budapest, Brisbane, and Philadelphia; Recorder of Section E, British Association, 1893-99; President, Section E, 1901; British Delegate to International Conference on the Exploration of the Sea, at Christiania, 1901; author of 'Rainband,' 'Rain-gauge,' 'Thermometer,' 'Whirlpool,' in Ninth Edition of 'Ency. Brit.,' 'Realm of Nature,' 'The Clyde Sea Area,' 'The English Lakes,' 'Hints on the Choice of Geographical Books,' 'New Lands,' 'The International Geography,' etc. (H. R. M.)

MILLINGEN, Alexander Van, M.A.; Robert College, Constantinople; author of 'Byzantine Constantinople,' etc. (A. van M.)

MILMAN, Sir Archibald John Scott, K.C.B., the late; Clerk of the House of Commons 1900, retired 1902; entered service of House of Commons in 1857; promoted Second Clerk Assistant, 1870; Clerk Assistant, 1886-1900. (A. J. S. M.)

MILNE, John, F.R.S., F.G.S.; twenty years employed by Japanese Govt. as geologist and mining engineer; established the Seismic Survey of Japan; designer of seismographs and instruments to record vibrations on railways, etc.; author of 'Earthquakes,' 'Seismology,' 'Crystallography,' etc. (J. Mi.)

MILTON, James Tayler, M.I.C.E.; Chief Engineer Surveyor, Lloyd's Register of Shipping; Member of Inst. of Naval Architects and of the Iron and Steel Inst., etc. (J. T. Mi.)

MINCHIN, E. A., M.A., F.Z.S.; Jodrell Professor of Zoology and Comparative Anatomy, Univ. Coll., London; late Fellow of Merton Coll., Oxford; late Lecturer Comp. Anatomy, Oxford; late Lecturer in Biology, Guy's Hospital; author of 'Sponges,' etc. (E. A. M.)

MITCHELL, Hugh; of Gibraltar; Barrister-at-Law, Inner Temple. (H. M*.)

MITCHELL, Peter Chalmers, D.Sc., M.A., F.Z.S.; Lecturer on Biology at the London Hospital Medical College; University Demonstrator in Comparative Anatomy, and assistant to Linacre Professor at Oxford, 1888-91; Lecturer on Biology at Charing Cross Hospital, 1892-94; at London Hospital, 1894; examiner in Biology to the R.C.P. 1892-96; author of 'Outlines of Biology,' 'The Biological Problem of To-day' (translated), 'Thomas Henry Huxley,' etc. (P. C. M.)

MONCKTON, Lionel; composer, and musical critic to the 'Daily Telegraph.' (L. M.)

MONCRIEFF, Sir Colin Campbell Scott, K.C.M.G., C.S.I., LL.D.; Under-Secretary for Scotland; Irrigation Depart. N.W. Provinces; Chief Engineer, Burmah; Under-Secretary of State Public Works, Memshy, Cairo, 1883-92; author of 'Irrigation in Southern Europe.' (C. S. M.)

MONKHOUSE, William Cosmo, the late Assistant Secretary (Finance) Board of Trade; served on several Departmental Committees and Committee on the Mercantile Marine Fund, 1894-96; author of 'The Christ upon the Hill,' 'A Question of Honour,' 'The Earlier English Water-Colour Painters,' 'The Italian Pre-Raphaelites,' 'British Contemporary Artists,' etc. (C. Mo.)

MONTAGU, Sir Samuel; head of the banking firm of Samuel Montagu and Co., London; member of Gold and Silver Commission, 1887-90; author of magazine articles on Finance, Decimal Currency, Weights and Measures, etc. (S. M.)

MOORE, A. W., M.A.; Speaker of the House of Keys, Isle of Man. (A. W. M.)

MOORE, Hon. John Bassett, LL.D.; Professor International Law and Diplomacy, Columbia University, New York; author 'Extradition and Inter-State Rendition,' 'International Arbitrations,' etc. (J. B. M*.)

MORENO, Dr Francesco P.; donor and director of the La Plata Museum, Buenos Aires; repr. in Great Britain of the Argentine in connexion with Chilian Argentine Boundary Dispute; author of 'La Plata,' etc. (F. P. M.)

MORFILL, William Richard, M.A.; Professor of Russian and the other Slavonic languages, Oxford; Curator of the Taylor Institution, Oxford; author of 'Russia' (History and Literature) in Ninth Edition of 'Ency. Brit.' (W. R. M.)

MORSE, John Torrey, Jr.; sometime Lecturer on History, Harvard University; author of biographies of Alexander Hamilton, Abraham Lincoln, John Quincy Adams, Thomas Jefferson, etc., and of 'The Life and Letters of Oliver Wendell Holmes.' (J. T. Mo.)

MORTON, Hon. Julius Sterling (the late); sometime U.S. Secretary of Agriculture and President of Nebraska State Historical Society. (J. S. M*.)

MOSCA, Gaetano; Professor of Constitutional Law, Turin, Italy. (G. Mo.)

MOSCHINI, V.; Mayor of Padua. (V. Mo.)

MOTT, Frederick Walker, M.D., B.S. Lond., F.R.C.P., F.R.S.; Physician to Out-Patients, Charing Cross Hospital; Pathologist to the London County Asylums; Croonian Lecturer, Royal College of Physicians, 1900. (F. W. Mo.)

MUIR, John, A.M., LL.D.; U.S. Explorer and Naturalist; discoverer of the Muir glacier, Alaska; author of 'The Mountains of California' and of numerous articles on the natural history of the Pacific Coast, Alaska, etc.; Editor 'Picturesque California.' (J. Mu*.)

MUIR, Robert, M.A., M.D., C.M.; Professor of Pathology, University of Glasgow; Examiner in Pathology, Oxford; senior assistant to the Prof. of Pathology, Edinburgh, and Pathologist to Edinburgh Royal Infirmary, 1892; Lecturer on Pathological Bacteriology, Edinburgh, 1894; Professor of Pathology, St Andrews, 1898-99; author of 'Manual of Bacteriology' (with Dr J. Ritchie), 'Scientific Papers,' etc. (R. M*.)

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MURRAY, Sir George Herbert, K.C.B.; Secretary to the Post Office since 1899; entered Foreign Office, 1873; transferred to Treasury, 1880; private secretary to Mr Gladstone and Earl of Rosebery when Prime Minister; Chairman Board of Inland Revenue, 1897-99. (G. H. M.)

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N

NAIRNE, Rev. Alexander, M.A.; Professor of Hebrew and Old Testament Exegesis in King's Coll., Lond.; Fellow of Jesus Coll., Cambridge, 1887-93; Vice-Principal of Clergy Training School, 1887-89. (A. N*.)

NANSEN, Fridtjof, D.Sc., LL.D., D.C.L., Ph.D.; went to Greenland Sea, 1882; curator in Natural History Museum, Bergen; went across Greenland, 1888-89; curator Museum of Comparative Anatomy, Christiania University; made his North Pole Expedition, in which he reached the highest latitude until then attained (86 deg. 175 m.), 1893-96; Prof. of Zoology, Christiania University; author of 'Across Greenland,' 'Eskimo Life,' 'Farthest North,' 'The Norwegian North Polar Expedition,' 'Scientific Results,' etc. (F. N.)

NASH, James Okey, M.A., of the Community of the Resurrection. (J. O. N.)

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NELSON, William Rockhill, Editor-in-Chief of the 'Kansas City Star,' Kansas City, Mo. (W. R. N.)

NEWCOMB, Prof. Simon, Ph.D., LL.D., D.Sc., D. Nat. Phil.; Superintendent U.S. Nautical Almanac; Foreign Mem. Royal Society, London; Assoc. Institute of France, etc.; author of 'Moon' in Ninth Edition of 'Ency. Brit.,' 'Popular Astronomy,' etc.; editor of 'American Journal of Mathematics.' (S. N.)

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NISBET, C. (C. N.)

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O

O'DONOGHUE, Freeman M., F.S.A.; Assistant Keeper of Prints, British Museum; author of 'Catalogue of the Collection of Playing Cards bequeathed to the British Museum by Lady Charlotte Schreiber,' 'A Descriptive and Classified Catalogue of the Portraits of Queen Elizabeth,' etc. (F. M. O'D.)

O'NEILL, Æneas; Assistant Correspondent of 'The Times,' Vienna. (Æ. O'N.)

ORDE-BROWNE, Capt. C., the late; author of 'Armour and its Attack by Artillery,' 'Short Notes on Field Batteries,' 'Ammunition for Rifled Ordnance,' etc. (C. O.-B.)

OWEN, Capt. C. R. B., R.A.; late Professor of Artillery, Ordnance College; Assist. Superintendent, Roy. Carriage Dept., Woolwich Arsenal. (C. R. B. O.)

OWEN, Edmund, M.B. Lond., F.R.C.S.; Senior Surgeon to St Mary's Hospital, London, and Consulting Surgeon to the Children's Hospital, Great Ormond Street; Member of the Council, and late Member of the Court of Examiners of Royal College of Surgeons; Examiner in Surgery at the Universities of Cambridge and of London; Knight of Grace of the Order of St John of Jerusalem; Corresponding Member of the Imperial Medical Military Academy of St Petersburg, of the Canadian Medical Association, and of the Association of American Orthopædic Surgeons; Hon. Surgeon to the Royal Society of Musicians; late President of the Medical Society of London; author of 'A Manual of Anatomy for Senior Students,' 'The Surgical Diseases of Children.' (E. O*.)

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PALGRAVE, Robert Harry Inglis, F.R.S.; editor of 'Economist,' 1877-83; author of 'The Local Taxation of Great Britain and Ireland,' 'Notes on Banking in Great Britain and Ireland, Sweden, Denmark, and Hamburg,' 'An Analysis of the Transactions of the Bank of England for the years 1844-72,' 'Bank Rate in England, France, and Germany, 1844-1878'; editor of 'Dictionary of Political Economy.' (R. H. I. P.)

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PARSONS, William Barclay; Chief Engineer of the Underground Railway, New York City. (W. B. P.)

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PATON, Diarmid Noël, M.D., B.Sc., F.R.C.P. Ed.; Superintendent of Research Laboratory of Royal College of Physicians, Edinburgh, 1889; Lecturer on Physiology, School of Medicine of Royal Colleges, Edinburgh, 1886; Biological Fellow of Edinburgh University, 1884; Member of the Royal Commission on Salmon Fisheries; author of many papers on Physiological subjects. (D. N. P.)

PAUL, Alfred Wallis, C.I.E., B.A.; late Scholar of Wadham College, Oxford; Indian Civil Service (retired): Political Officer Sikkim Expedition; British Commissioner under Anglo-Chinese Convention of 1890; Deputy Commissioner of Darjeeling. (A. W. P.)

PEACH, Capt. E., Indian Staff Corps; author of 'Tactics—Savage Warfare,' etc. (E. P.)

PEARSON, Karl, M.A., LL.B., F.R.S.; Professor of Applied Mathematics and Mechanics, University College, London; Gresham Professor of Geometry, 1892-94; Darwin Medal Royal Society, 1898; author of 'Grammar of Science,' 'Enlarged Grammar of Science,' 'The Chances of Death, and other Studies in Evolution,' 'The Ethic of Freethought,' 'Die Fronica, a History of the Mediæval Portraits of Christ,' etc. (K. P.)

PELSENUR, PAUL, D.Sc. (Brussels); cor. member of the Royal Belgian Academy of Science; member of the Belgian Committee of Mariculture; Professor in the Normal School, Ghent; lecturer, Brussels University; author of 'Introduction à l'Étude des Mollusques,' 'Report on the Pteropoda,' 'The Anatomy of the Deep-Sea Mollusca,' etc. (P. P.)

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PENNELL, Joseph, artist; author of 'A Canterbury Pilgrimage,' 'An Italian Pilgrimage,' 'Two Pilgrims' Progress,' 'Our Sentimental Journey through France and Italy,' 'Pen Drawing and Pen Draughtsmen,' 'Our Journey to the Hebrides,' 'The Stream of Pleasure,' 'The Jew at Home,' 'Play in Provence, 'Modern Illustration,' 'The Illustration of Books, 'The Work of Charles Keene,' 'Lithography and Lithographers.' (J. P*.)

PERSHING, James H., A.B.; Lecturer on International Law in the University of Denver, and Professor of Medical Jurisprudence in Gross Medical College, Denver. (J. H. PE.)

PETERSON, Frederick, Ph.D., M.D.; President New York Neurological Society and President of the Board of Managers of Craig Colony for Epileptics, Chief of Clinic, Department of Neurology, Columbia University. (F. P*.)

PETRIE, William Matthew Flinders, D.C.L., Litt.D., LL.D., Ph.D.; Edwards Professor of Egyptology, University Coll. London; surveying British remains, 1875-80; excavating in Egypt, 1880-1901; author of 'Pyramid,' 'Weights and Measures,' in Ninth Edition of 'Ency. Brit.,' 'Stonehenge,' 'Pyramids and Temples of Gizeh,' 'Season in Egypt,' 'Racial Portraits,' 'Historical Scarabs,' 'Ten Years' Digging,' 'History of Egypt,' 'Tel el Amarna,' 'Egyptian Tales,' 'Decorative Art,' 'Six Temples at Thebes,' 'Religion and Conscience in Ancient Egypt,' 'Syria and Egypt,' 'Royal Tombs of the First Dynasty,' 'Royal Tombs of the Earliest Dynasties,' etc. (W. M. F. P.)

PFEIL, Count Joachim Von, one of the founders of German East Africa; sometime resident in Bismarck Archipelago; author of 'The Founding of the Boer States,' 'Studies and Observations in the South Seas,' etc. (J. VON P.)

PHELAN, Hon. James Duval; Mayor of San Francisco, 1896-1901. (J. D. P.)

PHILLIMORE, George Grenville, M.A., B.C.L.; Barrister-at-Law of the Middle Temple. (G. G. P*.)

PHILLIMORE, Sir Walter George Frank, Bt., D.C.L., LL.D.; Judge of the King's Bench Div.; author of 'Book of Church Law,' 2nd ed. of 'Phillimore's Ecclesiastical Law, 3rd ed. of vol. iv. of 'Phillimore's International Law.' (W. G. F. P.)

PHILLIPS, R. W., M.A., D.Sc., F.L.S.; Professor of Botany in the University Coll. of North Wales; author of 'Memoirs on the Physiology of Plants,' 'Morphology of the Algæ,' etc. (R. W. P.)

PHILLPOTTS, Col. A. H. C., R.A. (A. H. C. P.)

PINCHOT, Gifford, B.A.; Forester of the U.S. Department of Agriculture, Special Lecturer in the Forest School, Yale Univ.; author of 'The White Pine.' (G. P.)

PITMAN, Charles Murray; stroke of the Oxford Eight, 1893-95. Author of articles on Rowing. (C. M. P.)

PITT, Walter, M.I.C.E., M.I.M.E.; Member of the Committee of International Maritime Conference (London), etc. (W. P*.)

POLLEN, John Hungerford, M.A.; Examiner for Art, South Kensington; Fellow of Merton Coll., Oxford; Professor of Fine Arts in Catholic University of Dublin; Cantor Lecturer, Society of Arts, 1885; author of 'Carving,' 'Filigree,' 'Furniture,' in Ninth Edition of 'Ency. Brit.,' 'Ancient and Modern Furniture and Woodwork,' 'Ancient and Modern Gold- and Silver-smiths' Work, 'The Trojan Column,' etc. (J. H. P.)

POLLOCK, Sir Frederick, Bt., LL.D., D.C.L.; Corpus Professor of Jurisprudence, Oxford; editor of the Law Reports from 1895; Fellow Trin. Coll., Camb. 1868; Corresponding member Institute of France, 1894; Professor of Jurisprudence, University Coll., London, 1882-88; Professor of Common Law in the Inns of Court, 1884-90; member Royal Labour Commission, 1891-94; author of 'Sword,' 'Tort' in Ninth Edition of 'Ency. Brit.,' 'Principles of Contract,' 'The Law of Torts,' 'Digest of the Law of Partnership,' 'The Land Laws,' 'History of English Law,' 'Spinoza, Life and Philosophy,' 'A First Book of Jurisprudence,' 'The Etchingham Letters,' 1899 (with E. Fuller Maitland). (F. Po.)

POORE, George Vivian, M.D.; Professor of Medicine and Clinical Medicine, University College, London; medical attendant to late Prince Leopold, Duke of Albany, 1870-71; and Prince of Wales, 1872; received Dannebrog for professional services to the Princess Thyra, Duchess of Cumberland, 1872; Physician University Coll. Hospital, 1876; Secretary-General of Sanitary Congress, 1891, etc.; author of 'Essays on Rural Hygiene,' 'A Treatise on Medical Jurisprudence.' (G. V. P.)

PORTER, W. Haldane, B.A.; Barrister, Middle Temple; Chancellor's English Essay, Oxford, 1893. (W. H. Po.)

POST, George B.; Architect; Member of the Am. Society of Civil Engineers. (G. B. P.)

POTTER, Rt. Rev. Henry Codman, D.D., LL.D.; Bishop of the Diocese of New York; author of 'The Church and Her Children,' 'The Scholar and the State,' etc. (H. C. P.)

POULTON, Edward Bagnall, M.A., D.Sc.; Hon. LL.D. Princeton, F.R.S.; Hope Professor of Zoology, Oxford; Fellow of Jesus Coll., Oxford; Member of Council of Royal Society, 1897-99; Member of Hebdomadal Council of Oxford; Demonstrator in Anatomical Department of University Museum, 1877-79; Lecturer in Natural Science, and tutor of Keble College, Oxford, 1880-89: Lecturer in Natural Science, Jesus College, Oxford, 1880-88; author of 'The Colours of Animals,' 'Charles Darwin and the Theory of Natural Selection,' many memoirs on Zoological Subjects in the Proceedings and Transactions of the Royal, Linnæan, Zoological, Entomological, and other learned Societies. (E. B. P.)

POWELL, F. York, M.A.; Regius Professor of Modern History, Oxford; Student of Ch. Ch., Oxford; author of 'Icelandic Language,' etc., in Ninth Edition of 'Ency. Brit.,' 'Alfred the Great and William the Conqueror,' 'History of England to 1509.' (F. Y. P.)

POYNTING, John Henry, D.Sc., F.R.S.; late Fellow of Trin. Coll., Camb.; Professor of Physics and Dean of the Faculty of Science, Birmingham University; author of the Adams Prize Essay (1891) on the 'Mean Density of the Earth,' 'A Text-Book of Physics' (with Professor J. J. Thomson), and various physical papers. (J. H. P*.)

PRINCE, Hon. L. Bradford, LL.D.; President of the Bureau of Immigration of the territory of New Mexico, Santa Fé, New Mexico; ex-Governor of the State of New Mexico; President of the New Mex. Hist. Soc.; author of 'New Mexico' in Ninth Edition of 'Ency. Brit.' (L. B. PR.)

PROCTER, Hon. John Robert, President U.S. Civil Service Commission, Washington, D.C.; Geologist State of Kentucky, 1880-1893; author of 'Kentucky' in Ninth Edition of 'Ency. Brit.' (J. R. P.)

PROUT, Major Henry Gosler, editor of 'The Railroad Gazette,' New York; sometime Governor of the Provinces of the Equator, Africa, and Colonel of Engineers, Army of the Khedive. (H. G. P.)

PROWSE, Daniel Wodley, K.C., LL.D., D.C.L.; retired Judge Central District Court of Newfoundland; appointed Judge Central District Court, 1869; Commissioner for the Consolidation of Colonial laws; Chairman Board of Health, 1893-96; author of 'History of Newfoundland,' 'Manual for Magistrates in Newfoundland,' numerous pamphlets and newspaper articles. (D. W. P.)

PULLAN, Rev. Leighton, Fellow of St John's Coll., Oxford; author of 'History of

Early Christianity,' 'Lectures on Religion,' etc. (L. P.)

PURSER, F., M.A., M.R.I.A.; Fellow of Trinity Coll., Dublin, and Professor of Natural Philosophy, University of Dublin. (F. Pu.)

PURSER, J., M.A., D.Sc., LL.D., M.R.I.A.; emeritus Professor of Mathematics, Queen's Coll., Belfast. (J. Pu.)

PUTNAM, George Haven, A.M., Litt.D.; Head of the publishing House of G. P. Putnam's Sons, N.Y.; led in reorganizing, 1887, the American Copyright League, and was its secretary during the movement for International Copyright which resulted in the Copyright Bill of 1891; Received Cross of the Legion of Honour from France, 1891; author of 'Question of Copyright,' 'Books and their Makers in the Middle Ages,' etc. (G. H. P*.)

PUTNAM, Hon. Herbert, Librarian of Congress, Washington, D.C. (H. P.)

PYLE, Joseph Gilpin; editor of the 'Post-Intelligencer,' Seattle, Washington; author of 'Minnesota' in Ninth Edition of 'Ency. Brit.' (J. G. P.)

Q

QUILLER-COUCH, Arthur Thomas, B.A.; Lecturer Classics Trin. Coll., Oxford, 1886-87; author of 'Dead Man's Rock,' 'Troy Town,' 'The Splendid Spur,' 'Noughts and Crosses,' 'The Delectable Duchy,' 'Adventures in Criticism,' 'The Oxford Book of English Verse,' 'The Laird's Luck,' finished R. L. Stevenson's uncompleted novel 'St Ives,' etc. (A. T. Q.-C.)

R

RADAU, R.; Membre de l'Académie des Sciences et du Bureau des Longitudes, Paris; writer on Astronomy, etc., part author of 'Géologie d'Ethiopie,' etc. (R. Ra.)

RAIKES, His Honour Judge Francis William, LL.D., K.C.; Judge of County Court (Hull); three years in Merchant Service, then passed into Royal Navy first; called to the Bar, 1873; author of 'The New Practice' (with Mr Justice Kennedy); 'Jurisdiction and Practice of County Courts in Admiralty' (with Mr Kilburn), 'Both to Blame,' paper read at Brussels International Law Conference, 1895; and various papers on 'Maritime Law,' translations and editions of the 'Maritime Codes of Europe,' etc. (F. W. Ra.)

RAMBAUT, Arthur Alcock, M.A. (Dub. and Oxon.); D.Sc., F.R.S., F.R.A.S.; Radcliffe Observer, Oxford; Assistant Astronomer Trinity College, Dublin, at Dunsink, 1882-92; Andrews Professor of Astronomy in the University of Dublin and Royal Astronomer of Ireland, 1892-97; author of various memoirs and papers on Astronomical subjects. (A. A. R*.)

RASHDALL, Rev. Hastings, M.A., D.C.L.; Fellow and Tutor of New College, Oxford; Lecturer in St David's College, Lampeter, 1883; Tutor in the Univ. of Durham, 1884-88; Fellow and Lecturer of Hertford Coll., Oxford, 1888-95; Chaplain and Theological Tutor of Balliol Coll., 1894-95; author of 'The Universities of Europe in the Middle Ages,' 'Doctrine and Development' (with R. S. Rait), 'New College.' (H. Rl.)

RÁTH, Dr Zoltán; Professor at the Royal Academy of Law, Kassa, Hungary; late of the Royal Hungarian Statistical Bureau; author of 'Evitzedunk egyenesadó-reform-jairól.' (Z. R.)

RAVENSTEIN, Ernest George; War Office, Topographical (now Intelligence) Department, 1855-75; Council Royal Statistical Society, 1877-92; President, Section E, Brit. Assoc., 1891; Professor of Geography, Bedford Coll., 1882-83; author of 'The Russians on the Amur,' 'Geographie und Statistik des Britischen Reiches,' 'Vasco da Gama's First Voyage,' 'Map, Equatorial Africa,' 'Systematic Atlas.' (E. G. R.)

RAYLEIGH, Lord, 3rd Baron, D.C.L. (Hon. Oxon.), LL.D., D.Sc. (Camb. and Dublin), F.R.S.; Professor of Natural Philosophy, Royal Institution; Scientific Adviser to Trinity House; Cavendish Professor of Experimental Physics, Cambridge, 1879-84; Secretary of Royal Society, 1887-96; author of 'Optics,' 'Wave Theory,' in Ninth Edition of 'Ency. Brit.,' 'Theory of Sound,' numerous scientific papers. (R.)

REDWOOD, Boverton, F.R.S.Ed., A.M.I.C.E., M.I.M.E.; Fellow of Inst. of Chem.; V.P. and Mem. of Council and Publication Com., Soc. Chem. Ind.; Fellow of Chem. Geol. and R. Geog. Soc.; D.Sc. Ohio Normal University; Mem. of Am. Chem. Soc., and Am. Philosophical Soc. (honorary); Hon. Corres. Mem. Imperial Russian Technical Soc.; Chevalier of the Order of Leopold; Consulting Chemist, with special experience in the technology of petroleum; Adviser on Petroleum to the Home Office; Consulting Adviser to the Corporation of London under the Petroleum Acts; Chemical Adviser to the Oil Trade Section of the London Chamber of Commerce; member of several juries at International Inventions and Health Exhibitions, president of International Jury for lighting appliances and materials at Brussels Exhibition, 1897, and member of Jury, Paris Exhibition, 1900; author of 'Cantor Lectures on Petroleum and its Products,' 'Petroleum: its Production and Use,' 'Report (with Sir Frederick Abel) on Accidents with Mineral Oil Lamps,' 'Report (with Sir Frederick Abel) on the Transport of Petroleum through the Suez Canal,' 'The Transport of Petroleum in Bulk,' articles on the Petroleum Industry, and Lamps in Chemical Technology, 'A Treatise on Petroleum,' 'The Detection and Estimation of Inflammable Gases and Vapours in the Air' (with Professor Clowes), 'Handbook on Petroleum' (with Capt. J. H. Thomson). (B. R.)

REEVES, Hon. William Pember, Agent-General for New Zealand; Member of Senate of University of London; edited the 'Canterbury Times,' and the 'Lyttelton Times'; Member of N.Z. Parliament, 1887-96; Minister of Education, Labour, and Justice, 1891-96; resigned position to become Agent-General for colony; author of 'The Long White Cloud, a History of New Zealand,' 'An Introduction to the History of Communism and Socialism,' also volume of New Zealand verse. (W. P. R.)

REICH, Emil, Dr. Juris, F.R.Hist.S.; author of 'History of Hungarian Literature,' 'History of Civilization,' 'Græco-Roman Institutions,' 'Historical Atlas of English History,' 'Historical Atlas of Modern History,' etc. (E. Re*.)

REID, Clement, F.R.S., F.L.S., F.G.S.; geologist on survey of England and Wales; formerly secretary and recorder to the Geological Section of British Association; author of 'Pliocene Deposits of Britain,' 'Origin of the British Flora,' many contributions to geological journals. (C. R.)

REID, Sir George, LL.D.,; President Royal Scottish Academy; author of 'Lithography,' 'Painting,' 'Turner,' in Ninth Edition of 'Ency. Brit.' (G. Re.)

REID, Hon. Whitelaw, A.M., LL.D.; editor of the New York Tribune; Ex-U.S. Minister to France; author of 'Greeley,' 'Newspapers,' in Ninth Edition of 'Ency. Brit.' (W. R.)

RENTON, A. Wood, LL.B.; Puisne Judge, Mauritius; author of 'Thurlow' in Ninth Edition of 'Ency. Brit.' (A. W. R.)

RENWICK, I. P. A., M.A., LL.B.; assistant editor of the 'Statesman's Year Book.' (I. P. A. R.)

REYNOLDS, Osborne, M.A., LL.D. Glasgow, F.R.S., M.I.C.E., Hon. Fellow Queens' Coll., Cambridge; Professor of Engineering, Owens College, Victoria University, Manchester; Fellow of Queens' College, Cambridge, 1877; President, Section G, British Association, 1887; author of upwards of sixty papers on original researches in 'Mechanics and Physics,' in the Philosophical Transactions and Proceedings of the Royal Society, etc. (O. R.)

RHODES, Hon. Bradford; editor of 'The Banker's Magazine,' New York. (B. R*.)

RHODES, James Ford, LL.D.; author of 'History of the United States from the Compromise to 1850.' (J. F. R.)

RICHARDS, Robert Hallowell, Sc.B.; Professor of Mining, Engineering, and Metallurgy, Massachusetts Institute of Technology. (R. H. R.)

RICHARDSON, Charles Francis, A.M., Ph.D.; Professor of English, Dartmouth College, N.H.; author of 'History of American Literature,' 'The Choice of Books,' etc., etc. (C. F. R.)

RICHARDSON, Professor Rufus B.; director of American School of Classical Studies, Athens. (R. B. R.)

RICHMOND, Sir William Blake, R.A., M.A., K.C.B.; Slade Professor at Oxford, 1878-83; President of Society of Miniature Painters, 1899. (W. B. Ri.)

RICKETTS, Charles, English printer, artist, and wood-engraver; one of the founders of the Vale Press; decorated 'Early Poems of John Milton,' 'The Poems of Keats,' etc. (C. Ri.)

RILEY, John Athelstan Laurie, M.A.; travelled in Persia, 1881; Turkey in Europe, 1883; Persia and Kurdistan, 1884, 1886, 1888; member of the House of Laymen of the Province of Canterbury; member London School Board, 1891-97; author of 'Athos, or the Mountain of the Monks,' various pamphlets and articles, subjects connected with education, Eastern Christians, and foreign travel. (J. A. L. R.)

RIPON, Bishop of, Rt. Rev. William Boyd Carpenter, Hon. D.D. Glasgow, Hon. D.C.L. Oxon.; Knight of the Order of the Royal Crown, Prussia; Hulsean Lecturer, Cambridge, 1878; Bampton Lecturer, Oxford, 1887; Pastoral Lecturer on Theology, Cambridge, 1895; Canon of Windsor, 1882-1884; Hon. Chaplain to the Queen, 1879-83; Chaplain-in-Ordinary, 1883-84; author of 'Commentary on Revelation,' 'Witness of Heart to Christ' (Hulsean Lectures), 'Permanent Elements of Religion' (Bampton Lectures), 'Lectures on Preaching,' 'Christian Reunion,' 'The Great Charter of Christ,' 'A Popular History of the Church of England.' (W. B. R.)

RISTORI, E. J., Assoc.M.Inst.C.E. (E. J. R.)

ROBERTS, W.; author of 'Christies',' 'The Book-hunter in London,' etc. (W. R*.)

ROBERTS-AUSTEN, Sir William Chandler, K.C.B., D.C.L. (Durham), F.R.S.; Chevalier de la Légion d'Honneur; chemist and assayer to Royal Mint since 1870; Professor of Metallurgy, Royal School of Mines since 1880; President of Iron and Steel Institute; author of 'Gold,' etc., in Ninth Edition of 'Ency. Brit.,' 'An Introduction to the Study of Metallurgy.' (W. C. R.-A.)

ROBERTSON, Sir George Scott, K.C.S.I., D.C.L.; entered Indian Medical Service, 1878; British Agent in Gilgit; conducted a political mission to Chitral, 1893; besieged in Chitral, during March and April 1895; installed the present ruler of Chitral, September 1895; author of 'The Kafirs of the Hindu Kush,' 'Chitral: The Story of a Minor Siege.' (G. S. R.)

ROBERTSON, James W.; Commissioner of Agriculture and Dairying, Ottawa, Canada. (J. W. R.)

ROBERTSON, John G.; Lecturer on the English Language, University of Strasburg. (J. G. R.)

ROBINSON, A. Mary F. (Mme. Duclaux; formerly Mme. Darmesteter), author of 'Emily Bronte,' 'The End of the Middle Ages,' 'Margaret of Angoulême, Queen of Navarre,' 'Retrospect, and other Poems,' 'Life of Renan,' 'Collected Poems,' 'Marguerites du Temps Passé,' 'Froissart,' 'Grands Ecrivains d'outre Manche,' etc. (A. M. F. D.)

ROBINSON, Rev. Charles Henry, M.A.; Hon. Canon of Ripon; Lecturer in Hausa in the University of Cambridge, 1896; travelled in Armenia in order to report to Archbishop of Canterbury on the condition of Armenian Church, 1892; conducted pioneer expedition to Kano, 1893-95; author of 'Hausaland, or Fifteen Hundred Miles through the Central Soudan,' 'Specimens of Hausa Literature,' 'Grammar of the Hausa Language,' 'Dictionary of the Hausa Language,' 'Studies in the Character of Christ,' 'Nigeria, Our Latest Protectorate,' 'Human Nature a Revelation of the Divine.' (C. H. R.)

ROBINSON, Gerald Philip; President of the Society of Mezzotint Engravers; late Mezzotint Engraver to Queen Victoria, and appointed same to the King, 1901. (G. P. R.)

ROBINSON, Rev. Joseph Armitage, D.D., Ph.D.; Canon of Westminster; Norrisian Professor of Divinity, Cambridge University, 1893-99; author of 'A Collation of the Athos Codex of the Shepherd of Hermas,' 'Appendix to The Apology of Aristides,' 'The Passion of St Perpetua,' 'The Philocalia of Origen,' 'Euthaliana,' 'Unity in Christ.' (J. A. R.)

ROCKHILL, Hon. William Woodville; Head of the Bureau of American Republics; sometime First Assistant Secretary of State;

U.S Commissioner to China, etc.; author of 'Land of the Llamas.' (W. W. R.)

ROCKWELL, General Alfred P., author of 'Fire,' 'Fire Extinction,' in Ninth Edition of 'Ency. Brit.' (A. P. R.)

ROGERS, Henry Wade, LL.D ; Lecturer at Yale University; sometime President of North Western University, Evanston, Ills.; Chairman of the World's Congress on Jurisprudence and Law Reform, World's Columbian Exposition; author of 'Expert Testimony, etc. (H. W. R.)

ROLLS, Hon. C. S.; pioneer in motor-car travelling. (C. S. R.)

ROSCOE, Sir Henry Enfield, Ph.D., LL.D., D.C.L., M.D., F.R.S.; Vice-Chancellor, University of London; Emeritus Professor, Owens College, Victoria University; Member of Royal Commissions on Noxious Vapours, Technical Instruction, Scottish Universities, Secondary Education, and Exhibition of 1851; President of the British Association (Manchester, 1887); President Society of Chemical Industry, 1881; President Chemical Society, 1882; author of 'Lessons in Elementary Chemistry,' 'Treatise on Chemistry,' 'Primer of Chemistry,' 'John Dalton,' 'New View of the Genesis of the Atomic Theory of Chemistry' (with Dr Harden). (H. E. R.)

ROSEWATER, Victor, A.M., Ph.D.; managing editor of the Omaha Bee, Omaha, Nebraska; Member Omaha Public Library Bd., Am. Economic Assn., Am. Library Assn., Neb. Historical Society; author of 'Special Assessments: a Study in Municipal Finance.' (V. R.)

ROSS, H. M., B.A.; formerly exhibitioner of Lincoln Coll., Oxford; writer on engineering and scientific subjects; associate editor of the new volumes of the 'Encyclopædia Britannica.' (H. M. R.)

ROSSETTI, William Michael; Professional Assistant to Board of Inland Rev. for Estate duty on Pictures and Drawings; author of 'Canova,' 'Correggio,' 'Fiesole,' 'Ghirlandajo,' 'Lippi,' 'Murillo,' 'Perugino,' 'Reni,' 'Rosa,' 'Shelley,' 'Titian,' 'Veronese,' etc., in Ninth Edition of 'Ency. Brit.'; 'Fine Art, chiefly contemporary,' 'Lives of Famous Poets,' 'Life of Keats,' 'Dante G. Rossetti as Designer and Writer,' 'Memoir of Dante G. Rossetti'; editor of 'The Germ,' 1850, of 'Shelley's Poems,' of 'Wm. Blake's Poems,' of 'Poems by Dante and Christina Rossetti,' of 'Ruskin,' 'Rossetti,' 'Præraphaelitism,' of 'Præraphaelite Diaries and Letters,' etc. (W. M. R.)

ROWLAND, Henry Augustus, Ph.D., LL.D., F.R.S., the late; Professor of Physics, Johns Hopkins University; recipient of Rumford, Draper, and Matteucci medals for scientific discoveries; Hon. Member Inst. of France, etc.; author of 'Screw' in Ninth Edition of 'Ency. Brit.' (H. A. R.)

RUFFINI, Arthur; Royal Naval Academy, Leghorn. (A. R*.)

RUGE, Dr Sophus; Professor of Geography, University of Dresden; author of 'Map' in Ninth Edition of 'Ency. Brit.,' 'Geschichte des Zeitalters der Entdeckungen,' 'Abhandlungen und Vorträge zur Geschichte der Erdkunde,' 'Christopher Columbus,' etc. (S. R.)

RUSSELL, Hon. Bertrand Arthur William, M.A.; Fellow of Trinity College, Cambridge; author of 'German Social Democracy,' 'Essay on the Foundations of Geometry,' 'Philosophy of Leibnitz.' (B. A. W. R.)

RUSSELL, George William Erskine, LL.D.; Parliamentary Secretary to the Local Government Board, 1883-85; Under-Secretary of State for India, 1892-94; for the Home Department, 1894-95; author of 'A Monograph on the Rt. Hon. W. E. Gladstone,' 'Letters of Matthew Arnold,' 'Collections and Recollections, 1898.' (G. W. E. R.)

S

SACHS, Edwin O., A.M.I.C.E.; Chairman of British Fire Prevention Committee; Fellow of the Royal Statistical Society; Associate of the Institution of Naval Architects, etc.; in 1898 he applied electrical power to the working of the stage at Drury Lane; in 1899 he was appointed technical adviser to the Royal Opera, Covent Garden; founded in 1897 the British Fire Prevention Committee, and in 1899 the first independent fire-testing station established in Europe; author of 'Modern Opera Houses and Theatres,' 'Stage Construction,' 'Fires and Public Entertainments.' (E. O. S.)

ST. JOHN, Molyneux; Ottawa, Canada. (M. St. J.)

SAMPSON, Rear-Admiral William Thomas, LL.D.; in command of U.S. North Atlantic Squadron, battle of Santiago; late Commandant U.S. Navy Yard, Boston, Mass.; Member of International Prime Meridian and Time Conference; U.S. Delegate to International Maritime Conference; Chief of U.S. Bureau of Ordnance, 1893-97. (W. T. S.)

SAUNDERS, George, B.A.; Berlin Correspondent of 'The Times'; late Berlin Correspondent of the 'Morning Post,' etc. (G. Su.)

SAYCE, Rev. Archibald Henry, M.A., LL.D., D.D.; Fellow of Queen's College, Oxford; Professor of Assyriology, Oxford; Member of O.T. Revision Company, 1874-84; Deputy Professor of Comparative Philology, Oxford, 1876-90; Hibbert Lect., 1887; Gifford Lect., 1900-1; author of 'Babylonia,' 'Cyrus,' 'Darius,' 'Grammar,' 'Humboldt,' 'Inscriptions' (Cuneiform and Semitic), 'Lydia,' in Ninth Edition of 'Ency. Brit.,' 'Assyrian Grammar for Comparative Purposes,' 'Translations in Records of the Past,' 1st series; 'Lectures on the Assyrian Language and Syllabary,' 'Babylonian Literature,' 'Introduction to the Science of Language,' 'The Monuments of the Hittites,' 'Fresh Light from the Monuments,' 'The Ancient Empires of the East,' 'Hibbert Lectures on Babylonian Religion,' 'The Hittites,' 'The Races of the Old Testament,' 'The Higher Criticism and the Verdict of the Monuments,' 'The Egypt of the Hebrews and Herodotus,' 'Early History of the Hebrews.' (A. H. S.)

SCHIDROWITZ, Philip, Ph.D. Berne; F.C.S. (Great Britain and Germany); Member of Societies of Chemical Industry and of Public Analysts; author (joint) of various papers on Acids, Wine, Analyses, etc. (P. S.)

SCHILLER, F. C. S., M.A.; Fellow and Tutor of C.C.C. Oxford. (F. C. S. S.)

SCHLICH, William, Ph.D., C.I.E., F.R.S.; Professor of Forestry, Cooper's Hill Coll.; appointed to the Indian Forest Department, 1866; Conservator of Forests, 1871; Inspector-General of Forests to the Government of India, 1881; organized the first School of Forestry in England at Cooper's Hill, 1885; author of 'A Manual of Forestry.' (W. Sch.)

SCHLOSS, David, M.A.; author of works on labour questions. (D. Sch.)

SCHOULER, James, LL.D.; Professor School of Law, Boston University, and Lecturer at Johns Hopkins University, Baltimore; author of 'History of the United States under the Constitution' and numerous works on Jurisprudence. (J. Sch.)

SCHRADER, Franz; Prix Gay de l'Académie des Sciences; editor of 'L'Année Cartographique,' 'Le Tour du Monde'; author of 'Aperçu de la Structure Géologique des Pyrénées,' etc. (F. Sch.)

SCHURMAN, Jacob Gould, D.Sc., LL.D.; President and sometime Professor of Philosophy, Cornell University; Chairman of the U.S. Philippine Commission, 1899; author of 'Kantian Ethics,' 'Ethics of Evolution,' 'Agnosticism and Religion,' etc. (J. G. S*.)

SCHURZ, Hon. Carl, LL.D.; Secretary of the Interior under President Hayes; author of 'Life of Henry Clay,' 'Abraham Lincoln,' 'Speeches.' (C. S.)

SCOTT, Austin, Ph.D., LL.D.; President Rutgers College and Rutgers Scientific School, New Jersey. (A. Sc.)

SCOTT, Dukinfield Henry, M.A., Ph.D., F.R.S.; Honorary Keeper Jodrell Laboratory, Royal Gardens, Kew; Assistant Professor of Botany, Univ. Coll., London, 1882-85; Royal Coll. of Science, London, 1885-92; a General Secretary of the British Association; cooperated with the late Professor W. C. Williamson in his 'Researches on Fossil Plants'; one of the editors of the 'Annals of Botany'; author of 'An Introduction to Structural Botany,' 'Studies in Fossil Botany'; author and joint-author of many botanical papers. (D. H. S.)

SCOTT, Harold Spencer; Barrister-at-Law, Lincoln's Inn. (H. S. S.)

SCOTT, Sir James George, G.C.I.E.; War Correspondent in Perak, 1875-76; Burma, 1879; Hong Kong, 1883-85; joined Burma Commission in 1886; member of Anglo-Siamese Boundary Commission, 1889-90; Superintendent Northern Shan States, 1891; Chargé d'Affaires in Bangkok, 1893-94; British Commissioner, Mekong Commission, 1894-96; British Commissioner Burma-China Boundary Commission, 1898-1900; author of 'The Burman, His Life and Notions,' 'France and Tongking,' 'Burma,' 'The Upper Burma Gazetteer.' (J. G. Sc.)

SCOTT, Hon. Sir John, M.A., D.C.L., K.C.M.G.; Deputy Judge-Advocate-General to His Majesty's Forces; Judge, afterwards Vice-President, International Court of Appeal in Egypt, 1874-82; Judge of High Court, Bombay, 1882-90; Judicial Adviser to the Khedive of Egypt, 1890-98; Vice-President International Law Association; Grand Cordon of the Medjidieh; Grand Cordon of the Osmanieh. (Jno. S.)

SCOTT, Leslie Frederic; Barrister-at-Law, Inner Temple. (L. F. S.)

SCOTT, Walter S.; foreign sub-editor of 'The Times.' (W. S. S*.)

SCRUTTON, T. E., M.A., K.C.; Barrister, Inner Temple; author of 'Law of Copyright,' etc. (T. E. S.)

SCUDDER, Horace Elisha, Litt.D., the late; editor of 'The Atlantic Monthly,' 1890-98; author of 'History of the United States,' 'Book of Fables,' 'The Life of James Russell Lowell,' etc. (H. E. S*.)

SECCOMBE, Thomas, M.A.; assistant editor, 'Dictionary of National Biography'; author of 'The Age of Johnson,' etc. etc. (T. Se.)

SEDGWICK, Adam, M.A., F.R.S.; Fellow and Tutor of Trin. Coll. Cambridge; Reader of Animal Morphology in the University. (A. Se*.)

SETON-KARR, Henry, M.A., M.P.; travelled and shot big game in Western America, British Columbia, and Norway; writer on sport and allied subjects. (H. S.-K.)

SEWARD, Albert Charles, M.A., F.R.S., F.L.S., F.R.G.S.; University Lecturer in Botany, Cambridge; Late Fellow of St John's College; Fellow and Tutor in Natural Science at Emmanuel College, Cambridge; author of 'Fossil Plants as Tests of Climate,' 'The Wealden Flora,' 'Fossil Plants for Students of Botany and Geology,' 'The Jurassic Flora,' also various Botanical papers contributed to scientific journals. (A. C. Se.)

SHADWELL, A., M.D.; Member of Council of Epidermiological Society; author of 'The London Water Supply,' 'Plague at Oporto,' 'Diphtheria at Darenth Asylum,' etc. (A. Sl.)

SHADWELL, L. L., M.A.; Barrister-at-Law, Lincoln's Inn; revising barrister, Middlesex, 1885-1902. (L. L. S.)

SHARP, David, M.A., M.B., C.M., F.R.S.; Past President of Entomological Society of London; author of 'Aquatic Carnivorous Coleoptera,' 'Insects.' (D. S*.)

SHARP, Robert Farquharson, B.A.; Assistant Librarian, British Museum; edited 'Lytton's Plays,' author of 'Dictionary of English Authors,' Wagner's drama, 'Der Ring des Nibelungen,' 'Translation of Victor Hugo's "Hernani,"' 'Makers of Music,' 'Architects of English Literature.' (R. F. S.)

SHAW, Albert, Ph.D.; editor of the American 'Monthly Review of Reviews'; author of 'Local Government in Illinois,' 'Municipal Government in Great Britain,' 'Municipal Government in Continental Europe,' etc. (A. Sw.)

SHAW, Flora L. (Lady Lugard); special correspondent for 'The Times' to South Africa and Australia, Canada and Klondike; author of articles on British colonial questions. (F. L. S.)

SHAW, Herbert, B.A.; Secretary of the Tyneside Geographical Society. (H. Sh.)

SHAW, Hon. Leslie Mortier, LL.D.; Secretary of the U.S. Treasury; formerly Governor of the State of Iowa. (L. M. S.)

SHAYLOR, J.; manager to Simpkin, Marshall, and Co. (J. Sh*.)

SHEARMAN, Montague; past President O.U.A.C.: joint-author of 'Football: Its History for Five Centuries,' author of 'Athletics and Football.' (M. S.)

SHEARMAN, Thomas Gaskell, the late; joint-author of 'Shearman and Redfield on Negligence'; author of 'Natural Taxation,' 'Crooked Taxation,' 'Distribution of Wealth,' 'The Single Tax,' etc. (T. G. S.)

SHERRINGTON, Charles S., M.A., M.D., F.R.S.; Professor of Physiology, Univ. Coll. Liverpool; Member of Council of Royal Society; Late Brown Professor of Pathology, University of London; Lecturer on Physiology, St Thomas's Hospital, London; Croonian Lecturer, Royal Society; Member of the Commission on Asiatic Cholera, 1886; Anglo-American Secretary, International Congresses of Physiology, Liége 1892, Berne 1895, Cam-

bridge 1898, Turin 1901; author of numerous scientific papers to the Royal and other scientific societies, especially on the brain and nervous system. (C. S. S.)

SHERWELL, Arthur; author of works on Temperance questions. (A. SH.)

SHIPLEY, Arthur Everett, M.A., F.Z.S.; Fellow, Tutor, and Lecturer at Christ's College, Cambridge; Lecturer on Advanced Morphology of the Invertebrata in the University; Demonstrator of Comparative Anatomy in the University, 1885-94; Fellow of Christ's College, 1887; Member of the Council of the Senate, 1896; author of 'Zoology of the Invertebrata'; author of 'Vine Disease,' 'Wasps,' 'Wheat Pests,' in Ninth Edition of 'Ency. Brit.'; joint-editor and part-author of the 'Cambridge Natural History'; editor of the 'Pitt Press Natural Science Manuals,' Biological Series; part-author of 'A Text-Book on Zoology,' etc. (A. E. S.)

SHORTER, Clement King; editor of 'The Sphere'; late editor of the 'Illustrated London News,' the 'Sketch,' and the 'English Illustrated Magazine'; author of 'Charlotte Bronte and Her Circle,' 'Sixty Years of Victorian Literature,' etc. etc. (C. K. S.)

SIBREE, Rev. James; for over twenty years a missionary in Madagascar; author of 'Madagascar' in the Ninth Edition of the 'Ency. Brit.,' 'Madagascar and its People,' 'The Great African Island,' 'Madagascar before the Conquest,' etc. (J. SI*.)

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SIMPSON, Rev. James Gilliland, M.A.; Principal of Leeds Clergy School; lately Rector of St Paul's, Dundee. (J. G. SI.)

SIMPSON, Lieut.-Col. W. A.; Assistant Adjutant-General U.S. War Department; Instructor U.S. Military Academy, West Point, 1883-87. (W. A. S.)

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SKINNER, Frank C.; Principal Examiner and Chief of Classification Division, U.S. Patent Office. (F. C. S.)

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SLOANE, William Milligan, Ph.D., L.H.D., LL.D.; Professor of History, Columbia University, New York; sometime Professor of History in Princeton University, and editor of the 'Princeton Review'; Secretary to George Bancroft in Berlin, 1873-75; author of 'The French War and the Revolution,' 'Napoleon Bonaparte,' etc. (W. M. S.)

SLOCUM, William F., LL.D.; President Colorado College. (W. F. S.)

SMITH, Benjamin Eli, A.M.; assistant editor of the 'Century Dictionary'; editor of the 'Century Cyclopædia of Names,' and of the 'Century Atlas.' (B. E. S.)

SMITH, Hon. Charles Emory; Postmaster-General, Washington, D.C.; formerly United States Minister to Russia; editor of the 'Philadelphia Press' since 1880. (C. E. S.)

SMITH, George Barnett, F.R.G.S.; author of 'Mrs Browning,' in Ninth Edition of 'Ency. Brit.,' 'Shelley,' 'Life of Mr Gladstone,' 'Victor Hugo,' 'The Life of Mr Bright,' 'The Prime Ministers of Queen Victoria,' 'Life and Enterprises of Ferdinand de Lesseps,' 'The Life of Queen Victoria,' etc. (G. B. S.)

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SMITH, Dr Hugh M.; in charge of Division of Inquiry respecting Food Fishes, U.S. Commission of Fish and Fisheries. (H. M. S*.)

SMITH, John, C.B.; Inspector-General in Bankruptcy. (J. SM*.)

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SOULE, R. H., B.A., M.E.; sometime General Manager of the Erie R. R. (R. H. SO.)

SPIELMANN, Marion H.; editor of the 'Magazine of Art' since 1887; art critic to 'Daily Graphic' until, in 1891, art editor and part-founder of 'Black and White'; author of 'Works of G. F. Watts, R.A.,' 'Henriette Ronner,' 'History of "Punch,"' 'Millais and his Works,' 'The Unidentified Contributions of Thackeray to "Punch,"' 'John Ruskin,' 'Notes on the Wallace Collection in Hertford House,' 'The Portraits of Geoffrey Chaucer,' 'British Sculpture and Sculptors of To-day.' (M. H. S.)

SPIERS, R. Phené, F.S.A., F.R.I.B.A.; Master of the Architectural School and Surveyor of Royal Academy; Associate and Hon. Fellow of King's Coll. London; Past President of Architectural Association; Member of Council Royal Institute of British Architects; Hon. and Corres. Member of the Société Centrale des Architectes, Paris; Sociedad de los Arquitectos, Madrid; edited 'Pugin's Normandy,' 'Fergusson's History of Architecture'; author of 'Architectural Drawing,' 'Architectural Essays on Pierrefonds,' 'Domed Churches in Perigord,' 'Mosque at Damascus,' etc. (R. P. S.)

SPRING-RICE, Stephen Edward, C.B.; Principal Clerk H.M. Treasury; Auditor of the Civil List; private secretary to successive Financial Secretaries to the Treasury, 1881-1888, and to Chancellor of the Exchequer, 1886. (S. E. S.-R.)

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STANTON, Rev. Vincent Henry, D.D., M.A.; Ely Professor of Divinity, Cambridge, and Canon of Ely; Hulsean Lecturer, 1879; author of 'The Jewish and the Christian Messiah,' 'The Place of Authority in Matters of Religious Belief.' (V. H. S.)

STATHAM, H. H.; editor of 'The Builder'; author of 'Architecture for General Readers,' 'Architecture among the Poets.' (H. H. S.)

STEBBING, Rev. Thomas Roscoe Rede, M.A., F.R.S., F.L.S., F.Z.S.; Fellow of King's College, London; Fellow of Worcester Coll. Oxford; prepared Report on the Amphipoda of the 'Challenger' Expedition; Chairman of Conference of Delegates, corresponding societies of British Association, 1899; author of 'Translation of Longinus On the Sublime,' 'Essays on Darwinism,' '"Challenger" Reports,' 'Zoology,' 'A History of Crustacea,' etc. (T. R. R. S.)

STEDMAN, Edmund Clarence, L.H.D., LL.D.; poet and critic; author of 'Poems,' 'Victorian Poets,' 'Poets of America,' 'The Nature and Elements of Poetry'; editor of 'Library of American Literature,' 'Victorian Anthology,' etc. (E. C. S.)

STEED, H. WICKHAM; Correspondent of 'The Times' at Rome. (H. W. S.)

STEPHEN, Sir Herbert, Bart., LL.M.; Clerk of Assize for the Northern Circuit; author of 'The Law Relating to Malicious Prosecutions,' 'Prisoners on Oath,' etc. (H. S*.)

STEPHEN, Leslie, Litt.D., M.A.; Hon. Fellow of Trin. Hall, Camb.; President of Ethical Society; formerly Fellow and Assistant Tutor, Trin. Hall Coll., and Clark Lecturer in English Literature; editor of Cornhill Magazine, 1871-82; Dictionary of National Biography, 1882-91; author of 'Hours in a Library,' 'History of English Thought in the Eighteenth Century,' 'Essays on Freethinking and Plain Speaking,' 'The Science of Ethics,' 'Life of Henry Fawcett,' 'An Agnostic's Apology,' 'Life of Sir James Fitz-James Stephen,' 'Studies of a Biographer,' 'The English Utilitarians'; edited 'Letters of John Richard Green.' (L. S.)

STEPHENS, F. G. one of the Pre-Raphaelite Brotherhood; late art critic of the 'Athenæum'; author of 'Landseer' in Ninth Edition of 'Ency. Brit.,' 'Catalogue of Satires' (Brit. Mus.), 'Artists at Home,' 'George Cruikshank,' 'Memorials of W. Mulready,' 'French and Flemish Pictures,' 'Sir E. Landseer,' 'T. C. Hook, R.A.,' etc. (F. G. S.)

STERLAND, Miss M. B.; writer on Ecclesiastical History. (M. B. S.)

STERLING, Maj.-Gen. John B.; Egypt, 1882; Sudan and Cyprus, 1885. (J. B. S.)

STEWART, John Alexander, M.A., LL.D.; Tutor of Christ Church; White's Professor of Moral Philosophy, Oxford; author of 'The English MSS. of the Nicomachean Ethics,' 'Notes on the Nicomachean Ethics.' (J. A. ST.)

STOCK, Eugene; Editorial Secretary of the Church Missionary Society. (E. ST.)

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STRANGE, Edward Fairbrother; Assistant Keeper, National Art Library; Assistant, South Kensington Museum, 1889; National Art Library, 1891; author of 'Alphabets: a Handbook of Lettering,' 'Japanese Illustration,' 'Worcester, the Cathedral and City,' and numerous essays on art subjects. (E. F. S.)

STREATFIELD, R. A., B.A.; author of 'Masters of Italian Music,' 'The Opera,' etc. (R. A. S.)

STURT, H.; Queen's College, Oxford. (H. ST.)

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SWINBURNE, Algernon Charles; author of 'Beaumont and Fletcher,' 'Congreve,' 'Keats,' 'Landor,' 'Marlowe,' 'Mary' (of Scotland), 'Tourneur,' 'John Webster,' in Ninth Edition of 'Ency. Brit.,' 'The Queen-Mother, and Rosamond,' 'Atalanta in Calydon,' 'Chastelard,' 'Poems and Ballads,' 'William Blake,' 'Songs before Sunrise,' 'Bothwell,' 'Songs of Two Nations,' 'George Chapman,' 'Poems and Ballads' (2nd series), 'A Study of Shakespeare,' 'Mary Stuart,' 'Tristram of Lyonesse, and other Poems,' 'Miscellanies,' 'A Study of Victor Hugo,' 'Locrine,' 'Poems and Ballads' (3rd series), 'Study of Ben Jonson,' 'Studies in Prose and Poetry,' 'Rosamund, Queen of the Lombards,' etc. (A. C. S.)

SYMONS, Arthur; author of 'An Introduction to the Study of Browning,' 'Days and Nights,' 'Silhouettes,' 'London Nights,' 'Studies in Two Literatures,' 'The Symbolist Movement in Literature,' 'Images of Good and Evil,' 'Collected Poems.' (A. SY.)

SYMONS, H.; British Museum. (H. SY.)

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TAIT, Peter Guthrie, M.A., D.Sc., the late; Professor of Natural Philosophy, Edin.; Sec. Royal Soc., Edin.; Hon. Fellow St Peter's Coll., Cambridge; Professor of Mathematics, Queen's Coll., Belfast, 1854; author of 'Light,' 'Sir W. Rowan Hamilton,' etc., in Ninth Edition of 'Ency. Brit.,' 'Dynamics of a Particle,' 'Quaternions,' 'Thermo-Dynamics,' 'Heat,' 'Light,' etc. (P. G. T.)

TANSLEY, A. G., M.A., F.L.S.; Asst. Professor of Botany, University Coll., London; author of 'Memoirs on the Anatomy of Plants'; editor of 'The New Phytologist,' etc. (A. G. T.)

TAUSSIG, Frank William, Ph.D., LL.D.; Professor of Political Economy, Harvard University, and editor of the 'Quarterly Journal of Economics'; author of 'Tariff History of the United States,' 'Wages and Labour,' etc. (F. W. T.)

TAYLOR, Charles, M.A., D.D., Hon. LL.D. (Harvard); Master of St John's Coll., Cambridge; author of 'Geometrical Conics,' 'The Gospel in the Law,' 'The Teaching of the Twelve Apostles,' etc. (C. T*.)

TAYLOR, Hon. Hannis, LL.D.; U.S. Minister to Spain, 1893-97; author of 'The Origin and Growth of the English Constitution.' (H. T*.)

TCHERTKOFF, V.; author of 'Christian Martyrdom in Russia'; agent for Count Tolstoy in England. (V. T.)

TEDDER, Henry Richard, F.S.A.; Secretary and Librarian of the Athenæum Club; librarian to Lord Acton, 1873-74; one of the organisers and joint-sec. of 1st International Conference of Librarians, 1877; joint hon. sec. of Library Association, 1878-80; hon. treas. of the same, 1889-97, and 1898-1901; President, 1897-98; treas. and sec. Metropolitan Free Libraries' Committee, 1878-80; hon. treas. second International Conference of Librarians, 1897; joint-editor of first three volumes of Transactions of

Library Association, and of Reports of 1st and 2nd International Library Conference; author of 'Libraries,' etc., in Ninth Edition of 'Ency. Brit.,' and of many papers in publications of Library Association, some printed separately, articles in reviews, etc. (H. R. T.)

TELBIN, William; English scenic artist; author of 'Scenery,' 'Act Drops,' etc., in 'Magazine of Art,' etc. (W. Te.)

TEMPLE, Lieut.-Col. Sir Richard Carnac, Bt., C.I.E.; Knight of Grace; Chief Commissioner, Andaman and Nicobar Islands, and Superintendent, Penal Settlement at Port Blair; served Afghan Campaign, 1878-79; Burmah War, 1887-89; Cantonment Magistrate, Panjab; Assistant Commissioner, Burmah, and Cantonment Magistrate, Mandalay, 1887; Deputy-Commissioner, 1888; to special duty with Government of India, 1890; Official President, Rangoon Municipality, and Port-Commissioner, Rangoon, 1891; has been member of the Council R. Asiatic Soc.; Asiatic Soc., Beng.; Cor. Member American Philosophical Socy.; Smithsonian Institute; Numismatic Socy. of Philadelphia; edited 'Fallon's Dict. of Hindustani Proverbs,' 'Burnell's Devil-Worship of the Tuluvas'; has been editor and proprietor of the 'Indian Antiquary,' since 1884; founded and edited the 'Panjab (Indian) Notes and Queries,' 1883-87. (R. C. T.)

THAYER, William Roscoe, A.M.; editor of 'The Harvard Graduates' Magazine'; author of 'The Dawn of Italian Independence,' 'Poems New and Old,' 'Throne Makers,' etc. (W. R. T.)

THEOBALD, F. V., M.A.; Foreign Member of Association of Economic Entomologists, U.S.; Zoologist to the South-Eastern Agricultural College; Lecturer in Economic Entomology to the Horticultural College, Swanley; author of 'A Text-book of Agricultural Zoology,' 'The Parasitic Diseases of Poultry,' 'British Flies,' 'Insect Life,' etc. (F. V. T.)

THOMPSON, Sir Edward Maunde, K.C.B., D.C.L., LL.D., V.P.S.A.; corresponding member of the Institute of France and of the Royal Prussian Academy of Sciences; Director and Principal Librarian, Brit. Museum; Assis. Brit. Mus., 1861; Keeper of the MSS. and Egerton Librarian, 1878; Sandars Reader in Bibliography, Cambridge, 1895-96; editor of 'Chronicon Angliae'; author of 'Miniature,' 'Paleography,' etc., in Ninth Edition of 'Ency. Brit.,' 'Letters of Humphrey Prideaux,' 'Correspondence of the Family of Hatton,' 'Chronicon Adae de Usk, 1377-1404,' 'Diary of Richard Cocks in Japan, 1615-22,' 'Chronicon Galfridi le Baker de Swynebroke, 1303-1356,' 'Adae Murimuth Continuatio Chronicorum, 1303-1347,' 'Robertus de Avesbury de gestis mirabilibus Regis Edwardi Tertii': joint-editor of publications of the Palæographical Society, and of the Facsimile of the Laurentian Sophocles, 'Handbook of Greek and Latin Palæography.' (E. M. T.)

THOMPSON, Sir Henry, Bt., F.R.C.S., M.B., London; Surgeon Extraordinary to King of the Belgians; Com. Order of Leopold; Consulting Surgeon to University Coll. Hospital, London, and emeritus Professor of Clinical Surgery; surgeon to University Coll. Hospital, 1863; Professor of Pathology and Surgery, Royal College of Surgeons, 1884; President of the Cremation Society of England; author of 'Practical Lithotrity and Lithotomy,' 'Cremation, or Treatment of the Body after Death,' 'Modern Cremation,' 'Charley Kingston's Aunt,' 'All But,' 'On Food and Feeding,' 'Diet in Relation to Age and Activity,' etc. etc. (H. Th.)

THOMSON, Basil H.; Governor of Dartmouth Convict Prison; late of the Colonial Service; acted as Prime Minister of Tonga, etc.; author of 'Diversions of a Prime Minister,' 'South Sea Yarns,' etc. (B. H. T.)

THOMSON, David Croal; editor of 'The Art Journal'; author of 'The Life and Work of Thomas Bewick,' 'The Life and Work of H. K. Browne ("Phiz"),' 'The Barbizon School of Painters,' 'Corot,' 'Luke Fildes, R.A.,' 'The Tate Gallery,' 'Fifty Years of Art,' 'The Paris Exhibition, 1900.' (D. C. T.)

THOMSON, Prof. Elihu; Electrician for the General Electric Company; inventor of electric welding and other important electrical appliances. (E. T.)

THOMSON, John Arthur, M.A.; formerly Lecturer on Zoology and Biology, School of Medicine, Edinburgh; Regius Professor of Natural History, Aberdeen University; part-author of 'Evolution of Sex'; author of 'The Study of Animal Life,' 'Outlines of Zoology,' 'The Natural History of the Year,' 'The Science of Life,' etc. (J. A. T.)

THOMSON, Joseph John, D.Sc., LL.D. Glasgow and Princeton, Ph.D. Cracow, F.R.S.; Cavendish Professor of Experimental Physics, Cambridge; Fellow of Trinity College; Lecturer Trinity College; Roy. Socs. Upsala and Turin; President of Cambridge Philosophical Society, 1894; President of Section A, British Association, 1896; author of 'A Treatise on the Motion of Vortex Rings,' 'Application of Dynamics to Physics and Chemistry,' 'Recent Researches in Electricity and Magnetism,' 'Elements of the Mathematical Theory of Electricity and Magnetism,' etc. (J. J. T.)

THORODDSEN, Dr Theodor H.; Icelandic expert and explorer; author of 'History of Icelandic Geography,' etc. (Th. T.)

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THURSTON, Prof. Robert Henry, A.M., C.E., LL.D.; Director of Sibley College, and Professor of Mechanical Engineering, Cornell University; sometime President Am. Society Mechanical Engineers; inventor of Testing Machines, etc.; author of 'Manual of the Steam Boiler,' 'History of the Steam Engine,' 'Materials of Engineering,' etc. (R. H. T.)

THWING, Charles Franklin, D.D., LL.D.; President Western Reserve University and Adelbert College; author of 'American Colleges,' 'The Reading of Books,' 'Within College Walls,' 'American College in American Life,' etc. (C. F. T.)

TIEDEMANN, H.; Anglo-Dutch journalist; ex-President of the Foreign Press Association. (H. Ti.)

TODD (J.), Spencer Brydges, C.M.G.; Secretary Dept. of Agent-General for Cape of Good Hope in London; Executive Commissioner, Paris, for Universal Exhibition, 1878; appointed by H.R.H. Prince of Wales a member of the International Jury; author of 'The Resident Magistrate at the Cape of Good Hope,' 'Handy Guide to Laws and Regulations at the Cape of Good Hope.' (S. B. T.)

TREBLE, Rev. Edmund John, A.K.C.L.; Eng. Chap., Wiesbaden; author of 'Plain Teaching about the Church of England,' etc. (E. J. T.)

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TRIPP, Hon. Bartlett; late U.S. Minister to Austria; Chief-Justice of the Supreme Court of Dakota Territory, 1885-89. (B. T.)

TROTTER, Lieut.-Colonel Henry, C.B.; British Delegate on the European Commission of the Danube, and H.B.M. Consul-General for Roumania; served 1863-75 on great Trigonometrical Survey of India; accompanied mission to Yarkand and Kashgar, 1873-74; special service in China, 1876; additional military attaché at Constantinople during Turko-Russian War, 1877-78; Consul for Kurdistan, 1878-82; military attaché, Constantinople, 1882-89; Consul-General in Syria, 1890-94; has acted as H.M. Chargé d'Affaires at Bucharest; author of various papers contributed to the Royal Geog. Soc. (H. Tr.)

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TURNER, Herbert Hall, D.Sc., F.R.S.; Savilian Professor of Astronomy, Oxford; Fellow of New College, Oxford; member of Senate of Cambridge University; formerly Fellow of Trin. Coll. Camb., and chief assistant Royal Observatory, Greenwich; author of 'Modern Astronomy.' (H. H. T.)

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UKITA, Goji; Chancellor of the Japanese Legation, London. (G. U.)

UNWIN, William Cawthorne, F.R.S., M.I.C.E.; Hon. Life M.I.M.E.; Hon. Mem. Am. Soc. M.E.; Hon. Assoc. R. I. Brit. Architects; Professor of Civil and Mechanical Engineering, Central Technical College, City and Guilds of London Institute; instructor at Royal School of Naval Architecture and Marine Engineering, Kensington, 1868-72; Professor of Hydraulic Engineering, Royal Indian Engineering College, Cooper's Hill, 1872-85; Professor of Engineering, Central Technical College of the Guilds of London, Kensington, since 1885; President, Section G, British Association, 1892; on the Council of Royal Society, 1894; on the Council Inst. Civil Engineers, 1900; on the Senate London University, 1900; author of 'Hydraulics,' etc., in Ninth Edition of 'Ency. Brit.,' 'Wrought Iron Bridges and Roofs,' 'Machine Design,' 'The Testing of Materials of Construction,' 'The Development and Transmission of Power from Central Stations,' etc. (W. C. U.)

V

VAN DER WAALS, J. D.; Doctor of Math. and Physics, Leyden; Professor of Physics, Amsterdam; Gen. Sec. Royal Academy of Sciences, Amsterdam; Cor. Member de l'Académie des Sciences de Paris, etc.; author of 'The Continuity of the Gaseous and Liquid States of Matter,' etc. (J. D. v. d. W.)

VAN DYKE, Prof. Henry, D.D., LL.D.; Professor of English Literature, Princeton University; author of 'The Poetry of Tennyson,' 'Little Rivers,' 'The Gospel for an Age of Doubt,' 'The Toiling of Felix, and other Poems,' etc. (H. van D.)

VAN DYKE, John Charles, L.H.D.; author of 'History of Painting,' 'Old Dutch and Flemish Masters,' etc. (J. C. Van D.)

VASCONCELLOS, Captain Ernesto de; Secretary of the Committee of Colonial Cartography, Department of Marine and Fisheries, Portugal; Secretary of the Lisbon Geographical Society; author of 'As Colonias Portuguesas,' etc. (E. de V.)

VAUGHAN, H.E. Herbert, Cardinal, D.D., Priest of the Title of SS. Andrew and Gregory on the Coelian Hill; Archbishop of Westminster; Bishop of Salford, 1872-92; author of a large number of pamphlets and letters concerning educational, social, and religious questions, etc. (✠H. E. V.)

VERDINOIS, Frederigo; Italian man of letters; translated 'Cantico di Natale' and 'La Piccola Dorrit' from Dickens, Shakespeare's 'Midsummer Night's Dream,' etc. (F. V.)

VERNON-HARCOURT, Leveson Francis, M.A., M.I.C.E.; Professor of Civil Engineering at Univ. Coll. London; proceeded to India, 1896, to inspect the river Húgli, reporting to Calcutta Port Commissioners; British Member of Jury for Civil Engineering, Paris Exhibition, 1900; author of 'River Engineering,' 'Water Supply,' in Ninth Edition 'Ency. Brit.,' 'Rivers and Canals,' 'Harbours and Docks,' 'Achievements in Engineering,' 'Civil Engineering as applied in Construction,' etc. (L. F. V.-H.)

VERWORN, Max, M.D., Ph.D.; Professor of Physiology, Jena, author of 'Allgemeine Physiologie,' 'Psycho-physiologische Protisten-Studien,' etc. (M. V.)

VETCH, Col. Robert Hamilton, R.E., C.B.; employed on defences of Bermuda, Bristol Channel, Plymouth Harbour, and Malta, 1861-1876; Secretary of R.E. Institute, Chatham, 1877-1883; commanded R.E. Submarine Mining Batt., 1884; Assistant Inspector-General of Fortifications at War Office, 1884-89; Deputy Inspector-General of Fortifications and Secretary of the Defence Committee, and of the Joint Naval and Military Committee on Defence, War Office, 1889-94; Chief Engineer in Ireland and Colonel on Staff, 1894-98; author of 'Gordon's Campaign in China,' 'Life of Lieut.-Gen. Sir Gerald Graham'; edited 'The Professional Papers of the Corps of R.E.'; also the 'R.E. Journal,' 1877-84. (R. H. V.)

VILLARS, Paul; Knight of the Legion of Honour; and London Correspondent of 'Le

Journal des Débats,' 'Le Figaro,' etc.; author of 'Sketches of England,' 'Scotland and Ireland,' etc. (P. V*.)

VINELLI, Dr Marcello; editor of 'La Unione Sarda,' Cagliari, Sardinia. (M. Vi.)

VINES, Sydney Howard, D.Sc. London, M.A., D.Sc. Camb., F.R.S.; President of the Linnean Society of London; Sherardian Professor of Botany, Oxford; Fellow of Magdalen College; Fellow and Lecturer of Christ's Coll. Cambridge, 1876; Reader in Botany, Cambridge, 1883; Hon. Fellow of Christ's Coll. Cambridge, 1897; author of 'Reproduction,' etc., in Ninth Edition of 'Ency. Brit.,' 'Lectures on the Physiology of Plants,' 'A Student's Text-Book of Botany,' papers in various scientific journals, etc. (S. H. V*.)

W

WADSWORTH, S., M.A.; Barrister-at-Law, of the Inner Temple and of Lincoln's Inn; joint-editor of the 17th edition of Davidson's 'Concise Precedents in Conveyancing.' (S. Wa.)

WAGER, Harold W. T., F.L.S.; formerly Lecturer in Biology, Yorkshire Coll. Leeds; H.M. Inspector of Science Schools; author of 'Memoirs on Cytology and Reproduction of the Lower Organisms,' etc. (H. W*.)

WAGLE, N. B. (N. B. W.)

WAGNER, Dr Hermann; Professor of Geography in Gottingen University; author of 'Germany (Geography)' in Ninth Edition of 'Ency. Brit.,' 'Lehrbuch der Geographie,' editor 'Geographisches Jahrbuch,' etc. (H. Wa.)

WALDSTEIN, Charles, Litt.D., Ph.D., L.H.D.; Knight Commander of the Order of the Redeemer; and Ernestine Saxon Order; Fellow of King's College, Cambridge, 1894; member of Council of British Archæological School, Athens, etc.; Lecturer in Classical Archæology in Univ. of Camb., 1880; Director of Fitzwilliam Museum, Camb., 1883-89; Director of American Archæological School, Athens (retaining Readership at Camb.), 1889-1893, retaining Professorship there till 1896; Slade Professor of Fine Art, 1895-1901; author of 'Balance of Emotion and Intellect,' 1878, 'Essays on the Art of Phidias,' 1885, 'The Work of John Ruskin,' 1894, 'The Study of Art in Universities,' 1895, 'The Expansion of Western Ideals' and the 'World's Peace,' 1899, 'The Jewish Question' and the 'Mission of the Jews,' 1899, and numerous reports of excavations and archæological memoirs. (C. W*.)

WALKER, James, D.Sc, F.R.S.; Professor of Chemistry, University College, Dundee. (J. Wal.)

WALKER, Norman, M.B., F.R.C.P.; Assistant Physician of Edinburgh Infirmary; part author of 'An Introduction to Dermatology.' (N. W.)

WALLACE, Sir Donald Mackenzie, K.C.I.E., K.C.V.O.; Private Secretary to Marquesses of Dufferin and of Lansdowne as Viceroys of India, 1884-89; attached to the Czarewitch as political officer during his tour in India and Ceylon, 1890-91; Director of the Foreign Department of 'The Times,' 1891-99; Assist. Private Secy. to H.R.H. the Duke of Cornwall and York during his colonial tour, 1901; member of Institut de Droit International and Officier de l'Instruction Publique of France; joint-editor of New Volumes of 'Encyclopædia Britannica"; author of 'Russia,' 'Egypt and the Egyptian Question,' etc. (D. M. W.)

WALLACE, William, M.A., LL.D.; assistant editor of the 'Glasgow Herald'; author of 'Burns and Mrs Dunlop,' 'Scotland Yesterday'; edited 'Chambers's Life and Works of Burns,' etc. (W. Wa.)

WALLIS, John Edward Power, M.A.; Advocate-General of Madras; Inns of Court Reader in Constitutional Law, 1892-97; author of 'State Trials' for the State Trials Committee, and numerous articles on constitutional law and history. (J. E. P. W.)

WALPOLE, Sir Spencer, K.C.B., Hon. LL.D. Edin.; Inspector of Fisheries, 1867; Lieut.-Governor of the Isle of Man, 1882; Secretary to the Post Office, 1893-99; author of 'History of England from 1815,' 'Life of Rt. Hon. Spencer Perceval,' 'Life of Lord John Russell,' 'The Electorate and the Legislature,' 'Foreign Relations,' 'The Land of Home Rule. (S. W.)

WALTON, Hon. Sir Joseph, K.C.; Judge of the King's Bench Div.; chairman of the General Council of the Bar, 1899; Recorder of Wigan, 1895-1901; author of 'Practice and Procedure of Court of Common Pleas at Lancaster.' (W.)

WARD, H. Marshall, D.Sc., F.R.S., F.L.S., F.R.Hort.S.; Professor of Botany, Cambridge; Fellow of Sidney Sussex College, Cambridge; Hon. Fellow of Christ's College, Cambridge; President of the British Mycological Society; corresponding Member Cryptogamic Society of Scotland; Cryptogamic Botanist to Ceylon Government, 1880-82; Berkeley Fellow, Owens Coll., 1882; Fellow of Christ's Coll., 1883; Professor of Botany in Forest School, Cooper's Hill, 1885-95; author of 'Schizomycetes' in Ninth Edition of 'Ency. Brit.,' 'Timber and some of its Diseases,' 'The Oak,' 'Sachs' Lectures on the Physiology of Plants,' 'Laslett's Timber and Timber Trees,' 'Diseases of Plants,' 'Grasses,' 'Disease in Plants.' (H. M. W.)

WARD, James, M.A., LL.D., D.Sc.; Fellow of Trin. Coll. Camb. and Professor of Mental Philosophy, Cambridge; Gifford Lecturer, University of Aberdeen, 1895-97; author of 'Herbart,' 'Psychology,' in Ninth Edition of 'Ency. Brit.,' 'Naturalism and Agnosticism.' (J. W*.)

WARD, Robert de C., A.M.; Instructor in Climatology Harvard University. (R. de C. W.)

WATERHOUSE, Major-Gen. James; Unemployed Supernumerary List, Indian Staff Corps; Vice-President Roy. Phot. Soc.; Hon. Mem. Vienna Phot. Soc. 1901; Indian Ordnance Dept. 1866; Assist. Surveyor-Gen. in charge of photographic operations in the Surveyor-General's Office, Calcutta, 1866-97; took part in the observation of total eclipses, 1871 and 1875, and of transit of Venus, 1874; President of the Asiatic Society of Bengal, 1888-90; awarded Roy. Phot. Soc. Progress Medal, 1890, also Vienna Phot. Soc. Voigtlander Medal, 1895; author of 'The Preparation of Drawings for Photographic Reproduction,' and numerous papers in the 'Bengal Asiatic Society's Journal' and various photographic journals and publications. (J. Wa*.)

WATSON, Alfred Edward Thomas ('Rapier'); editor of the 'Badminton Library' and 'Badminton Magazine'; musical and dramatic critic of the 'Standard'; edited the 'Illustrated Sporting and Dramatic News,' writing under the signature 'Rapier,' 1880-95; author of 'Sketches in the Hunting Field,' 'Race Course and Covert Side,' 'Types of the Turf,' 'Steeplechasing,' chapters in the Badminton volumes on Hunting, Riding and Driving, Racing and Chasing, 'The Turf,' etc. (A. E. T. W.)

WATSON, Colonel Charles Moore, C.M.G., M.A.; Deputy Inspector-General of Fortifications, War Office; served in Sudan under the late Gen. C. G. Gordon, C.B., 1874-1875; A.D.C. to Field-Marshal Sir Lintorn Simmons, G.C.B., 1878-80; employed in Indian Office, 1880-82; special service, Egyptian War, 1882; employed in Egyptian Army, 1882-86, with rank of Pasha (3rd class Osmanieh); Assistant Inspector-General of Fortifications, 1891-96; Deputy Inspector-General 1896. (C. M. W.)

WATTS, Philip, F.R.S.; Director of Naval Construction; formerly Naval Architect and Director of War Shipbuilding Department of Sir W. G. Armstrong, Whitworth and Co. (P. Wa.)

WATTS-DUNTON, Theodore; poet, novelist, and critic; author of 'Poetry,' 'Rossetti,' 'Sonnet,' 'Vanbrugh,' 'Wycherley,' etc., in Ninth Edition of 'Ency. Brit.,' 'The Coming of Love,' 'Aylwin'; edited 'Lavengro,' etc. (T. W D.)

WAUGH, Arthur; London Correspondent to the 'New York Critic,' 1893-97; literary adviser to Kegan Paul and Co. Ltd.; author of 'Gordon in Africa,' 'Alfred, Lord Tennyson'; edited 'Johnson's Lives of the Poets'; edited the 'Pamphlet Library,' 'Legends of the Wheel,' 'Robert Browning.' (A. Wa.)

WEBB, Gen. Alexander Stewart; President of the College of the City of New York; Brig.-Gen. of Volunteers in the Civil War; author of 'The Peninsula,' 'M'Clellan's Campaign of 1862,' etc. (A. S. W*.)

WEBBER, Maj.-Gen. C. E., C.B., M.I.C.E., M.I.E.E.; Indian Mutiny, 1857-60; instructor in topography, R.M.A.; with Prussian Army in 1866; Paris Exhibition, 1867; Egyptian expedition, 1882; Nile expeditions, 1884-85; founder (with late Sir Francis Bolton) and past President of the Institution of Electrical Engineers; author of various articles on military subjects, Telegraphy, Telephony, and Electrical Engineering. (C. E. W.)

WEBER, Gustavus A.; U.S. Dept. of Labour, Washington, D.C. (G. A. W.)

WEDMORE, Frederick; art critic of the 'Standard,' London; author of 'Pastorals of France,' 'Renunciations,' 'English Episodes,' and 'Orgeas and Miradou,' with other short stories and imaginative pieces; 'The Life of Balzac,' 'Studies in English Art,' 'Méryon,' 'Etching in England,' 'Fine Prints: On Books and Arts,' 'The Collapse of the Penitent.' (F. We.)

WELCH, Lewis S., A.B.; editor of the 'Yale Alumni Weekly.' (L. S. W.)

WELDON, Walter F. R., M.A., D.Sc., F.R.S.; Linacre Professor of Comparative Anatomy, Oxford; late Fellow of St John's Coll. Cambridge; late Jodrell Professor of Comparative Anatomy and Zoology, University Coll. London. (W. F. R. W.)

WELLS, Joseph, M.A.; Fellow and Tutor, Wadham College, Oxford; Delegate of Local Examinations, for Extension of University Teaching and for Training of Teachers; on Oxford and Cambridge Schools Examining Board; author of 'A Short History of Rome,' 'Oxford and its Colleges,' 'Wadham College.' (J. We*.)

WELLS, Captain Lionel de Lautour, R.N.; Chief Officer, Metropolitan Fire Brigade; author of 'Jack Afloat,' 'M.F.B. Drill-book.' (L. de L. W.)

WESTLAKE, John, K.C., LL.D.; Professor of International Law, Cambridge; author of 'A Treatise on Private International Law, or the Conflict of Laws,' 'Chapters on the Principles of International Law.' (Jno. We.)

WETHERELL, W.; assistant editor, 'Liverpool Daily Post.' (W. We.)

WHATES, H.; assistant editor of the 'Standard'; editor of the 'Politician's Handbook.' (H. Wh.)

WHEATLEY, Henry Benjamin; Asst. Secretary, Society of Arts, Assistant Sec. Brit. Royal Commission, Section of Chicago Exhibition, 1893; Hon. Sec. Early English Text Society, 1864-72; Treasurer, 1872-1901; author of 'Index,' etc., in Ninth Edition of 'Ency. Brit.,' 'Anagrams,' 'Round about Piccadilly and Pall Mall,' 'What is an Index?' 'Samuel Pepys and the World he lived in,' 'How to form a Library,' 'How to Catalogue a Library,' 'London Past and Present,' 'New Edit. Pepys' Diary,' 'Historical Portraits,' 'Prices of Books,' 'Pepysiana,' etc. (H. B. W*.)

WHEELER, Maj.-Gen. Joseph; Member of U.S. Congress, 1881-99, Lieut.-Gen. and Senior Cavalry General of the Confederate Armies in the Civil War; in charge of the cavalry under Gen. Joseph E. Johnston; Maj.-Gen. of Volunteers, U.S.A., Span.-American War. (J. Wh.)

WHETHAM, William Cecil Dampier, M.A., F.R.S.; Fellow of Trinity Coll. Cambridge; Lecturer on Physics, Cambridge; author of various papers on scientific subjects, and of text-book on 'Solution and Electrolysis,' etc. (W. C. D. W.)

WHITAKER, Edgar; editor of the 'Constantinople Messenger'; author of 'The Outlook in Asiatic Turkey'; translated Giacometti's 'Russia's Work in Turkey,' etc. (E. W*.)

WHITE, Horace; editor of the N.Y. 'Evening Post'; sometime editor of the 'Chicago Tribune'; author of 'The Silver Question,' 'The Tariff Question,' 'Money and Banking,' 'The Gold Standard,' etc. (H. Wh*.)

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WHITE, James Forbes, M.A., LL.D.; art critic; author of 'Rembrandt,' 'Velasquez,' in the Ninth Edition of the 'Ency. Brit.' (J. F. W.)

WHITFELD, W. H.; successor to 'Cavendish' on the 'Field.' (W. H. W*.)

WHYTE, Frederic W.; author and dramatic critic; author of 'Actors of the Century'; trans. of A. Filon's 'English Stage,' etc. (F. W. W.)

WILHELM, C.; designer of theatrical spectacle; author of 'Essays on Ballet and Spectacle,' etc. (C. Wi.)

WILKINSON, Henry Spenser, M.A., on staff of the 'Morning Post'; author of 'Citizen Soldiers,' 'Essays on the War Game,' 'Exercises in Strategy and Tactics' (from the German), 'The Command of Artillery in the Army Corps and the Infantry Division' (from the German), 'The Brain of an Army,' 'The Volunteers and the National Defence,' 'Imperial Defence' (in collaboration with Sir Charles Dilke), 'The Great Alternative, a Plea for a National Policy,' 'The Command of the Sea,' 'The Brain of the Navy,' 'British Policy in South Africa,' 'Lessons of the War,' 'War and Policy.' (H. S. W.)

WILLCOX, Walter F., LL.B., Ph.D.; Chief Statistician, U.S. Census Bureau; Professor of Social Science and Statistics, Cornell University; Member of the American Social Science Association, and Secretary of the American Economical Association; author of 'The Divorce

Problem: A Study in Statistics,' 'Social Statistics of the United States,' etc. (W. F. W.)

WILLEY, A., D.Sc. (A. W*.)

WILLIAMS, Aneurin; author of 'Relation of Co-operative Movements to National and International Commerce,' etc. (A. Wr*.)

WILLIAMS, E. H., M.D.; formerly Associate Professor of Pathology, State University of Iowa; and Assistant Physician at the Hospital for the Insane, Matteawan, N.Y., and at the Manhattan State Hospital, N.Y. (E. H. W.)

WILLIAMS, Sir E. Leader; consulting engineer Manchester Ship Canal; engaged as engineer since 1846 on the works of the Great Northern Railway, Shoreham and Dover Harbours, River Weaver and Bridgwater Canal Navigations; chief engineer of the Manchester Ship Canal during its construction; Member of Council of Institution of Civil Engineers; author of papers printed in 'Proceedings of Institution of Civil Engineers.' (E. L. W.)

WILLIAMS, Henry Smith, M.D., B.Sc.; former lecturer in the Hartford School of Sociology, U.S.A.; editor of forthcoming 'History of the World' in 25 volumes; author of 'The Story of Nineteenth Century Science,' 'The History of the Art of Writing,' 'The Lesson of Heredity,' etc. (H. S. W*.)

WILLIAMS, R. Vaughan, B.A.; Mus. Doc., Trinity College, Cambridge. (R. V. W.)

WILLIAMS, Talcott; editor of the 'Philadelphia Press.' (T. W*.)

WILLSON, Beckles; staff of 'Boston Globe,' U.S.A., 1887; correspondent in Cuba, 1888; editor, 'Press of Atlanta,' Georgia, 1889; staff of 'New York Herald,' 1890; staff of 'London Daily Mail,' 1896-98; author of 'Harold: an Experiment,' 1891, 'Drift,' 1893, 'The Tenth Island,' 1897, 'The Great Company,' 1899. (B. W*.)

WILSON, Maj.-Gen. Sir Charles William, R.E., K.C.B., K.C.M.G., D.C.L., LL.D., F.R.S.; secretary to North American Boundary Commission, 1858-62; surveys of Jerusalem and Palestine, 1864-66; Ordnance Survey of Scotland, 1866-68; survey of Sinai, 1868-69; director Topographical Department W.O., and A.Q.M.G. Intelligence Department, 1869-76; Ordnance Survey of Ireland, 1876-78; Royal Commission on Registration of Deeds and Insurances in Ireland, 1878; British Commissioner Servian Boundary Commission, 1878-79; Consul-Gen. Anatolia, 1879-82; special mission to Eastern Rumelia, 1880; and to Consulates in Asiatic Turkey, 1881; special service in Egypt and attached to Lord Dufferin's mission, 1882-1883; D.A.G. (Intelligence Department) Nile Expedition, 1884-85; Ordnance Survey of Ireland, 1885-86; Director-Gen. Ordnance Survey, 1886-94; Director-Gen. of Military Education, 1895-98; president Geographical Section British Association, Belfast, 1874; Bath, 1888; Vice-President Royal Geographical Society, 1897-1901; author of 'Notes to Ordnance Survey of Jerusalem,' 'Notes to Ordnance Survey of Sinai' (part), 'Picturesque Palestine' (Jerusalem vol.), 'From Korti to Khartûm,' 'Life of Lord Clive,' Murray's Handbooks to 'Constantinople' and 'Asia Minor.' (C. W. W.)

WILSON, W. J.; of the Canadian Geological Survey. (W. J. W.)

WINTER, Miss E. G.; contributor to 'The Times' Gazetteer. (E. G. W.)

WOLCOTT, Hon. Roger, the late; Governor of Massachusetts, 1897-99. (R. Wo.)

WOLF, Lucien; sub-editor and leader-writer, 'Jewish World,' 1874-93; staff of 'Daily Graphic'; London correspondent, 'Le Journal,' Paris; Fellow of Inst. of Journalists; first President and now Vice-President of Jewish Historical Society of England; author of 'Sir Moses Montefiore'; joint-editor with Joseph Jacobs of 'Bibliotheca Anglo-Judaica'; 'Menasseh B. Israel's Mission to Oliver Cromwell'; many essays on foreign and colonial politics in 'Fortnightly Review,' 'Nineteenth Century,' and other magazines. (L. W.)

WOLFF, Rt. Hon. Sir Henry Drummond, G.C.B., G.C.M.G.; Ambassador-Extraordinary and Plenipotentiary at Madrid, 1892-1900; author of a 'Life of Napoleon at Elba'; 'Memnon Letters on the Suez Canal,' 'Some Notes of the Past.' (H. D. W.)

WOOD, General Sir Evelyn, G.C.B., G.C.M.G., V.C.; commanding 2nd Army Corps; entered Navy, 1852; served in Crimea with Naval Brigade, 1 Oct. 1854 to 18 June 1855; Knight of Legion of Honour, Medjidieh, Turkish medal; Ashantee, Kaffir, Zulu, and Transvaal Wars, 1879-81; commanded Chatham District, 1882-83; 2nd Brigade (2nd Division) Expedition to Egypt, 1882; raised the Egyptian Army, 1883; served in Nile Expedition, 1894-95; commanded Eastern District, 1886-88; Aldershot Division, 1889-93; Quartermaster-Gen. to the Forces, 1893-97; Adjutant-General to Forces, 1897-1901; author of 'The Crimea in 1854-94,' 'Cavalry at Waterloo,' 'Achievements of Cavalry.' (E. Wo.)

WOODBERRY, George Edward, A.B.; Professor of English Literature, Columbia University, New York; author of 'The North Shore Watch,' 'Life of E. A. Poe,' 'Heart of Man,' 'Studies in Letters and Life,' 'Makers of Literature,' etc. (G. E. W.)

WOODHEAD, German Sims, M.A. M.D. Edin., F.R.C.P.Ed., F.R.S.Ed.; Fellow of Trinity Hall, Cambridge; Prof. of Pathology, Cambridge Univ., since 1899; formerly Director of the Laboratories of the Conjoint Board of the Royal Colleges of Physicians (London) and Surgeons (England); President Royal Medical Society; acted as Assistant Commissioner to the Royal Commission on Tuberculosis, 1892-95; Surgeon-Capt. Volunteer Medical Staff Corps; author of 'Practical Pathology,' 'Pathological Mycology' (with Arthur W. Hare, M.B.), 'Bacteria and their Products,' 'Report to the Royal Commission on Tuberculosis,' 'Report on Diphtheria' to the Metropolitan Asylums Board; editor of the 'Journal of Pathology and Bacteriology.' (G. S. W.)

WOODWARD, Arthur Smith, F.R.S., Hon. LL.D. (Glasgow); Asst. Keeper of Geology, British Museum; author of 'Cat. of Fossil Fishes in the British Museum,' 'Outlines of Vertebrate Palæontology,' etc. (A. S. Wo.)

WOOLSEY, Theo. S., LL.D.; Professor of International Law, Yale University; editor of 'Woolsey's International Law' (6th ed.), and of 'Pomeroy's International Law'; author of 'America's Foreign Policy.' (T. S. W.)

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WRIGHT, Hon. Carroll Davidson; U.S. Commissioner of Labour; author of 'Factory System of the United States,' 'Strikes and Lock-outs,' 'Cost of Production of Iron, Steel, etc.,' 'Industrial Evolution of the United States,' 'Outline of Practical Sociology,' etc. (C. D. W.)

WRIGHT, Charles Theodore Hagberg, B.A., LL.D.; Secretary and Librarian, London Library; Assistant Librarian, National Library of Ireland, 1890-93. (C. T. H. W.)

WRIGHT, Lewis; author of 'The Book of Poultry,' 'The Practical Poultry Keeper,' 'The Poultry Club Standards'; editor of 'Fulton's Book of Pigeons,' etc. (L. Wr.)

WYATT, J. W., A.M.I.C.E.; Fellow Roy. Indian Engineering Coll., Cooper's Hill; author of 'The Art of Making Paper,' etc. (J. W. W.)

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YOUNG, Alexander Bell Filson; assistant editor of the 'Pilot' since 1901; special war correspondent of the 'Manchester Guardian,' S.A.; author of various songs and instrumental works 'The Relief of Mafeking,' 'Five Lyrics,' 'A Volunteer Brigade,' 'Master-singers,' etc. (A. B. F. Y.)

YOUNG, Rev. William; for many years Minister at the English Presbyterian Church, Kersal, Manchester; Joint Secretary of the Religious Tract Society. (W. Y.)

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ZIMMERN, Miss Alice; author of 'The Renaissance of Girls,' 'Education in England' 'Methods of Education,' etc. (A. Z.)